EUROPEAN CONFERENCE OF MINISTERS OF TRANSPORT

16th INTERNATIONAL SYMPOSIUM ON THEORY AND PRACTICE IN TRANSPORT ECONOMICS

50 years of Transport Research: Experience Gained and Major Challenges Ahead

Budapest
29-31 October 2003

OECD

EUROPEAN CONFERENCE OF MINISTERS OF TRANSPORT

16th International Symposium on Theory
and Practice in Transport Economics

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EXPERIENCE GAINED
AND MAJOR CHALLENGES AHEAD

Introductory Reports and Summary of Discussions

Budapest, 29-31 October 2003

ECMT

EUROPEAN CONFERENCE OF MINISTERS OF TRANSPORT (ECMT)

The European Conference of Ministers of Transport (ECMT) is an inter-governmental organisation established by a Protocol signed in Brussels on 17 October 1953. It comprises the Ministers of Transport of 43 full Member countries: Albania, Armenia, Austria, Azerbaijan, Belarus, Belgium, Bosnia-Herzegovina, Bulgaria, Croatia, the Czech Republic, Denmark, Estonia, Finland, France, FRY Macedonia, Georgia, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Moldova, Netherlands, Norway, Poland, Portugal, Romania, Russia, Serbia and Montenegro, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine and the United Kingdom. There are seven Associate member countries (Australia, Canada, Japan, Korea, Mexico, New Zealand and the United States) and one Observer country (Morocco).

The ECMT is a forum in which Ministers responsible for transport, and more specifically the inland transport sector, can co-operate on policy. Within this forum, Ministers can openly discuss current problems and agree upon joint approaches aimed at improving the utilization and at ensuring the rational development of European transport systems of international importance.

At present, ECMT has a dual role. On one hand it helps to create an integrated transport system throughout the enlarged Europe that is economically efficient and meets environmental and safety standards. In order to achieve this, it is important for ECMT to help build a bridge between the European Union and the rest of the European continent at a political level.

On the other hand, ECMT's mission is also to develop reflections on long-term trends in the transport sector and to study the implications for the sector of increased globalisation. The activities in this regard have recently been reinforced by the setting up of a New Joint OECD/ECMT Transport Research Centre.

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50 ans de recherche en économie des transports

L'expérience acquise et les grands enjeux

Further information about the ECMT is available on Internet at the following address:

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INTRODUCTORY REPORTS

Topic 1:

Transport and economic growth: Which interdependencies?

Decoupling of Freight Transport and Economic Activity:
Realism or Utopia?

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SUMMARY

Antwerp, January 2003

1. INTRODUCTION

In recent decades, the derived nature of transport has been emphasized time and again, not only in the scientific literature, but also in research and indeed in policy discourse. This derived nature implies that, if no purposeful measures are taken, an increase in industrial production and growing international trade will inevitably lead to greater demand for transport services. After all, economic growth means that larger quantities of goods need to be conveyed between production and consumption centres. The globalisation of the economy and the ongoing liberalisation of international trade are a catalyst for this relationship between industrial output and freight transport. It is therefore predicted that the present evolution could cause very serious capacity problems in road haulage. For this reason, transport economists have been monitoring economic growth trends and international trade developments very closely.

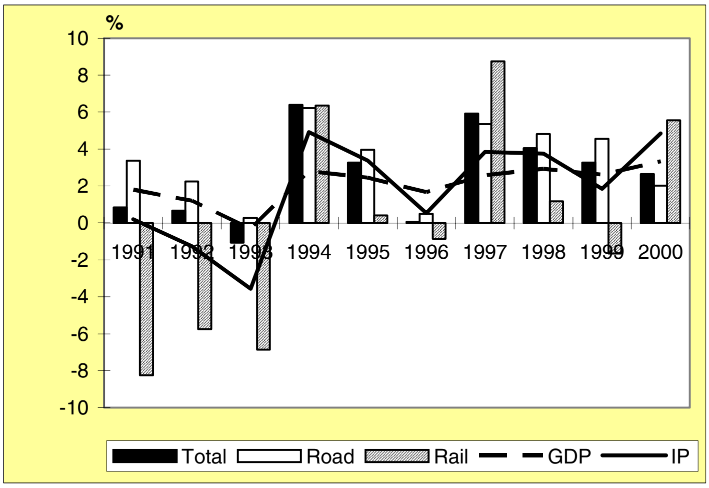
The recent White Paper by the European Commission (2001) ostensibly suggests a different approach, namely, the decoupling of transport demand and economic growth. One of the most striking assertions in this document has, for that matter, begun to live a life of its own. The claim concerns the future relationship between evolutions in transport demand (including freight transport) and economic growth, in the context of the debate on a necessary integration of transport issues into a sustainable development policy. The European Commission refers primarily to freight transport when it argues that greater efforts are required to gradually decouple transport growth from economic growth. It believes that this will allow the EU to attain the new modal equilibrium envisaged by the European Council of Gothenburg.

This paper explores whether such a decoupling is at all feasible in the context of freight transport within and between ECMT countries. Further enlargement of the European Union will undoubtedly result in new traffic flows, and not just in the border regions. Therefore, additional investment in infrastructure is required with a view to, for example, avoiding saturation of major traffic arteries and making or keeping peripheral regions accessible. In other words, what is at issue is not so much the unlinking of transport growth and economic growth as a different distribution between the various modes.

2. ECONOMIC ACTIVITY AND DEMAND FOR FREIGHT TRANSPORT: THE GENERAL PICTURE

Freight transport in the EU15 has grown spectacularly, especially in the 1990s, rising from 2 329 billion t-km in 1991 to 3 078 billion t-km in 2000[1]. This increase is more substantial than that realised in either GDP or industrial production (IP) over the same period, as is illustrated by Figure 1.

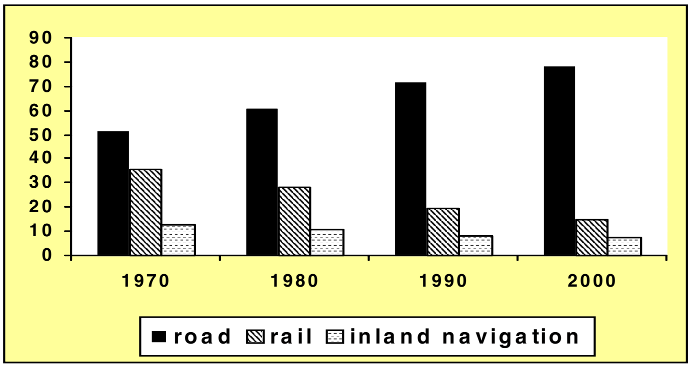
Figure 1. **Annual growth rates of freight transport, GDP and industrial production (IP) in the EU15**



Source: OECD Main Economic Indicators (GDP, IP) and EU Energy and Transport in Figures 2002.

The strong growth achieved in transport can be attributed for the most part to road haulage, which expanded between 1991 and 2000 by an annual average of 3.5 per cent. This was in stark contrast to rail transport, which declined sharply up until 1993. Consequently, road haulage is increasingly the dominant mode of transport. Figure 2 shows how the modal shares developed between 1970 and 2000. While in 1970 road haulage was less than twice the size of rail transport, it is now five times as important.

Figure 2. **Evolution of mode shares (%) in the EU15**



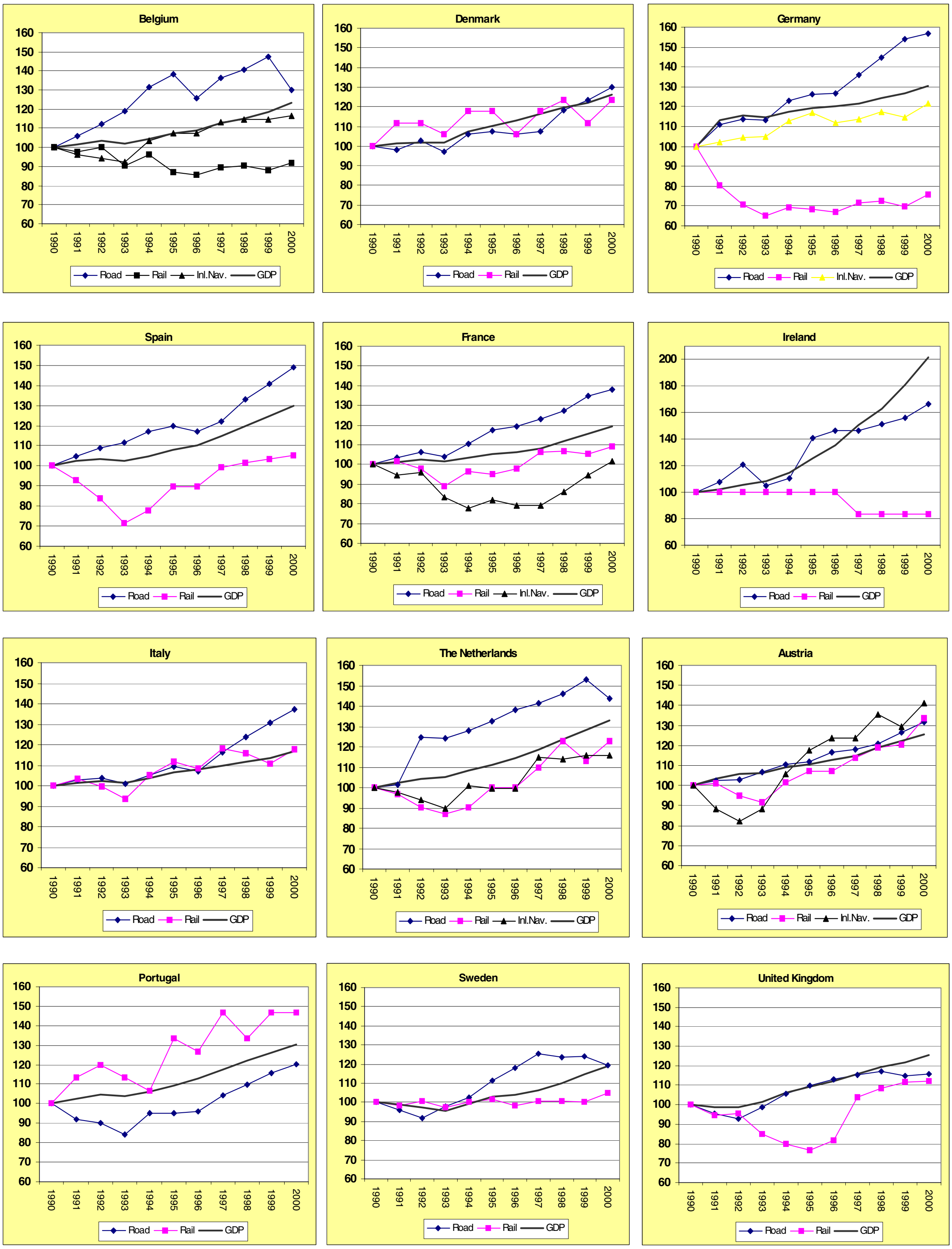
There are many factors which contribute to the dominance of road transport (Blauwens *et al.*, 2002, pp. 38-39). First and foremost, the location policy of enterprises has changed. Production centres are moved to specific industrial zones which often lie outside the urban sphere of influence and lack adequate connections to railway and inland navigation infrastructures.

Furthermore, there has been a strong evolution towards new production structures, whereby transport has been integrated into the production logistics of enterprises. The greater the value of the goods concerned, the more important speed and flexibility become in transportation (cf. modest transport costs in comparison to the total production and distribution cost).

It should also be noted that the nature of the goods produced has changed. There has clearly been a decline in the transportation of bulk (e.g. raw materials, semi-finished products), which typically has a high specific gravity and low value added. The trend towards the transportation of finished products with a high value added has clearly benefited the road haulage sector.

The above graphs apply to the EU as a whole. However, there are noticeable differences between developments in the modal distribution in the various Member States. Figure 3 provides an overview of the development of freight transport and GDP between 1990 and 2000 for selected Member States. In most countries, freight transport by road has grown more rapidly than economic activity, and especially in Belgium, Germany, France, Italy and the Netherlands. In Germany, Spain, the UK and, to a lesser extent, the Netherlands and Austria, freight transport by rail declined in the early 1990s, but subsequently recovered gradually.

Figure 3. **The evolution of freight transport (t-km) and economic activity (GDP volume) in some EU Member States (index 1990=100)**



Source: European Union Energy and Transport in Figures 2002.

Table 1 provides an overview for the various Member States of overall freight traffic volumes and the respective modal shares. It is striking how, in national and international transport over land (i.e. road, rail and inland navigation), road haulage accounts for 78 per cent of t-km performed. Equally strikingly, there are significant differences between the various Member States in terms of modal distribution. Typical examples are inland navigation, which is significant in Belgium (13.5 per cent) and the Netherlands (45.5 per cent), and rail transport, which is big in Austria (45 per cent) and Sweden (38.2 per cent).

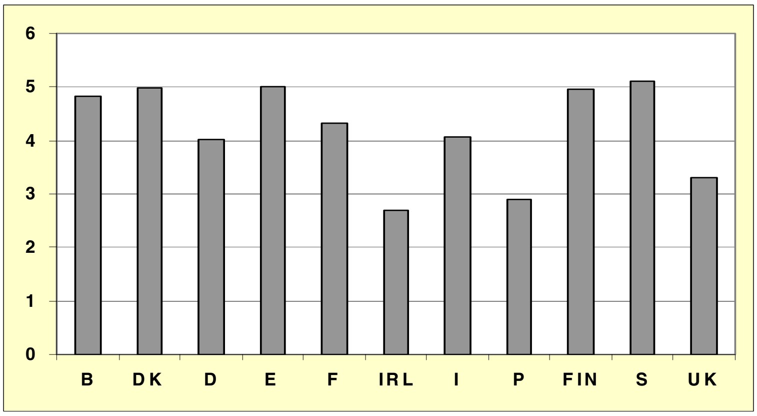
Table 1. **Mode shares in 2000**

	Total (billion t-km)	**Mode shares (%)**		
		Road	**Rail**	**Inland nav.**
Belgium	46.5	69.9	16.6	13.5
Denmark	19.9	89.4	10.6	0.0
Germany	490.5	70.8	15.7	13.6
Greece	18.8	97.9	2.1	0.0
Spain	129.7	90.6	9.4	0.0
France	329.2	81.0	16.8	2.2
Ireland	7.0	92.9	7.1	0.0
Italy	267.0	91.4	8.5	0.1
Luxembourg	3.3	72.7	18.2	9.1
The Netherlands	90.8	50.3	4.2	45.5
Austria	36.2	48.3	45.0	6.6
Portugal	16.9	87.0	13.0	0.0
Finland	38.1	72.2	26.5	1.3
Sweden	52.4	61.8	38.2	0.0
United Kingdom	176.6	89.5	10.4	0.2
EU15	1 722.9	78.3	14.5	7.3
USA(1999)	4 234.0	37.8	49.6	12.7

Source: European Union Energy and Transport in Figures, 2002.

This analysis can be further refined and qualified. One must, for example, take into account that roughly two-thirds of freight transport by road involves distances of under 50 kilometres. Road haulage's share would, for that matter, be even greater if one were also to take into consideration goods transported by van or lorry with a loading capacity of less than three tonnes.

Figure 4. **Direct employment in the transport sector as percentage of total employment**



Source: EU Energy and Transport in Figures 2002 and ILO Labour Statistics Database.

Thus far, our overview has concerned the relationship between economic activity and derived freight transport demand. In the past, too little attention has been paid to the reverse relationship, i.e. the impact of transport activities on economic development and growth. The development of the transport industry has undeniably had a strong effect on economic growth and the expansion of international trade. The transport and communications sector accounts for an important part of European GDP, which naturally translates into a significant number of jobs. In the EU15, direct employment in the transport sector accounts for 4.2 per cent of the total jobs market. Furthermore, transport creates indirect employment in the supply chain and in related industries.

The spectacular growth in transport as a whole and in freight transport in particular, and the two-way relationship with economic activity already provide an indication of the enormous economic significance of the transport industry. Only, this spectacular increase in transport services puts a considerable strain on society as a whole. Typical examples of such negative side effects are traffic congestion and environmental pollution. This partly explains the growing importance of the question of whether economic growth, even if modest, will give rise to increased demand for transport.

3. THE RELATIONSHIP BETWEEN TRANSPORT AND ECONOMIC ACTIVITY: A COMPARISON BETWEEN THE 80s AND THE 90s

With a view to developing an appropriate transport policy, a crucially important question is: to what extent could this spectacular growth in freight transport have been predicted? Could we have seen this evolution coming on the basis of the available knowledge at the time of forecasting? And which variables are to blame for the fact that predicted evolutions did not materialise?

Answering these kinds of question meaningfully requires scientific insight into the determinants and the extent of freight transport growth, preferably on the basis of an analytical tool that takes into account all relevant factors. Modelling of demand for freight transport is a complex matter, among other things because of the specificity of transport requirements (volume, batch size, etc.), the multitude of modes involved, the different internal structure per mode and rapid technological developments in transport operations. Any analysis of demand for freight transport therefore requires a thorough knowledge of the underlying transport sector as well as insight into the relationship between the transport industry and the economy as a whole.

As far as demand for freight transport is concerned, more research is needed into aspects of transport generation/attraction and distribution. Why are goods conveyed from one location to another? The answer to this question depends largely on the economic activity in the regions concerned. Production often requires a supply of raw materials and the removal of intermediate or finished products. This in itself is an indication that freight transport is almost a direct consequence of economic activity. This undeniable relationship serves as a guide in the forecasting of freight transport demand.

In what follows, we shall in two ways try to add to the body of knowledge, on the basis of an ex-post evaluation of forecasts. First and foremost, we shall compare forecasts with actual transport performances. In addition, we shall compare the estimated coefficients of a demand model.

In empirical research, several variables are put forward for estimating the significance of the relationship between transport and economic activity. The most obvious variables are undoubtedly GDP, employment, industrial production and import and export trade. Previous empirical studies (Meersman and Van de Voorde, 1999) show that, in Europe, it is not so much GDP that is the driving force behind freight transport demand, as industrial output. These two variables do not always evolve proportionately, mainly because economic growth in some western European countries is generated primarily by the services sector, while the relevance of industrial production is declining.

On the basis of the above-mentioned models, forecasts were made. It is interesting to see to what extent these forecasts deviate from reality. Tables 2 and 3 provide an overview of forecasts for the period 1990-99 on the basis of models developed in Meersman and Van de Voorde (1999). Three scenarios were considered: a weak economy with an annual growth of 1 per cent; an average economy realising an annual growth of 3 per cent; and a strong economy recording an annual growth of 5 per cent.

Table 2 shows the forecast increase in freight traffic under the three scenarios. As it turned out, predicted growth in all three scenarios, including that of a strong economic performance, was smaller than actual growth. The model underestimated reality in all cases.

Table 2. **Forecast growth and actual growth in freight transport, 1990-99**

Scenario	Forecast growth (%)	Actual growth (%)
Total: Scenario 1	*3.69*	
Scenario 2	*17.28*	32
Scenario 3	*30.87*	
Road: Scenario 1	*8.08*	
Scenario 2	*25.76*	50
Scenario 3	*30.87*	

Source: Estimations in Meersman and Van de Voorde, 1999.

A similar conclusion may be drawn from a comparable analysis of road haulage. Table 3 compares forecast growth and actual growth between 1990 and 1999 in four countries and under two scenarios (an annual economic growth rate of 1 per cent and 3 per cent, respectively). Despite the correct prediction that growth would vary considerably in these four countries, one notices that, in the case of Germany and the Netherlands, the growth rate was nevertheless seriously underestimated.

Table 3. **Forecast growth and actual growth in freight transport by road for some European countries, 1990-99**

Country	Scenario	Forecast Growth	Actual Growth
Germany	1%	38.49	87
	3%	63.95	
France	1%	12.6	34
	3%	34.4	
The Netherlands	1%	18.85	53
	3%	29.63	
UK	1%	6.54	15
	3%	20.73	

Source: Estimations in Meersman and Van de Voorde, 1999.

This underestimation is a consequence of the altered relationship between transport and economic activity in the 1990s. Table 4 has estimations of the coefficients of the following relationship,

$$\frac{\Delta tkm}{tkm} = \beta_0 + \beta_1 \frac{\Delta GDP}{GDP} + \beta_2 \frac{\Delta IP}{IP} + \beta_3 \frac{\Delta IMPORT}{IMPORT} + \beta_4 \frac{\Delta EXPORT}{EXPORT} + u$$

between the proportional change in t-km (total and for the various modes), on the one hand and the proportional change in GDP, industrial production (IP, imports and exports) on the other.

The results for the period 1984-93 relate to the EU12 (Meersman and Van de Voorde, 1999), while those for the period 1991-2000 concern the EU12 and the EU15. The latter figures were obtained through pooled estimation with common effects, on the basis of data from the EU Energy and Transport Figures, the OECD Economic Outlook and the OECD Main Economic Indicators. The coefficients β_1, β_2, β_3 and β_4 are the short-term elasticities of freight transport demand with regard to the economic activity measured in terms of, respectively, GDP, IP and imports and exports.

Table 4. **The changing relation between freight transport and economic activity (pooled data)**

Sample period 1984-93				
	EU12			
	%Δt-km total	**%Δt-km road**	**%Δt-km rail**	**%Δt-km inland navigation**
c	0.700*	1.08*	-1.01**	-1.26
%Δgdp	0.01	ns	ns	ns
%Δip	ns	.460**	.596**	-1.55
%Δimport	0.202	ns	0.224	ns
%Δexport	0.189	ns	ns	0.67
Sample period 1991-2000				
	EU12			
	%Δt-km total	**%Δt-km road**	**%Δt-km rail**	**%Δt-km inland navigation**
c	ns	1.64	-2.11	ns
%Δgdp	0.581*	0.3	0.3	1.847**
%Δip	ns	ns	ns	ns
%Δimport	0.167	0.199	1.045*	ns
%Δexport	ns	ns	-0.767**	ns
	EU15			
	%Δt-km total	**%Δt-km road**	**%Δt-km rail**	**%Δt-km inland navigation**
c	ns	1.036	-1.78	ns
%Δgdp	0.565*	0.302***	ns	1.893*
%Δip	ns	ns	ns	ns
%Δimport	0.161	0.192	.604**	ns
%Δexport	ns	ns	-0.27	ns

* significant at 1%
** significant at 5% ns Not significantly different from zero
*** significant at 10% *Source:* Meersman and Van de Voorde, 1999.

Strikingly, GDP in particular had a stronger impact on freight transport in the 1990s than it did in the 1980s, while changes in industrial production became far less influential.

The relationship between freight transport and economic growth, however, varies strongly from country to country. This was already apparent from Figure 3, but it is clearly confirmed by the figures in Table 5. Elasticities vary from 0.47 for Portugal to 2.16 for Finland.

Table 5. **Country estimates of the short-run GDP elasticity of total freight transport for the period 1990-2000***

	%Δtonkm/%ΔGDP		**%Δtonkm/%ΔGDP**
Austria	0.751 (0.54)	Italy	0.804 (0.26)
Belgium	1.399 (0.51)	Luxembourg	1.215 (0.56)
Denmark	1.468 (0.49)	The Netherlands	0.814 (0.41)
Germany	1.098 (0.58)	Portugal	0.474 (0.30)
Greece	1.412 (0.61)	Finland	2.164 (0.73)
Spain	1.325 (0.45)	Sweden	0.512 (0.47)
France	0.649 (0.17)	United Kingdom	1.015 (0.50)
Ireland	0.851 (0.46)		

* Based on estimates with pooled data from EU *Energy and Transport in Figures* 2002 and OECD *Economic Outlook*.
Values between brackets are standard errors.

4. THE REASONS BEHIND THE ALTERED RELATIONSHIP BETWEEN DEMAND FOR FREIGHT TRANSPORT AND ECONOMIC ACTIVITY

It would appear, then, that the connection which existed in the 1980s between freight transport demand and economic activity was far less strong than that in the 1990s. This may be due to various factors. First, there has been a growing trend towards globalisation. Furthermore, the 1990s were marked by more deregulation, privatisation and liberalisation of the transport market, which has undeniably led to lower freight rates. Other relevant factors are the developing trade towards eastern Europe and technical evolutions, including new stock and logistical policies in many companies.

We shall deal in greater detail with the following aspects: international (r)evolutions, the role of government and incorrect assessments of the capacity issue.

4.1. International logistical developments

In a study on international logistics and factors that contribute towards improving companies' competitive position, specific attention was paid to the role of the international economic environment in which these enterprises operate (Meersman and Van de Voorde, 2001). It identified a number of important developments which influence (international) goods flows: the globalisation of the production process; growing competitiveness in international trade; supply chain management strategies; time-based competition; and growth of computerization, EDI and global e-commerce.

As far as the globalisation of the production process is concerned, the following question is key: do the economies of scale offered by factories specialising in the production of certain components for a global market outweigh the economies of scope offered by factories which produce more extensive packages for a local market (Meersman and Van de Voorde, 2001, p. 68)? The answer to that question depends on a number of factors: the extent of modulation and standardization of the production process; the evolution of the local consumption level; the possibility of spreading technologies geographically; and the share of transport costs in the overall cost structure.

With regard to the latter aspect, the real cost of transportation is declining across the world. This is due to, among other things, the higher value of the goods conveyed and a declining ratio of weight to volume. This leads to a concentration of production (or part of production) in specialised companies. Declining costs of telecommunications and computers can also contribute to the internationalisation of the production process (cf. Table 6).

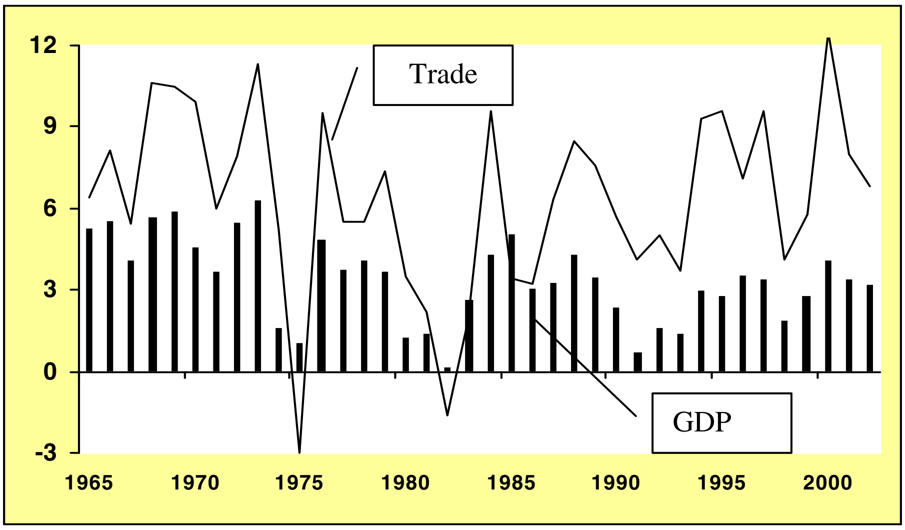
Table 6. **Costs (US$ 1990) of air transportation, telephone calls and computer price deflator**

Year	Average air transportation revenue per passenger mile	Costs of a 3-minute call, New York-London	US computer price deflator (1990 = 1 000)
1930	0.68	244.65	-
1940	0.46	188.51	-
1950	0.30	53.20	-
1960	0.24	45.86	125 000
1970	0.16	31.58	19 474
1980	0.10	4.80	3 620
1990	0.11	3.32	1 000

Source: Herring and Litan (1995).

A second important factor is expanding international trade. World trade has, on average, grown more rapidly than world GDP (cf. Figure 5). This is due mainly to reductions in tariffs and quotas.

Figure 5. **Annual growth rates of world trade and world GDP**



Source: World Bank Prospects.

Subsequently, there is the *emergence of supply chain management*, a concept based on the development of relations with partners further up or down the logistics chain. The goal is twofold: to achieve quality improvement of the logistics product (e.g. through greater reliability) and to attain the lowest possible cost for the chain as a whole. The latter is realised most easily if one has full control over that chain.

The concept of *time-based competition* (TBC) boils down to developing strategies for production and delivery with the purpose of supplying customers with products in as little time as possible. Cost, value and speed are no longer regarded as possible trade-offs for each other, but as objectives in their own right, to be realised through effective TBC programmes (Hise, 1995). The significance of TBC is apparent from the success of such integrators as DHL (cf. Table 7), who aim to provide a broad range of services (including return repair inventory) and specialise in quick delivery.

Table 7. **Growth, revenue and number of employees of DHL**

Year	**Growth (%)**	**Revenue (US$ billion)**	**Number of employees**
1996-97	17	4.7	53 222
1997-98	12	4.8	59 211
1998-99	8	4.4	60 486
1999-2000	18	5.2	63 552

Source: DHL in Meersman & Van de Voorde (2001).

Finally, there is the *worldwide growth of e-commerce*. The introduction of the Internet, e-commerce and e-business has had a profound impact on international logistics. Between 1997 and 1999, the global Internet connectivity rate increased threefold, though it did largely remain a privilege of countries with relatively high average incomes (cf. Table 8).

Table 8. **The number of computers with active AP addresses connected to the Internet, per 10 000 people**

	July 1997	July 1998	July 1999	July 2000
World	35.18	63.1	94.47	152.47
High income economies	203.46	347.89	607.55	981.74
Low- and middle-income economies	1.53	2.41	4.16	7.15
East Asia and Pacific	0.57	0.6	2.39	3.98
South Asia	0.06	0.11	0.17	0.31
Latin America and the Caribbean	3.48	7.65	14.78	29.62
Eastern Europe and Central Asia	6.53	10.55	15.47	24.10
Middle East and North Africa	0.2	0.23	0.37	0.69
Sub-Saharan Africa	2.03	2.32	2.32	3.10

Source: International Telecommunication Union in World Bank, 1998, 1999, 2000, 2001.

The emergence of worldwide commerce on the Internet has led not only to a greater need for international logistics systems, but also to important procedural changes. More emphasis is now put on speed, reliability, frequency and cost control. Obviously, though, the repercussions will vary depending on the goods category, transport mode and geographical area (Meersman and Van de Voorde, 2001, pp. 72-73).

It is very clear from this overview of international logistical developments that the marketplace is evolving very rapidly. In fact, it is evolving more quickly than modellers and forecasters ever anticipated, which has in turn resulted in an underestimation of freight transport demand. This affects the various market players and how they respond to changing circumstances. We refer explicitly to the trend towards the provision of integrated door-to-door services and additional value-added logistics, as well as the striving for optimal control over the main logistics variables.

4.2. The role of government

The literature on transport economics describes how government has (ab)used the transport sector to achieve goals that were not directly related to the sector itself (Blauwens, De Baere and Van de Voorde, 2002, pp. 334-344). These objectives often tie in with general economic and/or regional policy, and are sometimes even military in nature. This has had consequences, not only for transport generation and attraction, but also for the direction (i.e. the distribution) of the (goods) flows involved.

Although one appears not always to be aware of it, this political attitude still exists, at national and at international level. Take, for example, the Trans-European Networks (TENs), which the European Union considers to be "*a key element in the process of further economic integration and the promotion of free traffic of goods, persons, services and capital as well as economic and social cohesion in the Single European Market*" (Van Exel *et al*., 2002, p. 299)[2].

Table 9 offers an overview of the principal objectives of the TENs. Clearly, these objectives are not always related to transportation as such, but also to the implementation of large-scale financial projects. Sichelschmidt (1999, p. 173) has calculated that the cost associated with the 14 so-called "Essen priority projects" amounts to €240 per inhabitant of the European Union.

The intervention of the European Union through TENs is justified on the basis of the argument that, without such intervention, few investments would be made in cross-border infrastructure. After all, there is always a possibility with such investments that the benefits are felt mainly by another country. Consequently, they are not taken into account by national governments in the initial appraisal of the project. Moreover, the indirect network effects are often ignored in such projects.

However, even if one accepts the European Commission's reasoning, many questions remain unanswered. Why were the so-called Essen priority projects included, while other (competing) projects were not? One could argue on this basis that a supranational government, or indeed any other authority, should, at the very most, be allowed to play a modest role in such projects. Alternatively, one could accept their stimulating and initiating role, albeit with a correct assessment (*ex ante* and *ex post*) of every possible consequence, including the distribution effects between Member States and regions and the resulting demands for compensation.

Table 9. **The main EC TEN objectives**

	Objective	**Description**
I	Maximise transport efficiency	Improved performance and development of each mode and their integration into a coherent transport system, socioeconomic feasibility, improved comfort and level of service, etc.
II	Improve transport safety	Vehicle and infrastructure safety, dangerous transport, driver education and behaviour, socioeconomic feasibility, etc.
III	Contribute to environmental improvement	Local air pollution, noise, severance, quality of built environment and landscape, socioeconomic feasibility, etc.
IV	Improve strategic mobility	Accessibility and European networks, nodal points, peripheral areas, missing links, etc.
V	Contribute to strategic environmental improvement	Greenhouse gases, ecological damage, use of energy resources, etc.
VI	Contribute to strategic economic development	Regional economics, spatial planning considerations, etc.
VII	Contribute to technology development	Innovation in transport technology and standards, telematics, etc.
VIII	Contribute to implementation of the Single Market	Fair competition and pricing, technical harmonisation, etc.
IX	Contribute to social dimension	Equity, working conditions, "Citizens' Network", people with reduced mobility, etc.
X	Contribute to external dimensions	Network development and integration, agreements, technical assistance and co-operation, etc.

Source: van Exel *et al.* (2002, p. 299), based on the European Commission.

4.3. The capacity issue

In the production process, the economic barometer is assessed on the basis of (changes in) the capital stock and, even more so, the rate of capacity utilisation. This would appear also to be appropriate for the transport sector.

Port authorities and terminal operators have, in the past, always followed this line of reasoning. They have always tried to build up sufficient capacity, so that shipping companies or customers would not have to put up with waiting times at locks and/or berths. Certainly in European ports, time loss during port calls is kept to a minimum.

With regard to road infrastructure, there are clearly more problems. Figures have been published recently on the percentage of trunk roads that are congested for more than an hour a day (*source*: Commission for Integrated Transport, 2001). This was the case for just under 25 per cent of roads in Britain and about 15 per cent in the Netherlands, which implies an enormous waste of time and money.

Table 10. **Percentage growth of freight transport and transport infrastructure**

	1980/1970	**1990/1980**	**2000/1990**	**2000/1970**
Road				
T-km (billions)	47.23	35.84	38.40	176.80
Km motorways	89.73	28.86	31.39	221.22
Goods vehicles (1 000)	42.65	63.49	36.04	217.29
Rail				
T-km (billions)	2.84	-11.72	-2.73	-11.70
Length of lines km	-3.10	-3.49	-3.59	-9.84
Goods transport wagons (1 000)	-21.75	-31.53	-36.55	-66.01
Inland navigation				
T-km (billions)	3.92	0.94	16.82	22.55
Length in use km	-5.31	-3.21	-0.46	-8.78
Equipment (self-propelled)	-28.77	-21.14	-8.66	-48.69

Source: EU Energy and Transport in Figures, 2002.

Table 10 provides growth figures for the number of t-km performed per mode and for certain elements of transport infrastructure. It appears from the table that the number of kilometres of motorway grew more rapidly in the 1970s than the number of goods vehicles and t-km that were transported over those motorways. This obviously does not provide a reliable picture of the infrastructure and rate of utilisation. After all, besides freight transport by road, there has also been a significant increase in passenger vehicles. Especially during rush hour, the latter represent a considerable preload on roads. Likewise on the rail networks, freight transport must compete with passenger transport, which is given priority during peak hours. In inland navigation, locks often result in time loss. Thus, capacity problems usually occur at particular times of day, during certain periods of the year or at specific locations on the network.

5. ASSESSING THE FUTURE UNDER (UN)CHANGED POLICY

The literature on transport economics continues to emphasize the positive relationship between transport on the one hand and economic activity, employment and welfare on the other. However, an important qualification has recently been added. Transport, including freight transport, is increasingly associated with environmental harm and spatial planning problems. One thing is very clear though: taking the correct policy decisions first and foremost requires insight into future transport demand.

The latter part of 2001 was marked by a slowdown in industrial production. In most European countries, this led to slower growth in freight transport, too. The link between the two variables is undeniable. However, further globalisation, the growing importance of the western European service industry and evolutions in Central and Eastern Europe (including EU enlargement) may reasonably be expected to generate additional growth.

It speaks for itself that transport growth will vary between different goods categories and most certainly also between different geographical connections. Shifts will undoubtedly occur in interregional transport patterns. On some axes (e.g. between East and West), transport flows will increase at a faster rate than on others. Here, the problem arises of growth poles in newly emerging markets, which are catching up in terms of economic performance, with or without help from the European Union (cf. policy towards so-called lagged regions). In this respect, there is much to be learnt from previous experiences, after the accession of Spain and Portugal to the EU.

One may expect that seaports, as nodes in the generation of traffic flows towards the hinterland, will continue to gain in significance. To illustrate by how much port traffic might increase, Table 11 provides an overview of estimated growth rates of loading and unloading in the port of Antwerp.

Table 11. **Estimated growth (in %) in loading and unloading in the port of Antwerp (base year 1997)**

Annual growth in import/export	**General cargo (loading)**		**General cargo (unloading)**		**Bulk (loading)**		**Bulk (unloading)**	
	2005	**2010**	**2005**	**2010**	**2005**	**2010**	**2005**	**2010**
3%	7.67	16.25	1.11	11.64	27.04	36.39	22.00	27.69
4%	12.58	24.02	8.41	22.76	32.73	45.03	26.27	33.60
5%	17.49	31.79	15.72	33.89	38.41	53.67	30.53	39.51

Source: Meersman, H., F. Moglia and E. Van de Voorde, 2002, p. 45.

Table 11 concerns overall transport in one single port. Table 12 has comparable growth figures, but only for loading and unloading of containers, the growth category *par excellence* in the maritime sector. The growth rates concern four ports in the Hamburg-Le Havre range: Antwerp, Rotterdam, Bremen and Hamburg.

Table 12. **Expected growth rates (in %) of container loading and unloading for a number of ports** (base year 1997)

Loading for different export growth rates								
	Antwerp		**Rotterdam**		**Bremen**		**Hamburg**	
	2005	**2010**	**2005**	**2010**	**2005**	**2010**	**2005**	**2010**
3%	95	178	28	65	74	134	77	148
4%	140	286	49	109	101	195	115	238
5%	196	436	73	166	132	272	162	360
Unloading for different import growth rates								
	Antwerp		**Rotterdam**		**Bremen**		**Hamburg**	
	2005	**2010**	**2005**	**2010**	**2005**	**2010**	**2005**	**2010**
3%	55	115	16	41	48	88	30	76
4%	88	190	32	73	69	131	55	132
5%	128	292	49	111	92	183	84	205

Source: Meersman, H., F. Moglia and E. Van de Voorde, 2002, p. 45.

The above figures not only illustrate the enormous growth rates that may be expected in imports and exports of containers, but they also give an indication of the ferocity of port competition (see, among others, Huybrechts *et al.*, 2002). Predicted growth rates for Antwerp, Bremen and Hamburg are higher than those for Rotterdam, which is undoubtedly linked to a partial shift of so-called transhipment traffic towards the Mediterranean Range. Another important phenomenon is the possible shift of the so-called logistics chain inside Europe. It is by no means unthinkable that some import flows of raw materials, general cargo and especially containers -- which have thus far passed through the relatively large ports of the Hamburg-Le Havre range -- will in the future be attracted by such southern European ports as Giaio Tauro, Cagliari and Taranto. This would occasion a dramatic spatial shift in hinterland transportation.

Moreover, there would be important consequences in terms of infrastructure capacity utilisation, demand for new infrastructure, the technologies applied and the modal choice.

The question also arises whether existing infrastructure can cope with forecast growth and the altered market structure. Should infrastructure, including the road network, be expanded or should one promote a modal shift towards combined transportation and shortsea shipping? Or should one strive towards a better utilisation of existing capacity? Such questions require an analysis of available capacity and capacity utilisation per mode and per geographical relationship. Moreover, the Belgian experience shows that a significant shift from road to other modes will only materialise after extreme price changes (Meersman and Van de Voorde, 1996).

In general terms, it is clear that, under unchanged policy, freight transport will grow considerably. The question is, however, should transport policy be changed? After all, the spectacular growth of transport in general and of freight transport in particular is also causing significant societal problems. From an economic perspective, worsening congestion implies an extra cost for freight transport, if only because of the additional time loss caused. But undesired negative effects on the environment (e.g. in terms of safety, the isolation of certain regions, etc.) are also becoming an increasingly heavy burden on society, a burden which more and more people believe should be borne by whoever causes it.

The question of how the growing need for freight transport and transport infrastructure should be satisfied then presents itself in a broader context. Let us take as our starting point the forecast proposed by the European Commission in the recent White Paper (European Commission, 2001). Assuming that economic growth and transport are unlinked, and mobility is retained by a more efficient use of other transport means, road haulage is predicted to grow by 38 per cent between 1998 and 2010, compared to 50 per cent without intervention. The forecast rise in GDP, by comparison, is 43 per cent. By way of illustration, predicted growth in passenger transport under the same assumptions and for that same period is only 21 per cent.

This is precisely what the European Commission (2001) means by breaking the link between economic growth and transport growth: a transport sector that grows at a slower rate than the economy. But achieving this goal will require a very considerable effort.

The European White Paper (European Commission, 2001) discusses these efforts in greater detail. The starting point is a striving for sustainable transport, which is translated into a number of measurable indicators: transport growth, shifts towards more environmentally friendly modes, full internalisation of costs and decoupling of transport growth and economic growth (e.g. measured in terms of GDP). However, one is quite aware that today's reality is very different: anticipated economic growth will undoubtedly result in greater demand for personal mobility and freight transport services. Enlargement of the European Union is set to trigger larger exchanges of goods, and there is a need for additional investments, including in transport infrastructure.

As regards breaking the automatic link between economic growth and growth in freight transport, the solution is sought not so much in a reduction in transport, but in a redistribution between modes. The focus is on a package of measures that will have an immediate impact on the modal choice, more specifically measures that will make road haulage less attractive. In practice, the proposed measures will make road transport more expensive (e.g. by a full internalisation of external costs through fiscal policy), increase the efficiency of other modes (e.g. by eliminating bottlenecks) and revitalise them (e.g. by investment aimed at intermodality, technology, quality, safety and efficiency).

As far as the price of transport is concerned, the White Paper ties in with the European policy of fair and efficient pricing. The message of this policy is clear to see: a full internalisation of external costs of all modes, the application of the marginal cost principle and funding of necessary investments.

As regards the promotion and revitalisation of modes that compete with road haulage, here the focus is on rail and water transport (i.e. inland waterways and short sea shipping). It is clearly the intention to improve the image of these modes, through investment in quality (cf. the policy on maritime safety and the policy aimed at the reflagging of ships to Community registers through tonnage-based taxation) and in better interfaces between the modes concerned. Shipping can be integrated perfectly into the concept of Trans-European Networks by, for example, improving access to the port services market. There is an urgent need for true intermodality, based on those modal characteristics that might influence the behaviour of transport users and shippers: integration into a so-called "one-stop shop", encouraging the emergence of freight integrators, giving priority to technical harmonisation and interoperability between systems, and stimulating innovation (including financially).

Even if we interpret the goals of the European White Paper as "bringing under control the link between economic growth and growing freight transport", the issue at hand is clearly very complex. A slowdown of the growth rate in transport to 38 per cent still represents an increase from 2 852 billion t-km in 1998 to 3 936 billion t-km in 2010, while 21 per cent in passenger transport still signifies a 985 billion p-km increase over that same period. It is quite obvious that this cannot be realised merely through measures aimed at a better distribution between modes and across infrastructure.

Future policy must be founded on a battery of measures. It will also need to contain supply-driven elements. After all, the question can be reversed: "Considering forecast economic growth and the level of freight transport that this will take, which capacity is required in each of the modes?"

Policy must also be based on tools (models?) in order that the outcome of all possible scenarios may be adequately estimated. Even more importantly, policy must be based on certain principles from the literature on transport economics. A principle which we have already mentioned is that one should calculate an accurate cost price for every freight flow and every mode, i.e. that all externalities should be internalised. The consequence of such an approach would be twofold. Prices that reflect all social costs to society inevitably mean higher prices, and this will have a negative effect on the overall goods flows.

It is equally important that one should create total transparency with regard to subsidising and state aid for investment. A government that privatises its ports and does so at a price that is under the real value is effectively subsidising, which has a direct impact on competition. But what happens when replacement investments are needed? To what extent do government funds for (port) infrastructure affect the competitive balance within the sector? Similar questions may be asked in relation to rail transport (cf. the so-called joint cost nature of certain items).

On the basis of the above, we assert that European freight transport needs not only fair and efficient pricing but also, and perhaps even more so, fair and efficient competition.

6. CONCLUSIONS

"The opportunities are so great that we cannot fail to make the best of efforts to see that our policies work and provide the transport system that we need for the 21st century."

Loyola de Palacio, 26 May 2000

Political discourse, which often oscillates between sloganism and opportunism, is somewhat naïve. It is usually also rather vague, failing to commit to results. This also holds for European policy discourse on transport.

It should be clear by now that the economic growth envisaged by any authority, including that of the EU, will inevitably lead to an increase in freight transport. The much-hailed "decoupling" of growth in these two areas can only be interpreted as an attempt to break the automatism whereby absolute growth in freight transport is always greater than economic growth, and whereby the market share, of road haulage in particular, continues to rise.

However, decoupling demand for freight transport entirely from economic activity and international trade is a utopia. Moreover, the question arises whether such action would be desirable, as such an unlinking works in two directions. What can be attained, however, are more balanced, more efficient and less burdensome freight transport operations. If implemented fully, the package of measures proposed in the White Paper by the European Commission (2001) may produce some positive results. If, on the other hand, the proposed measures are not or only partly implemented, (transport) chaos looms as more bottlenecks will emerge. In such an event, anticipated economic growth may be undermined. Therefore, there is an urgent need for the development and implementation of a scientific tool that will allow us to systematically assess the two-way relationship between economic activity and (freight) transport. After all, (negative) developments in the freight transport sector can have repercussions for the economy as a whole.

NOTES

1. Figures include freight transport by road, rail, inland waterways, pipelines and intra-EU sea transport (*source:* EU Energy and Transport in Figures, 2002).

2. Van Exel *et al.* also assert that "*the TEN projects are recognised by the European Commission as having an important role to play in the process of launching a more dynamic, sustainable and job-creating economic growth* (see also Sichelschmidt, 1999); *in particular by improving the competitiveness of European countries to match or exceed that of other developed or developing regions of the world*".

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Economic Impacts of Infrastructure Investment:
The Spanish Infrastructure Plan, 2000-2010

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SUMMARY

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1. INFRASTRUCTURE AS AN INSTRUMENT OF ECONOMIC STRATEGY

The integration of Member States into the European Monetary Union has cast infrastructure policy in a new role, since it has now become one of the few structural policies that governments can use to achieve the goals of sustainable economic development and employment. However, the Stability and Growth Pacts and, in the case of Spain, the new Budget Stability Act requiring budget equilibrium (i.e. zero deficit), place restrictions on the volume of public investment in budgets and the scope for public borrowing, thereby requiring the development of new instruments and systems to manage and finance infrastructure on the basis of private sector participation or phased payments by the public sector.

The creation of monetary union in 1999, coupled with the budget adjustments that Member States had to make during the period prior to accession to improve their economic performance, reopened the on-going debate over infrastructure investment, which had been put back on the agenda by the European Council in Pörtschach by setting it against the background of economic growth, competitiveness and employment in the European Union.

It is worth noting, in this respect, the interesting Communication by the Commission "Public investment in economic strategy", COM(1998) 682 Final, which points out the major impacts that public investment in infrastructure has on national economies, despite the fact that infrastructure investment is one of the first budget items to be cut during periods of economic austerity or when the economic climate so dictates.

As the above communication points out, the European economy needs higher levels of public investment to remain competitive. The problem is how to increase public investment without jeopardising compliance with the strict budgetary discipline that has been imposed over the next few years, under the Stability and Growth Pact preceding the Agenda 2000 agreements, and how to do this independently of the share of infrastructure investment channelled towards the private sector or the development of new, joint financing systems, particularly in the form of public-private partnerships.

The new economic model adopted by the European Union, which is based on price stability -- the main goal of the European Central Bank -- and on the economic stability brought by curbing public deficits and by compliance with the Stability and Growth Pacts, has made infrastructure a major instrument of the economic policy of Member States.

The restrictions on monetary and fiscal policy imposed by the European Union on Member States have once again made it difficult to pursue Keynesian policies, which are designed to control aggregate demand to ensure stable and buoyant growth and which to this end use deficits as a means of expanding and revitalising the economy. These policies have therefore given way to a new economic model, based on the supply economy and the positive effects generated by structural policies (privatisations, public sector liberalisation, employment policies, infrastructure, etc.), over which governments continue to wield wide-ranging powers.

From this standpoint, public investment, particularly investment in infrastructure, has become a vital instrument of economic policy, generating major economic effects that help to maintain sustained economic growth and that can also act as countercyclical stabilisers during periods of crisis, even though it is true that, until only recently and while the Keynesian model was still in force, the role of public investment tended to be more that of an instrument of procyclical policy, in that it was used to make budget corrections.

It is therefore not surprising that, in response to this new context and to the situation of economic crisis in which Europe finds itself immersed, the debate over the economic impact of public investment and the role that infrastructure can play in the sustained and sustainable development of the economy is once again back on the agenda, thereby challenging the validity of models based on aggregate supply and calling for a return to Keynesian-type models, based -- as we have seen earlier -- on intervention in aggregate demand and on the use of the public deficit as a means of expanding the economy.

2. INVESTMENT IN TRANSPORT INFRASTRUCTURE AND ECONOMIC DEVELOPMENT: AN ON-GOING DEBATE

This discussion of the potential impacts of infrastructure on economic development and of the use of infrastructure as an instrument of anticyclical policy which politicians can present as justification for their public investment decisions, kindled a new scientific debate which led to the publication of a vast number of statistical and empirical studies, mainly conducted in the 1990s.

Although there is a huge volume of literature available on this subject, the results obtained from analyses of the effects on the economy of public spending in general and public investment in particular vary from one study to another, according to the respective level of development and individual circumstances of a given country, and therefore cannot be used to infer common principles.

The lack of a single criterion to apply to results has fuelled a long-running dispute between analysts and researchers. Over the past few years, this controversy has helped bring about major advances in research and in the development of new, more sophisticated and precise methodologies, even though a universal formula probably does not exist.

The ECMT has also entered into this debate, as may be seen from the theme of its 119th Round Table on *Transport and Economic Development* in 2001. The aim of this Round Table was far more ambitious in that, as its title indicates, the intention was to analyse the relationship between economic development and transport in the broad sense of the term. Despite this, the majority of the reports and most of the discussions focused on the impacts of transport infrastructure.

The conclusions drawn by the Round Table broadly match the comments made earlier and stress the fact that the relationship between transport and economic development is a highly controversial issue which has given rise to much discussion and an abundant literature. However, the Round Table challenged the view held by politicians that infrastructure encourages or promotes economic development and employment and several papers drew the conclusion that the effects of infrastructure investment were relatively limited, at least in developed countries, and that in some cases they could even be negative within a given region.

While participants held diverging views on many issues, all were in agreement that a *de facto* relationship existed between transport, particularly transport infrastructure, and economic development, even though it is probably not as close as politicians are wont to claim.

Note that analysis of the potential impacts of infrastructure construction or improvement must also include the impacts of improvements to the transport system.

3. EFFECTS OF INFRASTRUCTURE ON ECONOMIC ACTIVITY

As noted above, the effects derived from the transport system -- time savings, improved vehicle technology, improved quality of services and accessibility, etc. -- must not be divorced from those induced solely by infrastructure (the estimates that have been made can sometimes distort reality). Most of the studies that have been conducted, however, have focused exclusively on characterising the latter.

The effects that a given investment can have on economic activity are both numerous and diverse in that they depend on not only the time frame and the geographical or economic area considered, but also the specific circumstances and agents involved. It is for this reason, for example, that it is possible to talk in terms of impacts on aggregate demand or aggregate supply, the short- or long-term macroeconomic or microeconomic impacts at the national or regional level, global or sectoral impacts, qualitative or quantitative impacts, etc.

It is hardly surprising, therefore, that diverging methodological approaches have been adopted and that differences have appeared in terms of both viewpoints and results, even though advances in econometric and IT techniques have clearly narrowed these differences. In this respect, it would be fair to say that all approaches recognise the existence of a close relationship between public investment and economic development, even though there are differences of opinion over its nature, the causal relationship between the two terms, the extent to which its effects can be felt, etc.

We can therefore say, for example, that the debate which had been opened between classical and Keynesian models with regard to the macroeconomic effects of fiscal policy on economic activity, i.e. the crowding-out of private investment by public investment, ended with the disaggregation of public expenditure into its two components of expenditure and investment and with an analysis of fiscal policy that took account solely of public investment (Keynesian model) instead of total public expenditure (classical model). This distinction is of paramount importance in that the impacts of increased public expenditure differ according to whether the increase is in public consumption or public investment. If, in the latter case, an increase in public investment has the effect of attracting private investment (crowding-in) by influencing the productivity of private capital, the increase in total public expenditure due to the increase in current expenditure, on the other hand, has a crowding-out effect on short-term private investment, unlike the former which derives from the increase in interest rates.

When initially introduced, the Spanish Infrastructure Master Plan for the period 1993-2007 set out a methodology for studying the relationship between infrastructure and economic activity in which a distinction was drawn between the economic impacts during the construction phase and those which become apparent during the subsequent utilisation phase. While the former are short-term and clearly a function of the economic climate, the latter tend to be permanent and should therefore be viewed as long-term.

3.1. Effects of infrastructure construction

The short-term impacts are associated with aggregate demand and are the outcome of public sector decisions on fiscal policy with regard to both public investment policy and the funding of that policy through taxes or public borrowing. Existing Keynesian-type models can be used to estimate the impacts that infrastructure construction or -- to use the economic term -- the introduction of a fixed capital shock, can have in macroeconomic spheres at either an overall level (GDP, employment, public deficit, inflation, etc.) or at the level of different sectors within the economy.

3.1.1. Short-term macroeconomic effects

There can be no doubt, as we have already explained earlier, that an increase in public expenditure -- in our particular case public investment -- has an expansionary effect on aggregate demand which gives rise to an increase in output, employment and income, as well as in revenue from the taxes levied on the income generated. This policy of stimulating aggregate demand was designed to allow Keynes to achieve macroeconomic equilibrium and thereby escape a situation of economic crisis, even though he took no account of the relationship between unemployment and inflation (Phillips curve) or the potential impacts of the latter.

The rise in inflation and interest rates which can ensue from increased public investment has a series of negative impacts which can outweigh the positive ones. On the one hand, the loss of competitiveness following the price increase has an adverse impact on the trade balance and consequently aggregate demand, while on the other, the rise in interest rates has a crowding-out effect on private investment by stimulating private consumption. However, as we shall see in the following sections, the crowding-in effect on private investment by public investment which makes itself felt in the long run is usually greater than the former.

The figures given below are designed to illustrate the above comments. The aggregate demand function, represented in Figure 1, is expressed in the following equation:

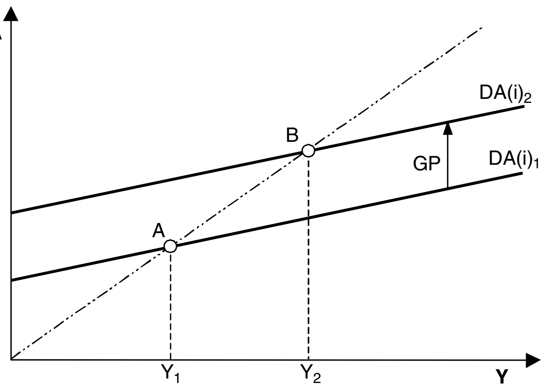
$$DA = C(Y) + I(i) + GP$$

where C denotes private consumption, which depends on the marginal propensity to consume and disposable income; I is private income; GP is public spending in the form of either current expenditure or public investment; i is the interest rate; and Y is aggregate supply, i.e. total output or income.

If public expenditure, GP, is considered to be an exogenous variable in the model and i a given rate of interest, the aggregate demand function has a linear form in relation to output Y. Starting from the equilibrium conditions represented in Figure 1 at point A, where aggregate supply and demand are equal, an increase in public investment, ΔGP, would establish the equilibrium at point B, increasing production by Y1Y2.

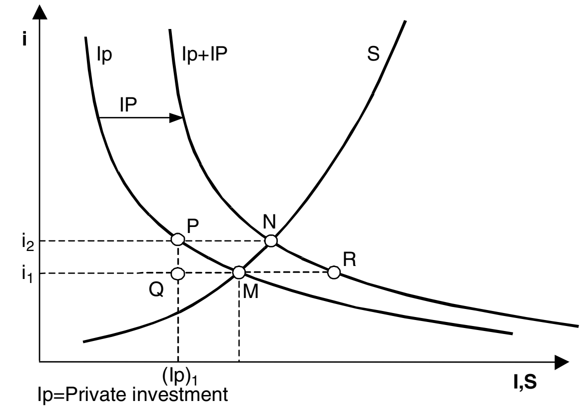
In response to this positive effect and other derived effects such as job creation, increased income, etc., account needs to be taken, as noted earlier, of the crowding-out effect of public investment on private investment following the increase in interest rates. This effect is clearly illustrated in Figure 2, which charts the relationship between private investment, I, and the interest rate, i. Starting from the initial equilibrium point, M, between private investment and savings, where at an interest rate of i1 private investment is Mi1, an increase in IP (public investment) results in an increase in the interest rate to i2, making N the new equilibrium point and resulting in a reduction in private investment equal to MQ (crowding-out effect).

FIG. 1



DA= Aggregate demand
GP= Increase in public expenditure
Y= Income (GDP)

FIG. 2



Ip=Private investment
IP= Increase in public investment
S= Savings
i = Interest rate

It should nonetheless be noted that, since the transfer of the powers of Member States with regard to monetary policy and exchange rates to the European Union and the setting of interest rates by the European Central Bank, the new equilibrium point is R instead of P, which severely curtails, if not eliminates, the crowding-out effect.

It is important in this macroeconomic analysis to determine the impact that public investment can have on the budget deficit in accordance with the commitments made by Member States to the EU under Stability and Growth Pacts (the most recent Spanish legislation on budget stability contains the additional requirement of a zero deficit in State budgets from 2003 onwards), as well as the requirements of the SEC(95). For this reason, it would be advisable to ensure that investment is financed under current expenditure, public sector borrowing or taxes.

The methods used to study the effects described vary but can be broadly divided into two categories: models based on input/output analysis at the aggregate level; or macroeconometric models created for that purpose.

While it is a fact that input/output tables are usually used to study demand by individual sector or economic activity, it is also true that they can be used to analyse the macroeconomic effects that an initial shock of final demand, in this case an investment, can have on the national economic system, i.e. output, income and employment. We shall consider this analysis, and the problem it poses, in greater depth in the following section dealing with impacts by sector.

The econometric models are primarily national models, more or less tailored to individual countries and usually designed to estimate the medium- or long-term impacts of the implementation of fiscal policy measures, one of which is increased public expenditure in the form of either current expenditure or investment. Most of these models are designed to help the Administration or, to be more precise, the Treasury Department construct the National Macroeconomic and Budgetary Framework, but they can also be applied in our own case here. The MARIBEL and TREASURY models, developed in Belgium and the United Kingdom respectively, are typical examples of such models.

In Spain, the Ministry of Finance designed the first Spanish Economic Research and Simulation Model (MOISEES) in 1990; this model had a high level of aggregation and, independently of the application mentioned above, was used in 1993 to analyse the potential impacts of the Infrastructure Master Plan for the period 1993-97 (MOPT, 1993) and, more recently, to forecast the impacts of the latest Regional Development Plan 2000-2006 for Structural Fund Objective 1 regions.

MOISEES is a macroeconometric model, based on economic theory and exhibiting a high level of aggregation, unlike other national models. It falls into a category of what are commonly referred to as disequilibrium models, in which aggregate supply (or economic output) is systematically lower than aggregate demand and forecast production, and is therefore markedly different to previous models. Even though this model utilises 150 equations, linking an equal number of macroeconomic values, most of which are identities and specifications of utility, in practice it makes use of no more than 18 equations, divided into the following blocks: Aggregate Supply; Aggregate Demand; Foreign Sector; Prices and Salaries; and Monetary Sector (López Blanco, 1990).

This model can be used in individual case studies to estimate the impact of different types of public expenditure funding on final outcomes. Tables 1 and 2 illustrate the different results obtained when public investment is financed through either public sector borrowing, budget subsidies or reduced current expenditure.

Table 1. **Macroeconomic effects of an increase in public investment equivalent to 1% of GDP, financed through public sector borrowing**

Concept	**t+1**	**t+2**	**t+3**	**T+4**	**T+5**
GDP (pesetas, 1980)	0.6	0.8	0.8	0.7	0.6
Gross capital formation (pesetas, 1980)	4.3	4.8	4.8	4.4	4.1
Inflation *	0.8	1.2	1.1	0.9	0.6
Employment	0.5	0.7	0.6	0.4	0.2
Trade balance/GDP	-0.1	-0.2	-0.2	0.0	0.1
Public deficit/GDP	-0.6	-0.6	-0.6	-0.7	-0.9

Values expressed as percentage variations from reference values.
* Value expressed as an absolute variation from reference values.

Source: PDI (2000).

Table 2. **Macroeconomic effects of an increase in public investment equivalent to 1% of GDP, financed by means of subsidies**

Concept	**t+1**	**t+2**	**t+3**	**T+4**	**T+5**
GDP (pesetas, 1980)	0.4	0.4	0.3	0.2	0.1
Gross capital formation (pesetas, 1980)	3.7	3.3	2.8	2.4	2.2
Inflation *	0.6	0.6	0.4	0.2	0.1
Employment	0.4	0.4	0.2	0.0	-0.1
Trade balance/GDP	0.0	0.1	0.1	0.2	0.2
Public deficit/GDP	0.2	0.2	0.1	0.1	0.1

Values expressed as percentage variations from reference values.
* Value expressed as an absolute variation from reference values.

Source: PDI (2000).

The first estimate shows that an increase in public expenditure on investment, equivalent to 1 per cent of GDP and funded by means of public sector borrowing, raises the rate of variation in GDP over the following five years by more than 0.6 per cent compared with the reference values, reaching 0.8 per cent in the third year, whereas if such investment is financed by a reduction in current expenditure, the effect is both lower and decreasing. Similarly, gross capital formation increases, as does employment, at a higher rate in the first case than in the second.

In contrast, the inflationary impact decreases over the five years and is significantly lower in the second case than in the first, with improved public sector (deficit) and trade balances, thereby avoiding the budgetary imbalances arising from the funding of investment by public sector borrowing.

Running a simulation of the Regional Development Plan (PDR) 2000-2006 on the MOISEES model allowed the following potential impacts to be predicted: average annual growth in GDP which was 0.5 per cent higher than the baseline; average annual growth in employment of 0.28 per cent higher than that obtained with the plan, which is equivalent to the creation of 350 000 new jobs over the seven years considered; and, lastly, a highly positive impact in terms of cohesion and regional development, in that 63 per cent of the value added created by the PDR would be distributed within the EU Structural Fund Objective 1 regions concerned.

3.1.2. Effects by sector

The input/output analysis can also be used to assess the impacts of public investment on different sectors of economic activity by distinguishing between sectors according to type of investment, while allowing an output matrix to be obtained from the aggregate demand matrix.

The model shows that the impacts of demand on the productive system extend beyond the straightforward and direct satisfaction of demand and have a knock-on effect within the network of intersectoral relations in the economic fabric (MFOM, 2003).

Using the model to simulate the impact of the Infrastructure Master Plan in Spain showed that an investment of 100 000 million pesetas (currently equivalent to 600 million euros) in the railway or road network could generate, at the national level, some 21 000 or 24 000 new jobs and a value added of 87 000 and 90 000 million pesetas, respectively.

In addition, the model can be used to study the way in which individual sectors stimulate and drive, or conversely stifle and act as a brake on, the rest of the economy. Given that the construction sector, which includes the building and civil works sub-sectors, has higher than average stimulative (1.04) or stifling (1.35) effects and high job-creation capacity, it may be held as one of the key sectors of the economy, for which reason an uneven growth trend in the sector would have a depressive effect on the national economy (MOPT, 1993).

Having said that, however, the problem posed by this methodology is the time it takes to obtain the input/output tables. In the case of Spain, the latest tables are those for 1995-96, which can lead to erroneous results. These delays are partly attributable to the need to modify the table construction method to ensure compliance with EU standards SEC(95), designed to harmonize the accounting frameworks of Member States.

3.1.3. Effects on the economic cycle

As we noted in section (a), economic analysis has traditionally treated public investment as an instrument of anticyclical policy, capable of stabilizing aggregate demand so that governments can increase public investment during periods of economic slowdown, thereby maintaining income and employment levels.

The situation in reality, however, is quite different in that the financial restrictions arising from a sharp increase in social expenditure and a higher level of public debt often result in public investment being used in a diametrically opposed manner. During economic slowdowns, when budgetary income falls and the need to contain the public deficit results in reduced public spending, the budget item which poses the fewest problems in this respect is public investment. We can see from this example that public investment acts, in fact, as an instrument of procyclical policy, thereby extending the economic cycle.

Studies recently conducted in Spain (Sánchez Soliño, 2002) reflect the above comments. Until fairly recently, at a time of radical change in infrastructure policy, public investment was used as a variable for budgetary adjustment. The changes currently taking place are primarily the outcome of new Infrastructure Plan 2000-2006, introduced by the Ministry of Public Works. During this period of economic deceleration, investment has a major role to play as an instrument of economic stabilization policy, and this is largely achieved by involving the business sector in the funding of the plan, either through income-generating public firms, which because of their status are excluded from the Public Administration in terms of the National Accounts, or through a franchising system.

3.2. Effects during the period of infrastructure use

In response to these Keynesian-type, short-term effects, associated with aggregate demand and the outcome of decisions by the public sector, infrastructure can also induce another series of medium- and long-term macroeconomic effects, during the operating and utilisation phases, in relation to aggregate supply. These effects have not been studied as much as the former but have nonetheless recently been the subject of discussion.

The aim of these new models is to verify and determine the relationships between the increase in public expenditure and increased productivity in the private sector, which incorporates the positive externalities generated by public capital -- in this case infrastructure – and, similarly, the impacts of public expenditure at the territorial level. These two impacts which, unlike the previous one, are the outcome of decisions and actions taken by the private sector, determine, to a large extent, the competitiveness of the economy.

3.2.1. Impacts on private sector productivity

The first qualitative analyses of the possible relationship between infrastructure and economic growth date back to the work of Arrow and Kurz (1970), even though it was not until the 1990s that they were further developed, on the basis of the endogenous growth models of Barro (1990) and particularly Aschauer (1989 and 1993), which prompted a lengthy debate, that is still running today, on the nature of the effects produced.

While the increase in public expenditure was initially held, according to Barro (1990), to have a negative impact on productivity and economic growth, empirical work based on the ideas of Aschauer (1989) showed that, depending upon whether the analysis in question considered aggregate public expenditure or the expenditure corresponding to specific budget items such as infrastructure, radically different results could be obtained. The current consensus among researchers is that, while aggregate public expenditure has a negative effect on economic growth, investment in infrastructure clearly has a positive one.

Empirical analyses start with econometric models based on aggregate Cobb-Douglas production functions for the private sector of the economy, in which public capital stock is considered as another factor of production in addition to the classical factors of private capital and labour. These functions may be expressed as follows:

$$Yt = At.(Lt)\alpha.(Kt)\beta.(Gt)\gamma$$

where Yt denotes private sector output; (Lt) is private sector employment; (Kt) is the private capital stock; (Gt) is the public capital stock; At. is the total factor productivity (TFP), which incorporates the remaining factor; and α, β and γ are the output elasticities of the labour, private capital and public capital inputs.

The results obtained by several researchers -- Munnell (1993); Ligthart (2000); Bonaglia (2000), etc. -- appear to confirm that the trend in public capital is partly responsible for the increase in private sector output. The values obtained from the output elasticities of public capital vary substantially from one country to another and also from one region to another within the same country. An average value of 0.30 can nonetheless be accepted, which would suggest that a public investment equivalent to 1 per cent of the public capital stock would generate a 0.3 per cent increase in private output.

This attraction of private investment by public investment is known as the crowding-in effect, which is the opposite of the crowding-out effect described in section 3.1., and which, according to the latest studies, is apparently stronger than the latter.

In Spain, during the preparation of the Infrastructure Master Plan, the above model was used to simulate several scenarios in order to study the possible correlation between public investment and productivity. The result obtained was an elasticity value of 0.23, which corresponds statistically to a confidence level of 95 per cent. When investment was limited to transport infrastructure, the elasticity value obtained proved to be 0.18-0.16 in the case of roads, which shows that the impact of public investment on productivity primarily derives from the transport sector.

The results obtained for Spain match those recently obtained in other countries and appear to confirm that the estimates made by Aschauer (elasticities of the order of 0.40) are too high and that, although significant, the impact of infrastructure investment on productivity and economic growth is therefore not as high as previously thought. Another result that needs to be taken into account is that infrastructure has less impact at the regional level than at the national level (Bonaglia, 2000).

Independently of the discussion as to whether or not a direct or indirect causal link exists between public investment and economic growth, the single-equation production model described above has been criticised by economists who argue that the model provided a static analysis based on elasticities, that it treated public capital like an exogenous variable and that it failed to take account of the possible relationship between the latter and private production. The use of multiple-equation models, in which possible relationships between these different economic variables are described, might avoid these earlier limitations.

To estimate the impact of public investment in transport infrastructure under the Infrastructure Plan 2000-2010, currently in force, the Spanish Ministry of Public Works (MFOM, 2003) is in the process of developing, at the Valence Institute of Economic Studies (IVIE), a new econometric model, similar to that developed by Sims (1980), which consists in estimating reduced format multivariable dynamic models -- vector autoregressive (or VAR) models -- that can be used to obtain the short-, medium- and long-term impacts of infrastructure investment by simulating several scenarios with dynamic relations between model variables, all of which are held to be endogenous. The process in fact consists in a generalisation of the traditional single-equation approach described above.

According to the study cited, the first results obtained indicate that, by 2010, national value-added (private sector output) will have increased by 6.95 per cent, employment by 5.18 per cent (some 715 000 jobs) and private capital by 2 per cent (crowding-in effect). All this is attributable not only to the initial impact derived from the commissioning of public infrastructure but, at the most basic level, to the outcome of the major dynamic effects generated by such infrastructure.

Table 3 shows the cumulative effects of the Spanish Infrastructure Plan 2000-2010, as well as the annual averages for these same data. It should be recalled, however, that these impacts have not been distributed evenly over this time period and that the strongest impacts took place during the initial years of implementation of the Plan.

Table 3. **Cumulative effects of the Spanish Infrastructure Plan, 2000-2010**

Cumulative				**Annual average**			
NVA	**Private capital**	**Employment**		**NVA**	**Private capital**	**Employment**	
%	%	%	**thou.**	%	%	%	**thou.**
6.95	2.00	5.18	715.071	0.61	0.18	0.46	65.006

Source: MFOM (2000).

Another less commonly-used approach -- which can be used to supplement the previous approach and to assess the impact of public investment on the productive structure of the firm and demand for employment and private capital -- is that based on the estimation and analysis of cost functions reflecting the optimising behaviour of the firm with regard to output and the factors to be employed.

This analysis, which begins by either minimising costs or maximising the firm's profits, makes it possible to estimate the cost of production as well as the effects of public capital in infrastructure on demand for factors of production.

3.2.2. Long-term macroeconomic impacts

The macroeconomic impacts of the infrastructure analysed in section 3.1.(a) reflected the effects that an aggregate demand shock -- public capital in this instance -- had on the economy in the short term. Considering infrastructure solely from the standpoint of demand is an incomplete approach that can skew the results of analyses, given that, as we have explained in section 3.2.(a), this same investment in infrastructure is also an aggregate supply shock, which results in an improvement in the productivity of productive factors and increased private investment. This increase in economic output and reduction in costs offsets the inflationary effect of the aggregate demand shock.

Consequently, a proper evaluation of the total, long-term effects of investment in infrastructure requires the impacts of demand due to infrastructure construction and the impacts of supply, due to its use, to be considered concurrently. This is the case, for example, of the total impact on employment, which will be lower than that obtained from the aggregate demand model, in that the increased productivity attributable to the new infrastructure will, in the long term, reduce this factor.

This new approach to the assessment of the macroeconomic impacts of infrastructure requires traditional macroeconomic models to be modified so that they can estimate demand and supply impacts simultaneously.

The Foundation for Applied Economics Studies (FEDEA) has developed a macroeconomic model for the Spanish economy -- HERMIN Spain -- which not only analyses existing relations between economic parameters but also assesses the impact of EU aid on growth in peripheral Member States (Herce, 1995 and 2002). It is a structural model of four sectors of the economy (public sector, agriculture, trade and non-trade) which has been modified to include the effects of both demand and supply and to assess the overall macroeconomic effects of the Infrastructure Plan 2000-2006, currently in force.

Table 4 incorporates the first set of results obtained through the use of this model into a reference framework representing the *ex ante* situation, namely, the situation without the Plan. All of the individual impacts calculated for the period 2000-2010 -- GDP, unemployment rate, inflation, public deficit and balance of trade -- have been broken down into demand effects and aggregate effects, which can then be used to verify existing differences (MFOM, 2003).

In the case of GDP, the demand effects of the Infrastructure Plan result in an increase of 0.5 per cent in the first year compared with the reference framework; this figure falls to 0.28 per cent by the year 2010. In the case of aggregate effects (demand and supply), the result for the first year is the same as that for the previous year, whereas the increase in GDP rises to 0.53 per cent by the year 2010, again compared with the reference framework.

Table 4. **Macroeconomic impacts of the 2000-2007 Infrastructure Plan (Horizon 2010)**

	Shock (a)	Real GDP (b)		Unemployment rate (c)		Private consumption deflator (b)		Public deficit (c)		Trade balance (c)	
		Demand effects	Total effects	Demand effects	Total effects	Demand effects	Total effects	Demand effects	Total effects	Demand effects	Total effects
2000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2001	0.03	0.05	0.05	-0.02	-0.02	0.05	0.05	0.00	0.00	-0.03	-0.04
2002	0.08	0.12	0.14	-0.06	-0.06	0.12	0.15	-0.01	-0.01	-0.08	-0.08
2003	0.11	0.16	0.21	-0.08	-0.07	0.17	0.23	-0.01	-0.01	-0.10	-0.09
2004	0.12	0.19	0.27	-0.09	-0.08	0.19	0.30	-0.01	-0.02	-0.11	-0.09
2005	0.12	0.18	0.29	-0.09	-0.07	0.19	0.33	-0.01	-0.02	-0.11	-0.07
2006	0.11	0.18	0.30	-0.09	-0.07	0.18	0.34	-0.01	-0.03	-0.10	-0.06
2007	0.15	0.25	0.40	-0.13	-0.09	0.26	0.45	-0.02	-0.05	-0.14	-0.06
2008	0.16	0.27	0.45	-0.14	-0.10	0.28	0.51	-0.02	-0.06	-0.15	-0.05
2009	0.16	0.28	0.49	-0.14	-0.11	0.29	0.55	-0.02	-0.07	-0.15	-0.04
2010	0.17	0.28	0.53	-0.14	-0.12	0.30	0.59	-0.01	-0.08	-0.15	-0.03

a) Investment in infrastructure as a percentage of current GDP
b) Percentage difference in relation to the corresponding value for no investment, for each year (cumulative effect).
c) Absolute difference in relation to the corresponding value for investment, for each year (cumulative effect).

Notes: (1) For each year, the percentage (or absolute) difference in relation to the corresponding macro-value in the basic simulation (without a shock) represents the cumulative effects of the preceding years.
(2) The supply effects are derived from the different total effects and demand effects.

Source: FEDEA.

3.2.3. Regional effects

The conclusions reached in research studies with regard to the possible effects of infrastructure at the territorial level all appear to agree that infrastructure endowment has a substantial impact on regional macroeconomic aggregates, in that transport infrastructure is precisely the type of infrastructure that has the greatest influence over income and employment indicators.

Of the different methodologies used to analyse the relationships between infrastructure and regional development, the method put forward by Biehl is particularly noteworthy. The theoretical basis for this methodology lies in the approach it adopts to the potential for regional development. Starting from the assumption that there exists a special group of resources, characterised by their overtly public nature, which determine income, productivity and potential employment, Biehl concludes that the four determining factors in regional development potential, that is to say the potential productive capacity of a region, are geographical location, agglomeration, sectoral structure and infrastructure. However, to determine the real productive capacity of a region it is necessary to incorporate traditional factors of production.

According to Biehl's hypothesis, the productive capacity of a regional economy is a function of the four above-mentioned resources, resources which must be quantified by means of a series of indicators to be established on a case-by-case basis. These resources act as exogenous variables and certain indicators of development (income, productivity or employment) act as endogenous variables. Consequently, the function for regional development potential will be of the following type:

$$PDR = f(I, L, A, S)$$

where PDR denotes development potential; I is infrastructure; L is location; A is agglomeration; and S is social structure.

The problem primarily lies in the specification of the indicators which are used to measure each of the above factors and which faithfully reflect their role. Orellana (1994) has revealed the shortcomings of the indicators usually used to assess transport infrastructure. These indicators attempt to measure infrastructure on a quantitative basis and not in terms of its capacity to meet the needs which originally prompted its construction.

To remedy these shortcomings, he introduced indicators of absolute accessibility, whose calculation makes use of three out of the four factors mentioned above (infrastructure, agglomeration and location) as a new instrument for assessment.

Unlike other elements, infrastructure is not the outcome of private transactions but of decisions taken by the public sector, which has made them a major instrument of economic policy aimed at increasing the development potential of regions and at encouraging growth in income, employment and productivity within a given region.

3.2.4. Other effects

As noted by Prud'homme (ECMT, 2001), output models only assess the impact of transport infrastructure on economic development and not that of transport in general. It is for this reason that it would be interesting to expand the scope of traditional analyses to include the possible effects of the reorganisation and improvement of the transport sector, the adoption of advances in vehicle technology, development of intermodality, etc., as an outcome of improvements to infrastructure.

In the study that the Ministry of Public Works is currently conducting under the 2000-2010 Infrastructure Plan mentioned earlier (MFOM, 2003), some of these (not readily quantifiable) effects have been evaluated and divided into three major groups: effects on the transport market; effects on the quality of life; and effects on other markets and economic agents.

The first of these groups includes the effects that infrastructure can have on the productive efficiency of firms operating in transport markets, as well as firms supplying infrastructure and services. Reduced transport times, higher vehicle running speeds, fuel consumption, etc., can serve as a basis for constructing efficiency indicators. The impacts on demand for passenger and freight transport, the modal split, growth in multimodal transport, etc., all need to be taken into account.

To assess the potential impact of infrastructure on quality of life, use can be made of the indicators of accessibility, peripherality and the external impacts of transport – namely, accidents, bottlenecks and environmental impacts -- developed by the European Commission as indicators of infrastructure endowment.

Lastly, account must also be taken of the impact of new infrastructure on other markets and economic agents. One example in this respect is the role played by infrastructure in firms' choice of location and in the development of their productive systems and logistics techniques, which has allowed many firms with adequate transport networks to successfully introduce just-in-time techniques, thereby cutting costs and increasing productivity.

4. CONCLUSIONS

Having reached this stage in our discussion, we can now draw the following conclusions.

Public investment, particularly in infrastructure, is a major instrument of economic policy. It generates a number of economic effects which contribute to sustained economic growth and which, in the event of a crisis, can act as an anticyclical stabilizing element, even though it would be true to say that, until fairly recently during the period when the Keynesian model prevailed, they tended to serve as instruments for procyclical policy, since they were used for budget correction.

The new framework which has resulted from creation of a single economic and monetary space, coupled with the fresh economic crisis into which Europe finds itself plunged, has reopened the debate over the economic effects of public investment and the role which infrastructure plays or can play in sustained and sustainable economic development. At the same time, it challenges the validity of models based on aggregate supply and predicates a return to Keynesian-type models, founded, as we have seen, on measures aimed at aggregate demand and the use of the public deficit as a means of expanding the economy.

The models that have been built to determine the relationship between infrastructure investment and economic development have primarily been aimed at determining, firstly, the macroeconomic and sectoral effects generated during the construction phase and, secondly, the effects at regional level and on competitiveness generated during the phase in which the infrastructure in question is used.

The former are the outcome of pursuit of a demand-based policy of the Keynesian type, while the latter are the outcome of a supply-based policy.

The advances currently being made in both econometrics and the processing of statistical information make it easier to develop more sophisticated multiple-equation models, designed to provide a more accurate representation of reality. In the case of Spain, multivariable, vector-autoregressive (VAR) models are used to estimate the short, medium and long-term effects of investment in infrastructure in different scenarios and with dynamic links between all variables, which are treated as endogenous variables; a structural macroeconomic model is also used, which simultaneously takes account of the effects of demand and supply and thereby makes it possible to assess the total effects of the 2000-2010 Infrastructure Plan currently in force (HERMIN, Spain).

The simulations run confirm the existence of a strong correlation between public investment in infrastructure and productivity, as well as the fact that the crowding-in effect of private investment by public investment, due to the increase in productivity, is higher than the crowding-out effect generated by the increase in aggregate demand -- which proves that the net impact of public investment on private investment is positive. We have also noted, however, that the values for the output elasticity of public capital stock are lower than those that have been used until now and are also lower at the regional compared with the national level.

Public investment has a high multiplier effect, through demand, on macroeconomic values, GDP, employment and investment. In contrast, it has unfavourable effects on the public deficit, interest rates and the trade balance.

Infrastructure investment is one of the main instruments which the public sector can use to promote increased income, employment and productivity within a given region.

By way of a final conclusion, we can say that, within the stock of public capital, investment in infrastructure, primarily transport infrastructure, is the form of investment which makes the greatest contribution to productivity growth and hence economic competitiveness.

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History of the Transition of the Hungarian Transport Industry and Infrastructure

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SUMMARY

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INTRODUCTION

One of the most significant and dramatic changes in the final decade of the 20th century was the collapse of the centrally planned economies. From East Germany to the Pacific Ocean, in the Central and Eastern European countries (CEECs) and throughout the former Soviet Union, some 300 million persons switched (or attempted to switch) to a market economy from one year to the next. This structural and economic shock, and the subsequent transition, modified business and management systems and styles, spurred demands for greater efficiency, transformed corporate cultures and, last but not least, significantly altered the transport sector.

Hungary is one of the CEECs that took part in this economic transformation. It is a well-known fact that the effectiveness of transport, as a service, is one indicator of the real state of an economy. Transport is a lynchpin of world trade and globalisation. Globalisation has affected the entire approach to transport and logistics, as well as corporate strategies, in most countries of the world, and in the CEECs in particular. A wave of privatisation was created in these countries, plunging transport enterprises into a competitive world market overnight. This report will explore the effects of the transformation of the Hungarian transport sector.

1. "50 YEARS OF TRANSPORT RESEARCH…"

The aim of this paper is to analyse how, between 1990 and 2000, the Hungarian transport sector moved from the central planning stage to that of market economics. But insofar as the subject of this 16th International Symposium of the ECMT is "50 Years of Transport Research: Experience Gained and Major Challenges Ahead", we should also provide a brief overview of the Hungarian transport sector's last half-century.

The population of Hungary was 9.3 million in 1950 and 10.2 million at the beginning of 2002. The total Hungarian passenger transport performance, which a half-century ago had been 7.6 billion p-km, climbed to 89.0 billion p-km by 2000, whereas the volume of goods transport rose over the same period from 9.7 to 32.4 billion tonne-km (see Table 1).

Table 1. **Performance and modal split of Hungarian passenger transport**

	1950	1990	2000
	Performance (billion p-km)		
Cars	0.085	48.7	53.4
Bus	0.396	27.4	23.1
Rail	7.142	12.1	9.8
Air	0.011	1.7	2.7
Total	**7.634**	**89.9**	**89.0**
	Modal split (%)		
Cars	1.1	54.2	60.0
Bus	5.2	30.4	26.0
Rail	93.6	13.4	11.0
Air	0.1	2.0	3.0
Total	**100.0**	**100.0**	**100.0**

Source: KSH, KTI.
Note: Performance increased by 0.3% in 2001 and by 0.8% in the first three quarters of 2002.

A half-century ago, rail was the unchallenged leader of the transport market. In 1950 it accounted for 93.6 per cent of passenger transport and 84 per cent of goods transport. At the time, the transport performance of goods shipped by inland waterways was 8.6 per cent higher than that of road transport. Fifty years ago, horses could still be found on Hungarian roads, and there were more horse-drawn vehicles than there were trucks and buses (Table 3).

Table 2. **Performance and modal split of Hungarian goods transport**

	1950	1990	2000
	Performance (billion tonne-km)		
Road	0.495	15.2	18.3
Rail	5.421	16.8	7.9
Inland water	0.538	2.1	1.3
Pipeline	…	5.2	4.9
Total	**6.454**	**39.3**	**32.4**
	Modal split (%)		
Road	7.7	38.7	56.5
Rail	84.0	42.7	24.4
Inland water	8.3	5.3	4.0
Pipeline	…	13.2	15.1
Total	**100.0**	**100.0**	**100.0**

Source: KSH, KTI.
Note: Performances decreased by 0.6% in 2001 and by 0.5% in the first three quarters of 2002.

Table 3. **The stock of road vehicles in Hungary (thousands)**

	1950	1990	2000
	Vehicles (thousands)		
Horse-drawn	7	-	-
Motorcycles	42	169	92
Cars	13	1 945	2 365
Buses	1	26	18
Trucks	3	263	342
Total	**66**	**2 403**	**2 909**

Source: KSH [1].
Note: It is worth noting that there had been 4 500 trucks in 1930, or more than in 1950. As of 30 June 2002, there were 3 032 719 road motor vehicles in Hungary.

In the mid-20th century, there had been 66 000 road vehicles in Hungary; 40 years later there were 2.4 million; and at year-end 2002 there were more than 3.1 million.

The gap with the West has narrowed dramatically: in 1960, France had 125 cars per thousand population, whereas Hungary had only 3.1. From 40:1 then, the ratio has fallen to only 2:1 today. Between 1990 and 2000, the stock of automobiles increased in Hungary by 23.5 per cent, as opposed to 15.9 per cent in the European Union countries. It is not surprising, then, as the 21st century gets underway, that the road dominates the transport market in Hungary, as it does throughout the EU.

Whereas half a million vehicles crossed the borders during the 1960s, the number rose to more than ten million in the 90s. Hungary moved gradually from a closed, centrally planned economy to one that is market-based, and transport is a component of this global economy. The transformation gathered pace over the past twelve years, during the transition period.

2. MACROECONOMIC FRAMEWORK OF THE HUNGARIAN TRANSPORT SECTOR

While a decade may seem a very short interval from an historical perspective, it is sufficient to observe reasonable interdependencies and trends based on economic policy. Hungary began its reversion to market economics in 1990, but this was accompanied by major socio-economic transformations which also had a decisive impact on the demand for transport. Over these ten years, the Hungarian economy passed through three distinct stages. During the first third of the 1990s, the policy of rapid privatisation and market opening led to a sharp decline in output, which triggered a huge drop in transport performances and a spectacular reduction of the railways' share of the goods transport market. The economic restructuring of the second third of the 90s gradually restored Gross Domestic Product (GDP) to an upward trend, marked by ups and downs of varying amplitude. With respect to the modal split, rail and inland waterways continued to lose ground, while road transport made slow gains and, as a result, there was growth in the volume of road export, import and transit traffic. In the final third of the 1990s, the Hungarian economy exhibited steady growth. This economic upswing also boosted the demand for transport. A comparison of economic growth in Hungary and the European Union shows significantly diverging trends in GDP and transport performances (Figures 1 and 2 in Annex).

There was a significant difference in economic trends between Hungary and the European Union. The aggregate GDP of EU Member States rose by 1.8 per cent per year between 1990 and 1999, while the Hungarian GDP stayed flat. (This long-term stability masks significant fluctuations, however, insofar as the Hungarian GDP fell by nearly 20 per cent between 1990 and 1993 but regularly outpaced EU GDP as from 1996.)

This apparent "stagnation" ran in parallel to a radical restructuring of the Hungarian economy over the past ten years. Inflows of working capital rose to USD 1 950 per capita between 1990 and 2000 -- a category in which Hungary therefore ranked first amongst the countries in transition.

The initial GDP decline, stemming from restructuring of the Hungarian economy and cutbacks in mass production aimed at Eastern European countries, had a deep impact on the demand for transport. Nevertheless, after a long period of decline, this demand began to rebound in the final years of the decade. The growth rate of goods transport may even have exceeded the growth in passenger traffic in Hungary.

3. MODAL SPLIT AND EMPLOYMENT TRENDS

In Hungary, shifts in the modal split have been closely correlated with the modernisation of the economy and the restructuring of foreign trade. Before the transition period, 20 to 25 per cent of Hungary's foreign trade was with EU countries, the bulk of it with the former socialist countries, and a small portion with third-world countries. Since the mid-1990s, 70 to 75 per cent of Hungary's export/import trade has been with EU countries (Figure 3 in Annex). Like all services, goods transport is dependent on demand and consequently a sharp shift in the modal split has begun, moving towards prevailing trends in the European Union (Figure 4 in Annex). The modal split in Hungary now lies between those of the CEECs and the European Union.

Hungarian GDP rose by 7 per cent between 1990 and 2000, but the passenger traffic performance was 1 per cent lower at the end of the decade than it had been at the beginning of the transition period. Rail and bus/coach performances (expressed in p-km) declined, while car and air traffic increased by 10 and 59 per cent, respectively.

An INRETS-NEA–WWI–KTI survey concluded that passenger traffic will increase by 8 to 10 per cent between 2000 and 2005, and that the automobile's share of the modal split will probably rise to 63 or 65 per cent.

The change was far more radical in the goods transport sector. The total volume of goods transport (expressed in tonne-km) fell by 18 per cent between 1990 and 2000. Air and road freight alone progressed over that period (with road transport gaining 20 per cent), whereas rail -- the big loser -- lost 53 per cent of its goods traffic.

For this reason, it is important to develop the Hungarian motorway system -- especially along the TINA and Helsinki corridors. The Hungarian motorway system is only about 40 per cent as dense as the EU's, but its growth rate is now higher (at 47.3 per cent as opposed to 25.5 per cent).

It is also important to stress that, if the European Union was successful in cutting the number of road accident fatalities by 17.5 per cent between 1990 and 2000, Hungary managed over the same period to cut them by 50.7 per cent. Even so, a number of relative indicators were not as good in Hungary as in the EU, and the number of road accidents was up again in Hungary in 2001 and 2002.

At the same time as the domestic transport market contracted, the number of individual entrepreneurs rose, from 29 500 in 1990 to 62 818 in 1993. Subsequently, the number fell regularly, sliding to 35 824 in 1997 and 29 841 in mid-2002, when there were 11 843 transport firms in Hungary [2]. Following this economic transformation, the number of road transport undertakings and entrepreneurs is higher in Hungary than in some more highly developed industrialised countries, which shows a real loss of balance.

Employment rates in the various segments of the transport industry vary widely between the European Union and Hungary. The number of railway workers is high in Hungary, but the number of workers employed in the road and air sectors, as well as in other transport-related services, is lower than in the EU.

The transport-sector workforce dropped by 27 per cent between 1989 and 2000 as a result of the socioeconomic transformations, but it still accounts for roughly the same proportion of the country's labour force. (The transport sector employed about 300 000 people at the end of the 1960s and 161 000 in mid-2002.)

4. CHARACTERISTICS OF THE FREIGHT MARKET, ACCORDING TO THE CLIENTS

Although Hungarian transport policy (adopted by Parliament in 1996) seeks to promote environmentally-friendly modes of transport, i.e. railways, inland waterways and public transport, and to support logistics centres and intermodal transport, road transport is experiencing sharp and rapid growth.

Why? It was mentioned above that the demands of transport customers with respect to speed, price, intensity, reliability and safety (loss and damage prevention) have evolved in line with economic restructuring. New buyers of transport services have new requirements. These requirements are closely linked to security. Bauer and Berács show what customers value most highly (Table 4).

Table 4. **Demands of Hungarian purchasers of transport services**

Figures indicate how modes are ranked in respect of the following criteria, from 1 (best) to 5 (worst)

Mode of transport	Ranking criteria								
	Speed	**Service intensity**	**Reli-ability**	**Loading capacity**	**Avail-ability**	**Specific costs**	**Loss, prevention of damage**	**Combined ranking**	
Air	1	3	5	4	3	5	3	3.4	5
Rail	3	4	3	2	2	3	5	3.1	4
Road	2	2	2	3	1	4	4	2.9	1-2
Inland waterway	4	5	4	1	4	1	2	3.0	3
Pipeline	5	1	1	5	5	2	1	2.9	1-2

Source: Bauer-Berács, in Pálfalvi [3].

These rankings are subjective, but buyer decisions are based on just such opinions. The overall rankings of the above criteria show the preferred modes of transport to be road and pipeline. The main problem stems from the fact that rail transport was not ranked first in respect of any criterion, and that it was even ranked fifth with regard to loss and damage prevention. If they want to survive, the Hungarian railways are going to have to adopt a new business plan, especially in the realm of international and transit freight. Among their customers are certain large multinationals which require complex logistical services. (The new organisational structure of the Hungarian State Railways Company (MÁV), in 2003, will set it on this more market-oriented course. The company will then be divided into profit centres, including freight, passenger operations, infrastructure and stock.)

5. EXPANSION OR CONTRACTION OF THE ROAD TRANSPORT MARKET

The new EU transport policy White Paper* outlined measures to be taken in order to reduce road traffic and increase rail traffic by 2010 because of road congestion, accidents and environmental damage. The big question is whether the European Union can or cannot cut back road transport's share of the market. If it can (by promoting the use of rail and inland waterways), the shrinking market share will intensify competition between road hauliers. The integration of Hungarian hauliers into the European Union road freight market could be complicated considerably by the fact that the EU's excess capacities could spread eastward and heighten competition.

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* White Paper - European Transport for 2010: Time to Decide [COM(2001)0370].

It would be realistic to think that road freight will tend to expand sharply in Hungary, and that Hungary, given its location at the heart of the Helsinki corridors, could become the region's logistical and commercial hub.

Analysis of the development of road freight shows that it has reached the maturity stage in the European Union. Transport enterprises are struggling to maintain market share, find it difficult to win new markets and are putting the emphasis on efficiency and cost-cutting. In Hungary, firms are in a growth phase, show greater selectivity in their purchasing and compete with each other in large numbers, eliminating weaker competitors, slashing prices to win business, and so on.

6. CHARACTERISTICS OF HUNGARIAN ROAD FREIGHT UNDERTAKINGS

Countries in the West have long -- since the 1970s, in fact -- been going the way of privatisation, but Hungary and other CEECs have had less time to do so. Having abandoned its centrally-planned economy, Hungary privatised the entire road freight sector in the early 1990s. Company officers and owners find themselves in a business climate and a corporate culture which changed completely between the 1980s and 90s. Corporate strategy and managerial aims and methods are not the same for an enterprise operating in a (post-socialist) centrally-planned economy as for a private firm doing business in the macroeconomic environment of the early 1990s. Corporate officers have been exposed to other cultures and have welcomed the market economy with open arms. Initially caught up in the euphoria produced by the launch of new enterprises, they were stunned thereafter by a cultural and economic shock (1993-95).

Today, after an intermediate acclimatisation phase, transport CEOs have found new stability which could infuse them with a new, positive outlook. That outlook is likely to change once again after Hungary's accession to the European Union, but the new multicultural environment is better known and will be less disruptive for Hungarian road transport enterprises.

Analysis of the context in which road hauliers do business in Hungary shows that the adoption and application of the countless rules and regulations entailed by harmonization with EU law are going to be one of the most difficult tasks for the authorities and carriers alike. Small private firms are incapable of adjusting on their own to this new legislative framework, and it is therefore essential that they join an association, federation or other industry organisation if they wish to remain competitive in the domestic and (especially) EU markets.

Hungary has adopted very strict environmental protection laws (regarding EURO II and III engines, vehicle age, etc.) which impose a greater financial burden on Hungarian international hauliers than is borne by their counterparts in other CEECs.

Hungarian tax policy is aligned on that of the EU, but fuel taxes and social contributions are higher in Hungary than in most other countries, putting yet another cost burden on businesses. Even so, the business climate in Hungary is affected very positively by the fact that the country has historically enjoyed stable governments, as it did throughout the transitional period.

Analysis of the socio-cultural context shows that the level of education is satisfactory in the Hungarian road freight sector, and that the new trucks of Hungarian international hauliers surpass EU trucks in certain technical respects, but also that knowledge of foreign languages is a weak point.

This socio-cultural context will help Hungarian firms to carve out a prime position in the world market and will prompt foreign investors to create profitable businesses in Hungary.

As mentioned above, since the country's industry, trade and agriculture were restructured, Hungarian products have been lighter and smaller, but higher in value. Such products are well suited to road and air transport, but less appropriate for railways or inland waterways.

Lastly, the technological factors show a greater contrast. International carriers have fleets which are more modern than their competitors in the European Union, while most of the small private firms who confine their business to the domestic market operate old-model vehicles which are competitive because of low costs, they may have to go out of business if they cannot find the resources to renew their fleets, as several companies have already. Technology transfers in these companies have been swift: those on the leading edge use GPS and modern logistics and supply chain management techniques to bolster their market positions and enhance efficiency and profitability.

7. EU INTEGRATION: CHALLENGES AND OPPORTUNITIES

Hungary's economic development, its security, its position in the world economy and its effectiveness on the international political scene all hinge on the country's integration into Europe. The development and transformation of Hungary's transport system ought to be a contributing factor.

Transport helps reduce imbalances in regional development and enhances interactions between the various parts of a country, as well as between a country and its neighbours. It also helps to improve economic conditions and raise living standards in small communities.

The integrity of human life, the environment and the country's natural habitats will be taking on added importance, and this will have to be taken into account as major factors in the operation and development of the transport system.

The aim of economic policy is to ensure further development of a market-oriented economy. Even so, the State will continue to shoulder some responsibility for the effective operation of the transport system because of its essential role in the national economy.

The transport sector will help improve the level of employment:

- by employing the labour needed to operate public services; and
- by generating direct and indirect jobs via development activities which also stimulate the economy.

Employment in the transport sector itself can be expected to decrease further in the near future, but at a slower pace. New methods and technologies (logistics, telematics) entail not only a change in the structure of employment, but a reduction in the number of administrative and clerical jobs as well. At the same time, it will be vital to take steps to retain skilled workers and ensure their employment in the sector. In this way, firms would be assured of a continued operational capability even when undergoing rationalisation and consolidation. Recognition of the less desirable employment environment and working conditions should be gradually reflected in the pay of workers, who should hold on to the sector's traditional benefits as well.

Tackling the problems stemming from working conditions will require the support of labour organisations. Such organisations play an important role in the workplace, where they prevent disputes and motivate, inform and educate their members.

As called for in European Union Directives, vocational training ought to be dispensed systematically at the secondary and higher levels, because only in this way will the transport sector be assured of having the properly trained specialists it needs to be efficient, safe and competitive on the international market. Training in transport trades should also be dispensed outside the schools.

At the same time as the population is made aware of transport safety in general, and of the security issues raised by today's traffic, it needs to be educated about transport's impact on the environment.

Hungary ought to play a more active part in the European Union's ongoing research and development (R&D) programmes. Until the end of the 20th century, Hungary had merely adapted to the results of research and development work carried out in the field of transport. Given the vastly unequal levels of technological and other development, even this (limited) adaptation effort entails measures to preserve (or create) an effective national scientific base. Most important is to customise the most recent knowledge and systems in the realms of computer science, telematics and logistics.

In the fields of education and research, it is necessary to ensure the transparency of objectives and operating conditions, along with the continuity of funding. Because it is a public asset, transport research and its supporting institutions need to be sustained, now and in the future, through ongoing government contracts or continued financing.

Economic transformation has caused considerable disruption to the operation of statistical systems and other information systems. A new national information system is needed, along with a new system of transport statistics, harmonized with the ones in use in the European Union.

CONCLUSION

The “50 Years of Transport Research” began in Hungary in the era of central economic planning and ended with twelve years that have brought the economy to maturity. The economic theory and practice of the Hungarian transport sector and the basic strategy of Hungarian businesses are comparable to those prevailing in most of the European Union’s Member States, and in countries associated with the Union.

The globalisation and integration of commercial and industrial multinationals are forcing transport enterprises to fall in step and adapt to the market’s changing demands. To succeed in this, they must:

- Develop their basic strategy by giving priority to their home country;
- Go international by extending their business to other countries, whilst innovating and adjusting;
- Globalise their international strategies, integrating strategies vis-à-vis the various other countries.

Given their environmental, safety, cost, market and competitiveness constraints, transport enterprises have to raise their economic and strategy systems to a world-class level.

Even so, unless the central government and international institutions can stimulate and develop knowledge of transport economics and practice, it will be impossible to:

- Expand market share;
- Standardize services;
- Concentrate activities;
- Make marketing uniform;
- Integrate competitive actions.

ANNEX

Figure 1

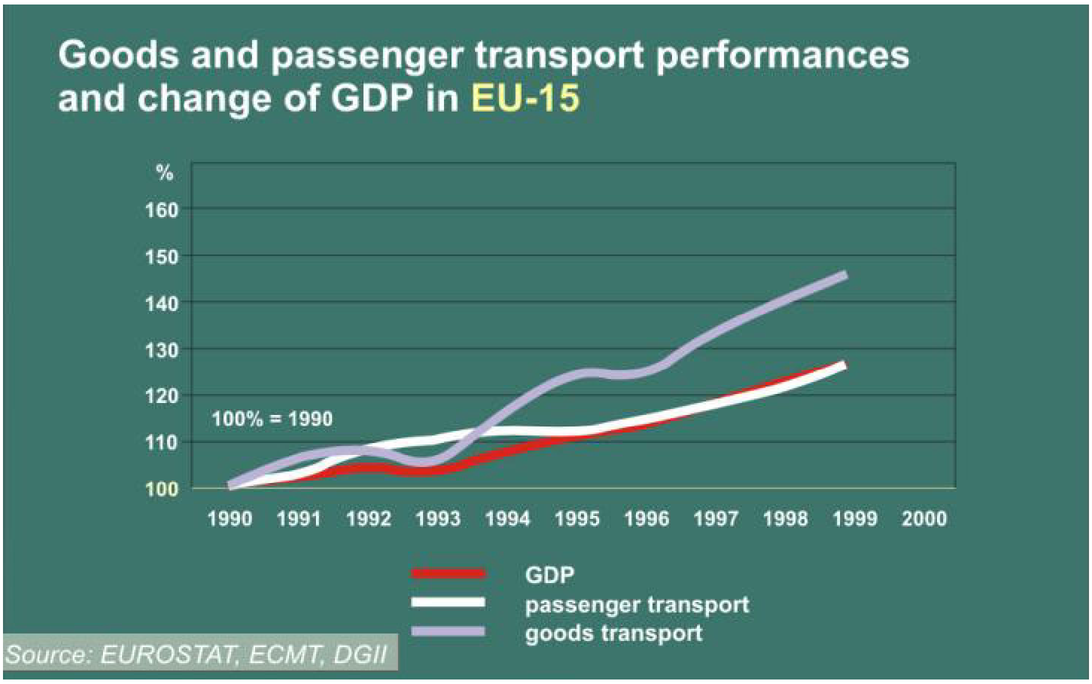


Figure 2

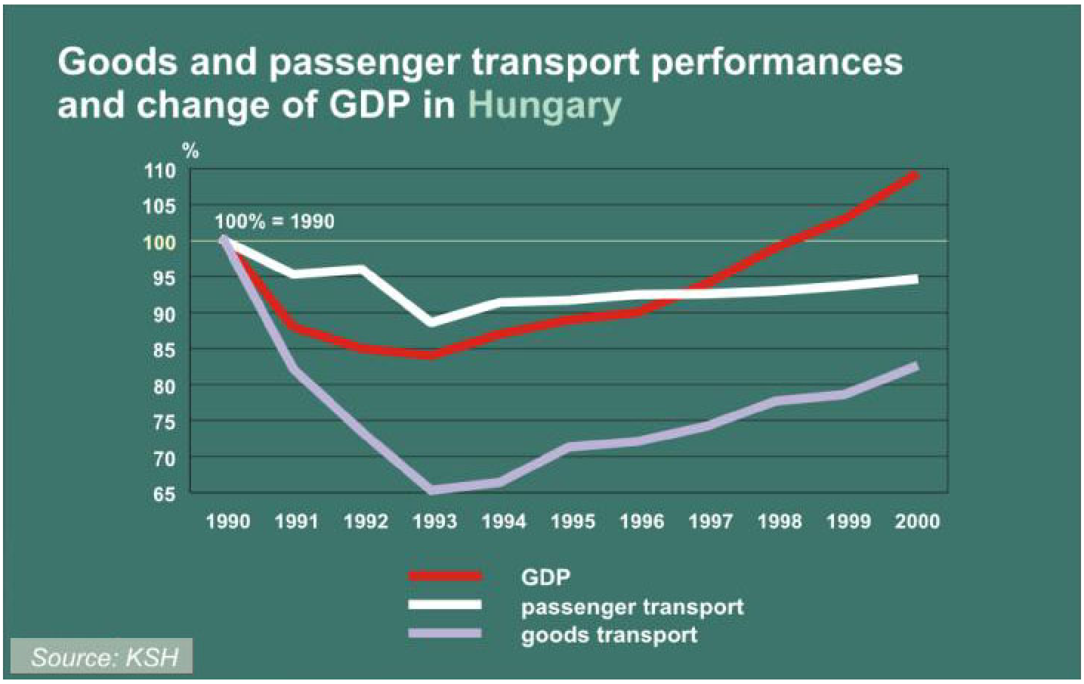


Figure 3

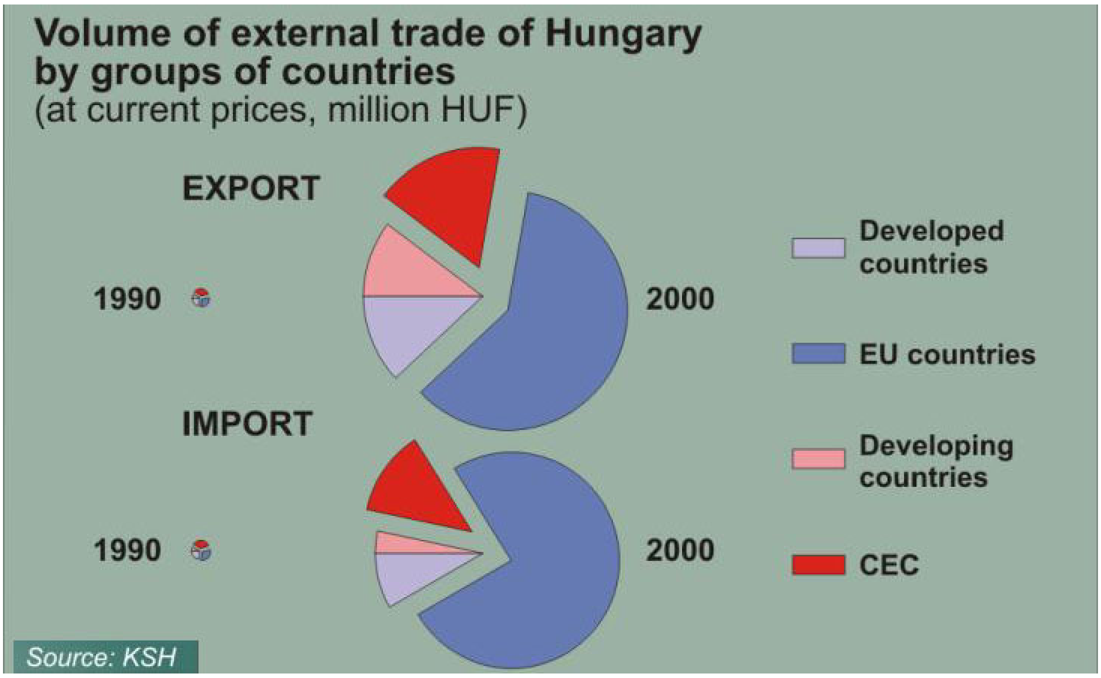
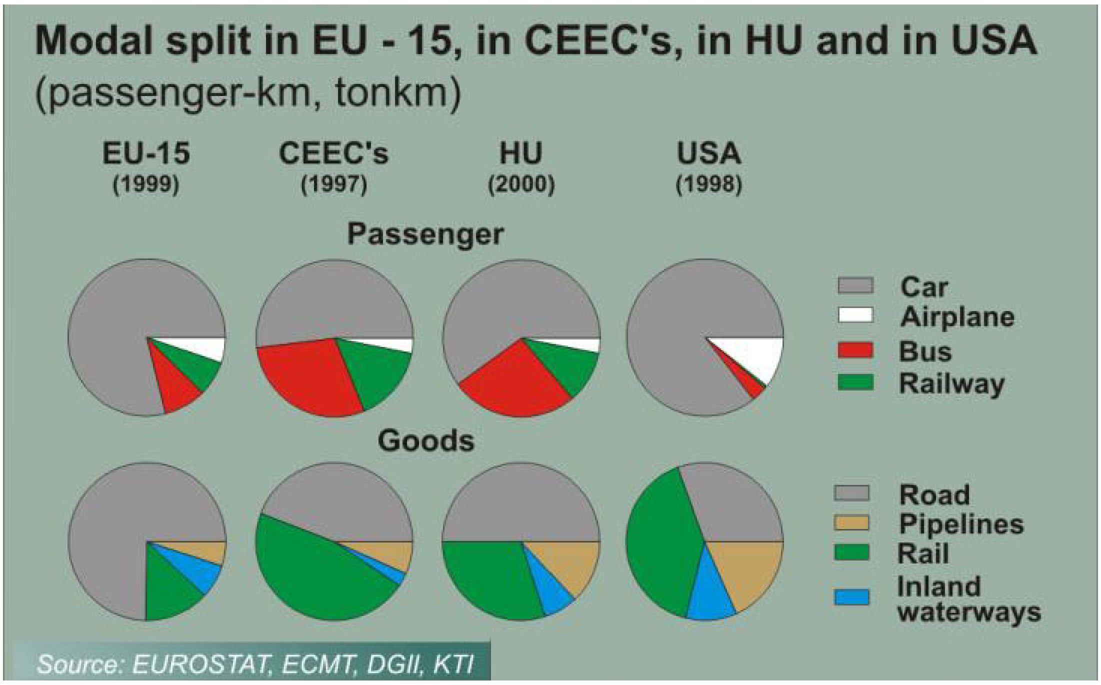


Figure 4



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The Correlation Between Freight Transport and Economic Growth

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SUMMARY

Rijswijk, March 2003

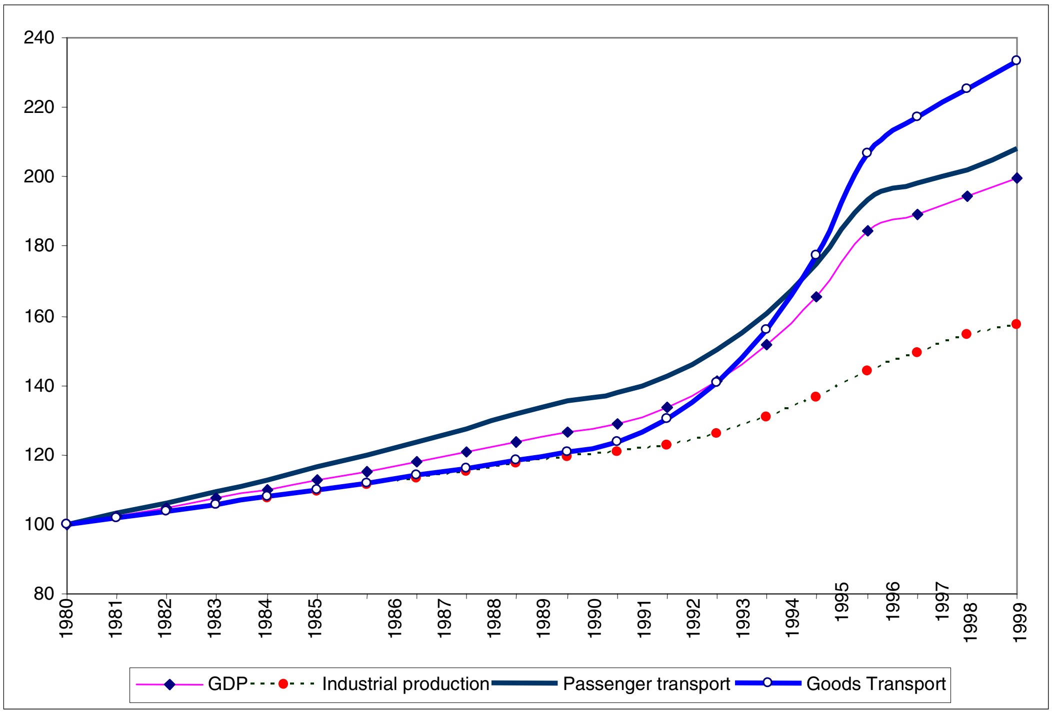
1. INTRODUCTION

One of the main fields of work of NEA is modelling and forecasting transport flows. Over the years, NEA has been involved in several forecasting and modelling projects which were funded by the European Commission. Examples of these projects are:

– forecasting transport flows in Central and Eastern European countries up to 2015, and
– forecasting transport flows in the European Union (and Switzerland and Norway) for 2020.

Currently, NEA is working on the STAC project, the main objectives of which are forecasting transport flows in western and central Europe and identifying main corridors and assessing bottlenecks in the infrastructure on the network. In this process of forecasting, the view on the correlation between the economy and transport is crucial.

Figure 1. **EU-15 statistical correlations between developments of GDP, passenger transport measured in person-kilometres and freight transport measured in tonne-kilometres**



Source: Annual Growth Rates EU 15 (DG TREN, Energy and *Transport in Figures 2001*).

Historical analysis shows that there is a strong statistical correlation between the growth of GDP and growth in transport, both passenger and freight. This was illustrated by several contributions at ECMT Round Table 119 (see Bibliography). In Figure 1, during the period 1980-99 at EU-15 level, the clear statistical correlation is shown between the developments of GDP, passenger transport measured in person-kilometres and freight transport measured in tonne-kilometres. Industrial production basically follows the same development as the other variables, but shows a far less dynamic growth. However, the statistical correlation is not based on an economic law and it is therefore not obvious that this correlation will remain the same in the future. On the contrary, it has been mentioned in various policy papers that policies for the decoupling of this correlation should be developed and applied.

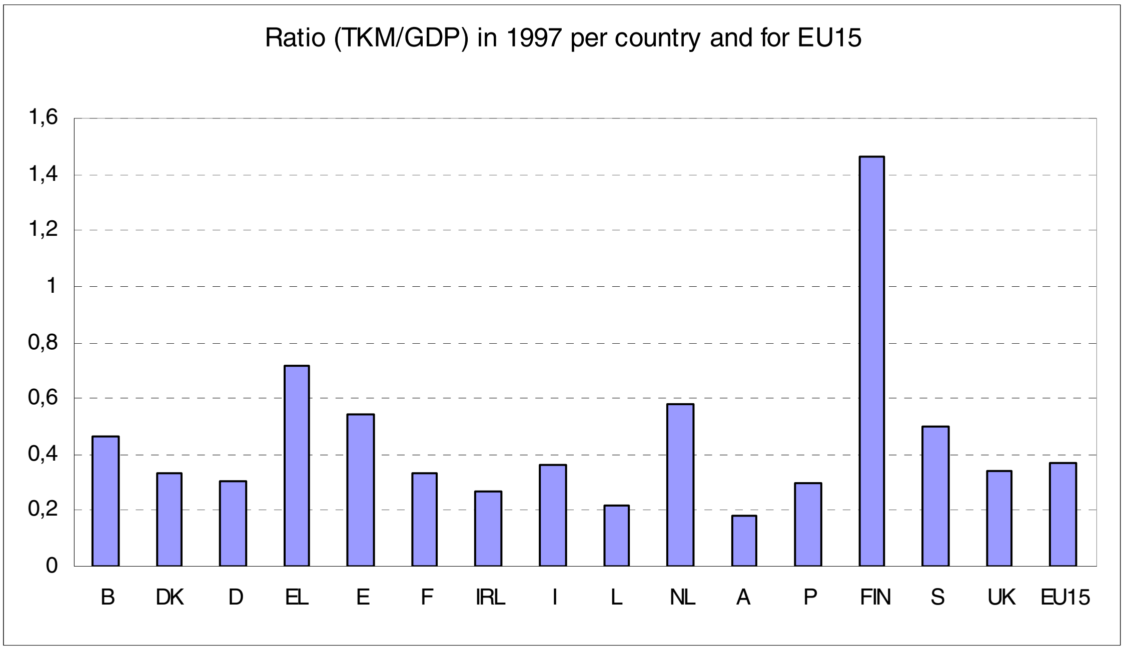
In this contribution, the nature of the correlation between freight transport and economic development will be analysed from the perspective of a consultancy firm's research director, developing forecasts for transport. Since in the modelling work at NEA for the projects mentioned the emphasis lies on freight transport, I will restrict the analyses to freight transport. The tonne-kilometres for freight transport will be used as the main indicator.

In a cross-section analysis between different countries, it becomes evident that the correlation between freight transport and GDP is not as close as was shown in the time-series at EU level. This is illustrated in Figure 2. Differences between the countries reflect differences in economic and spatial structure and the organisation of transport. The most extreme values can be found in Finland, with the highest ratio of transport to GDP, and Austria, with the lowest ratio. These structures are not fixed; changes in the structure will have implications on the ratio transport/GDP over time. The constant value of the correlation at EU level over time is the result of a number of factors, each having its own influence on the correlation of transport to GDP. It is important that these influences are looked at by factor; since there is no obvious reason why they should compensate each other in the future in the same way as occurred in the past.

There are other causes for changing the correlation between transport and GDP over time:

- The development of technology leading to a rise in the average value of one tonne of produced goods;
- The development of international trade as a result of the withdrawing of trade hindrances such as quota and import taxes. In particular, the enlargement of the European Union is important here;
- Recently, the objective of decoupling has been stated (in European policy papers as well as in national policies) as an instrument to reduce the negative impacts of transport and to meet the Kyoto criteria.

Figure 2. **Correlation between freight transport and GDP**



Source: Eurostat.

2. PAST ANALYSES

2.1. Transport as part of the economy

Transport flows occur in the whole chain from the origin of raw materials through the production and distribution process towards the final consumption. Since transport does raise costs, transport flows are optimised in this process. This optimisation not only regards the direct transport costs but includes other cost factors as capital costs of the transported goods. Transport costs including these additional elements are called generalised transport costs. By this approach, transport follows the developments of the economic system.

There can be many reasons why the inclusion of transport is optimal within the chain from production to consumption. Obvious reasons are the location of origins of raw materials (where oil is drilled/found) and the climate (where oranges grow). Another basic economic principle is the price of production factors; for example, the shift to production in countries with lower labour costs. Taste and fashion create a demand for foreign products. Technical skills in some cases can restrict production to certain areas and lead to specialisation. Economies of scale influence production locations supported by logistical concepts for distribution. To equalise the trade balance, flows of goods are used as payment for other goods. Trade restrictions and taxation have a negative influence on the level of trade and consequently on the transport volumes.

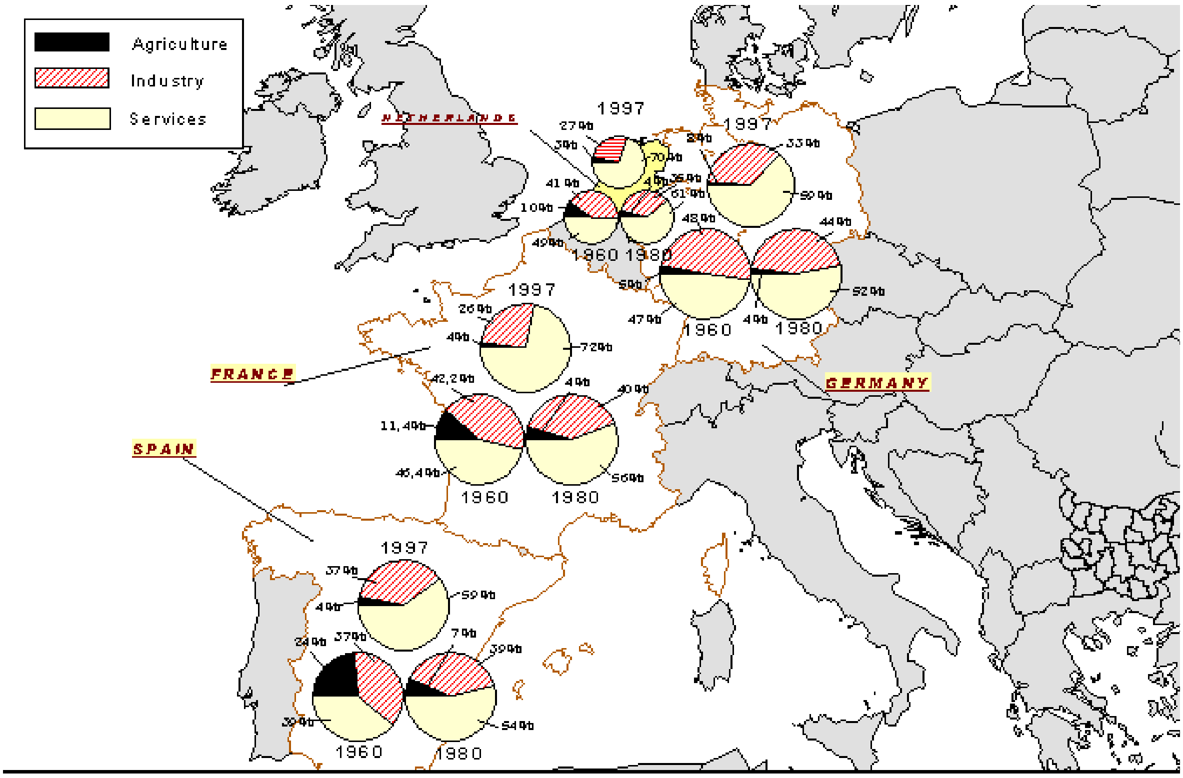
It has been stated in recent White Papers that pricing in transport is not optimal and that transport prices do not, at the moment, fully take external effects (like the environment) into account. A change in the price level of transport would have an impact on the process of optimising production and distribution. Pricing is also an instrument in the policy towards mode choice. Changes in the price levels between modes, on top of changes in the use of modes, will lead to changes in the production and distribution patterns and thereby have an influence on the volumes of transport and transport distances.

There is also a correlation between transport and the economy in the opposite direction. Transport facilities are a condition for the functioning of the economic system and can be an incentive to develop further activities in a region. Without transport, no materials from different origins could be assembled and no specialisation could take place. The influence of transport facilities (e.g. infrastructure) on the economy is called an indirect effect. In the contributions to Round Table 119, several approaches to measuring the indirect effects were mentioned.

2.2. The influence of the economic structure

The transport intensity of different economic sectors varies. This is already obvious on a high macro level, splitting up the economy into three sectors: agriculture, industry and services. The dynamic of the structure is shown in Figure 3: between 1960 and 1997 the share of services grew considerably, while the share of agriculture decreased.

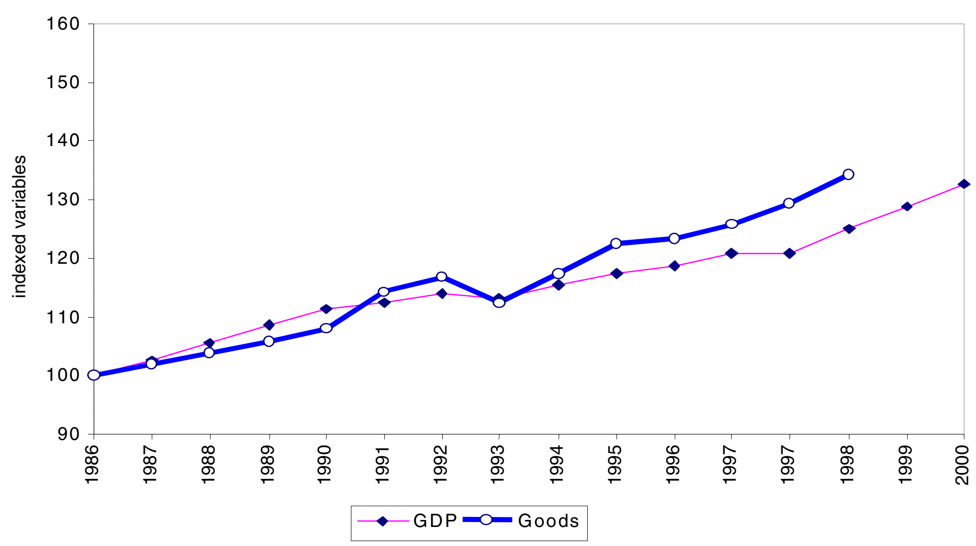
Figure 3. **Changes in the composition of economic sectors in France, Germany, Spain and The Netherlands between 1960 and 1997**



Source: EarthTrends World Resource Institute; Economic and Monetary Affairs DG; Eurostat.

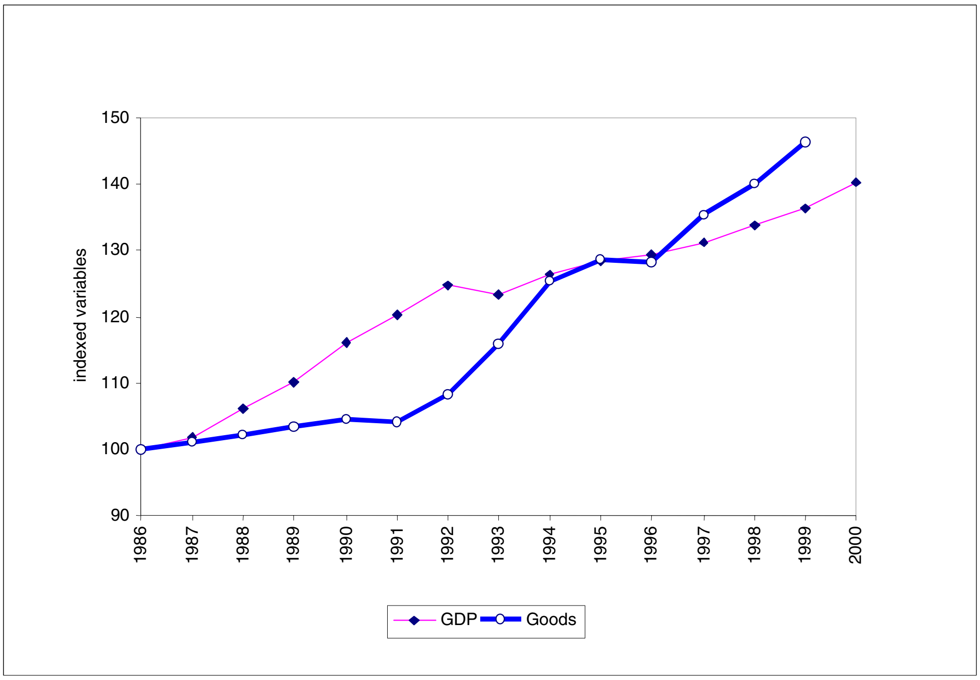
Industry gives a mixed picture, with strong decreases in Germany, France and The Netherlands and stability in Spain. An implication is that the development of the correlation between transport and GDP will, in principle, be different for different countries. This is shown in Figures 4a-d for four western European countries (Spain, Germany, France and The Netherlands) for the period 1986-99, and for two central European countries (Poland and Romania) for the period 1990-99. The decline in the transport/GDP ratio in Poland and Romania is the result of the changes in economic structure during the nineties. Many heavy industries, responsible for low-value bulk transport, disappeared and light industries and services arose. The larger transport distances in the new industries do not compensate these lost flows.

Figure 4a. **France: Evolution of indexed GDP (real growth in volume), goods transport (road, rail, sea, IWW) and passenger transport (car, bus, rail. waterborne) in 1986-99**



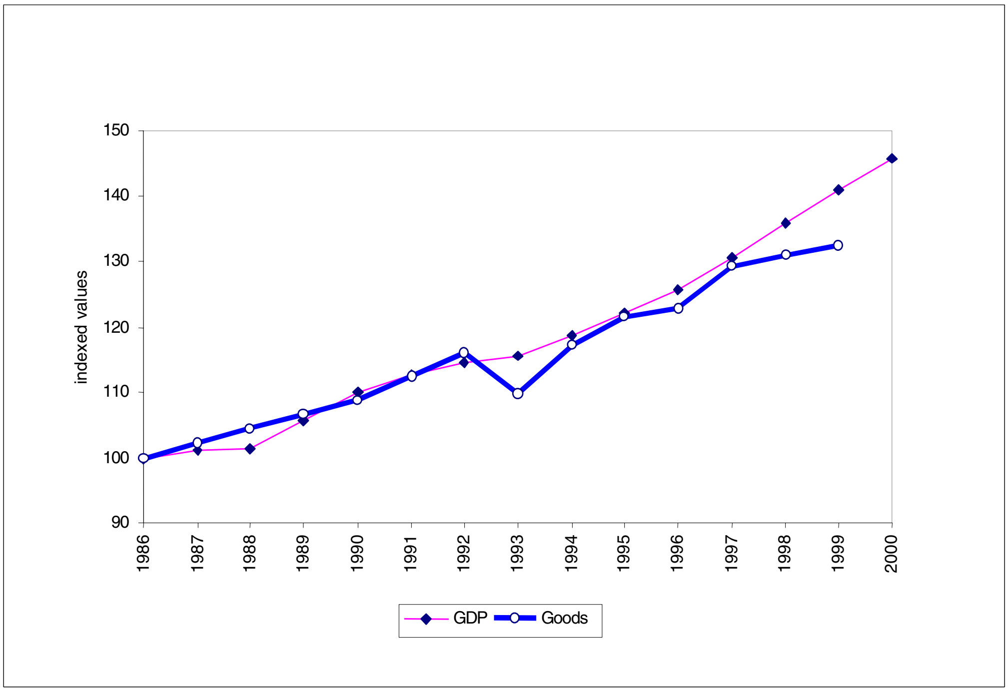
Source: Eurostat, *EU Transport in Figures* (annual publication).

Figure 4b. **Germany: Evolution of indexed GDP (real growth in volume), goods transport (road, rail, sea, IWW) and passenger transport (car, bus, rail, waterborne) in 1986-99**



Source: Eurostat, *EU Transport in Figures* (annual publication).

Figure 4c. **The Netherlands: Evolution of indexed GDP (real growth in volume), goods transport (road, rail, sea, IWW) and passenger transport (car, bus, rail, waterborne) in 1986-99**



Source: Eurostat, *EU Transport in Figures* (annual publication).

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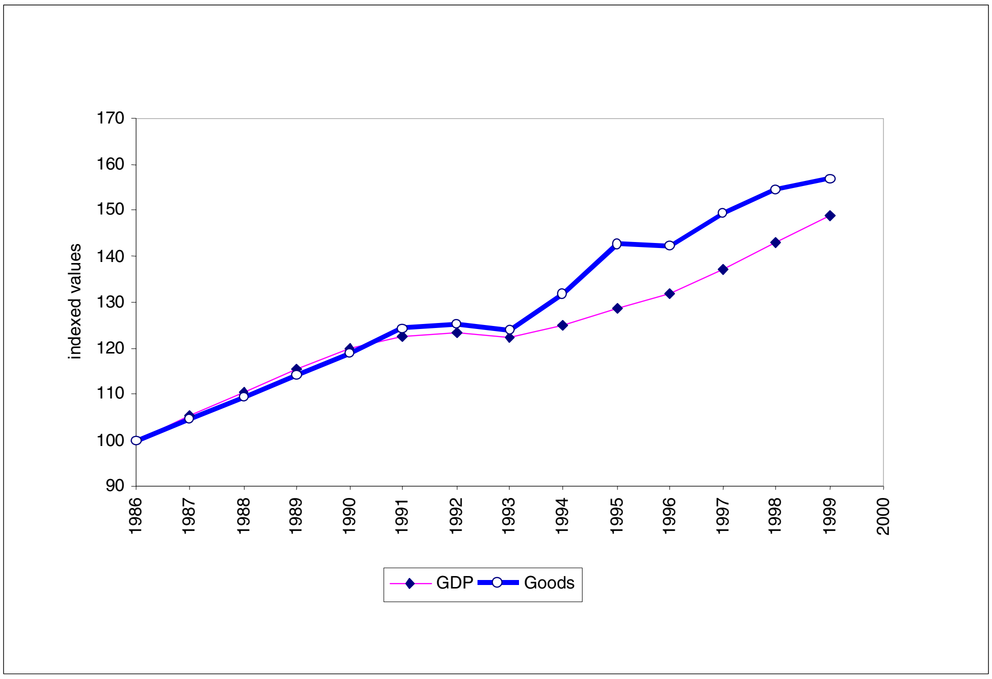
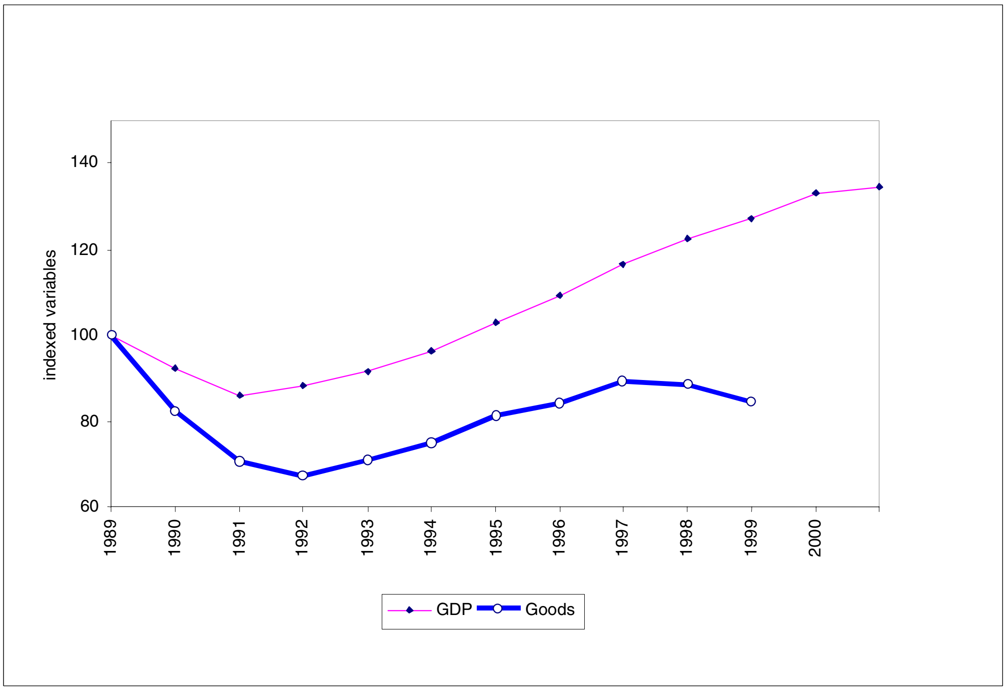
Figure 4d. **Spain: Evolution of indexed GDP (real growth in volume), goods transport (road, rail, sea, IWW) and passenger transport (car, bus, rail, waterborne) in 1986-99**



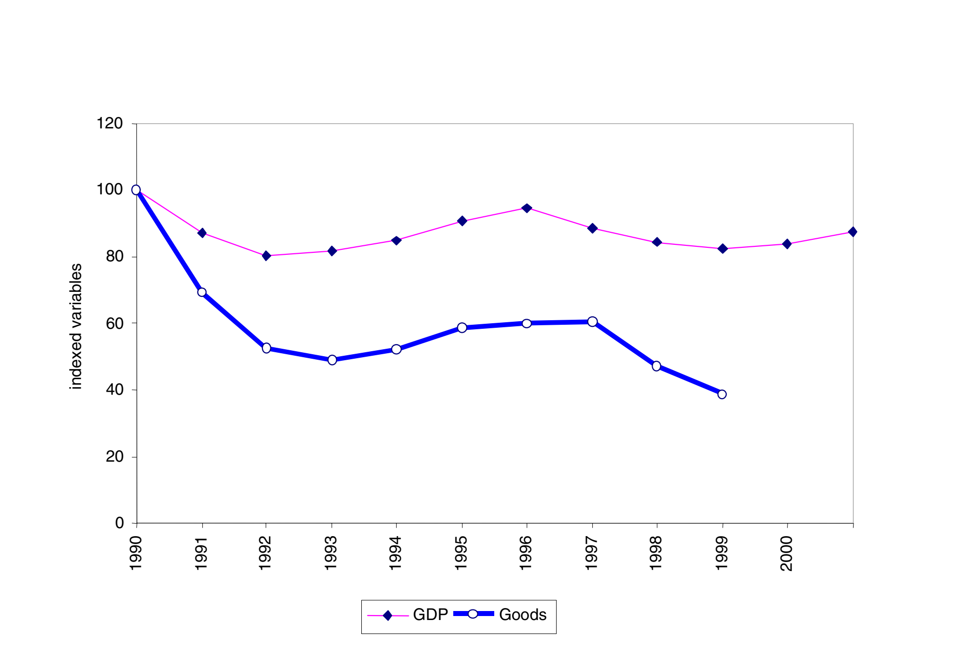
Source: Eurostat, *EU Transport in Figures* (annual publication).

Figure 4e. **Poland: Evolution of indexed GDP growth and goods transport performance (road+rail+IWW) (1989 index = 100)**



Source: UN-ECE; Centre for Markets in Transition;
HSE Ministry of Economy of Poland; Eurostat; ECMT.

Figure 4f. **Romania: Evolution of indexed GDP growth and goods transport performance (road+rail+IWW) (1990 index = 100)**



Source: UN-ECE; National Statistics Institute of Romania; Eurostat; ECMT.

There is a strong impetus from the development of the world trade blocks on the structure of the economies in each European country. Transport flows over longer distances originate from specialisation.

2.3. The influence of spatial development

Differences in spatial structure are responsible for differences in transport flows. The impact on transport distances is obvious. Structural changes in spatial development do not occur overnight, so in the short term the influence on the transport/GDP ratio is limited. However, in the long run, spatial planning can be an important instrument in the decoupling of the ratio.

2.4. The influence of the characteristics of the transport system

In his contribution to Round Table 119, Prud'homme mentions four main reasons for the decline in the generalised costs of transport:

- Infrastructure developments;
- Vehicle improvements;
- Organisational changes due to liberalisation;
- Shift to more cost-efficient modes.

The decline in generalised transport prices creates another optimal level for the transport component within the production and distribution chain. Infrastructure improvements, leading to lower transport times, do have an effect on both the direct transport costs (lower tariffs) and lower indirect costs (lower capital costs of the transported goods). The reason is that liberalisation and changes to more efficient modes are interrelated, and the combined effect is a strong growth in the public road carrier sector to the cost of both transport on own-account and the rail mode.

2.5. The influence of technological developments

Technology leads to the use of lighter materials and the application of advanced technologies. An example is the use of electronic components instead of mechanical constructions. The influence on the correlation transport/GDP is twofold:

1. A trend towards a decline in transport, since less weight has to be transported in relation to its contribution to the GDP;

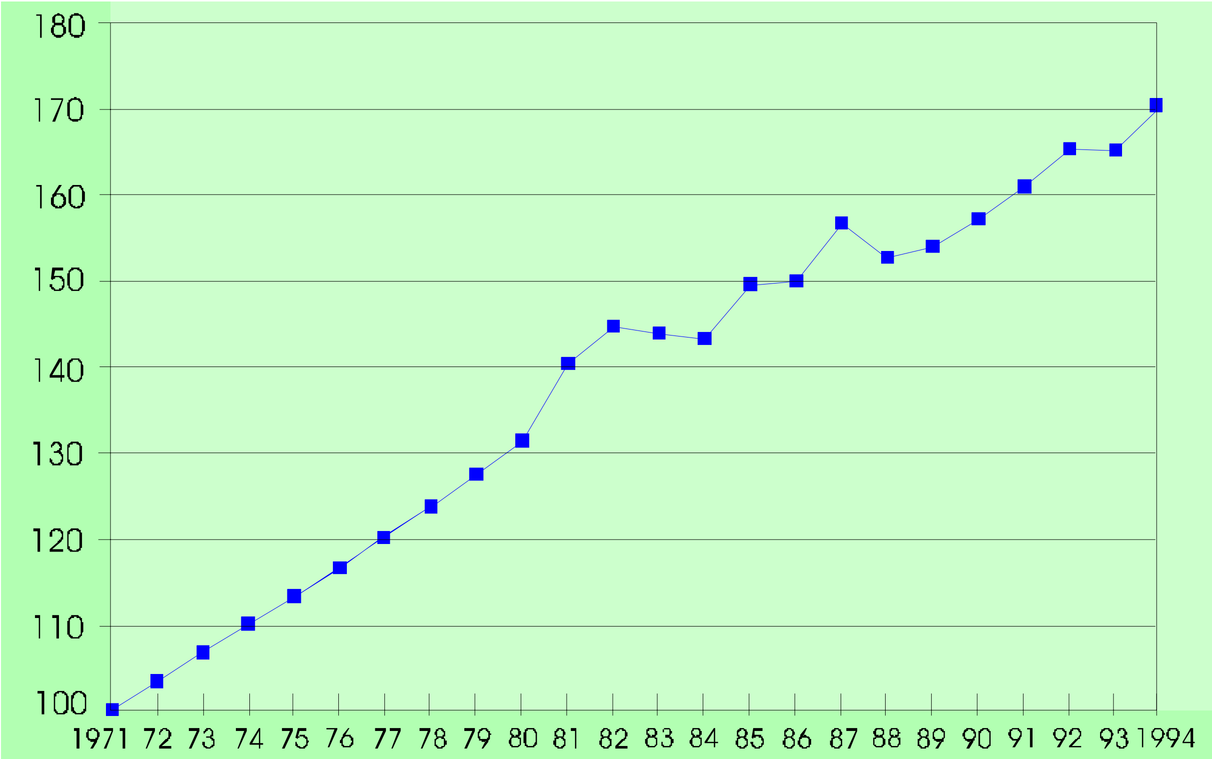
2. A trend towards an increase in transport since, due to the higher weight per unit, transport costs are relatively lower. This implies that, within the optimalisation process of production and transport, the influence of raising transport distances is smaller.

The combined effect of the two trends results in transport of lower volumes over larger distances, expressed in tonne-kilometres. This leads either to a rise or a decline, depending on the specific circumstances.

Both trends favour road and air transport, since the time-related costs (capital costs of the transported goods) are becoming relatively more important. A major explanation factor for the growth in the road sector's market share can be found here: both the technical developments and the changes in relative importance of the different economic sectors have led to a considerable change in the value/weight ratio.

For the EU15, this is shown in Figure 5.

Figure 5. **Average value of one traded tonne in the EU (1971-94)**
Index 1971=100



Source: Eurostat, Prognos, NEA.

2.6. The influence of the development of trade conditions

Economies have become more open. The development of the European Union, both geographically and at the level of integration, has been a stimulus for trade and consequently for transport. Equally, trade in relation to the rest of the world is on the increase. Over the last few decades, a process of breaking down trade restrictions between trade blocks has begun, but free trade conditions are not yet generalised.

The effect of the European Union can be expressed in a factor showing the trade level between EU countries compared with trade between EU countries and third countries, given production and consumption levels. In Figure 6 this is shown over time for five types of products (agricultural products, foodstuffs, metal products, chemical products and manufactured goods). Agricultural products and foodstuffs have been affected the most: the implications for transport distances are obvious. The effect of the European Union can also be shown in the development of trade in the countries that entered the Union in a later stage, such as Greece, Spain and Portugal. Figure 4 shows this effect for Spain, where freight transport has grown considerably over the last decades, in real terms as well as in relation to the GDP development.

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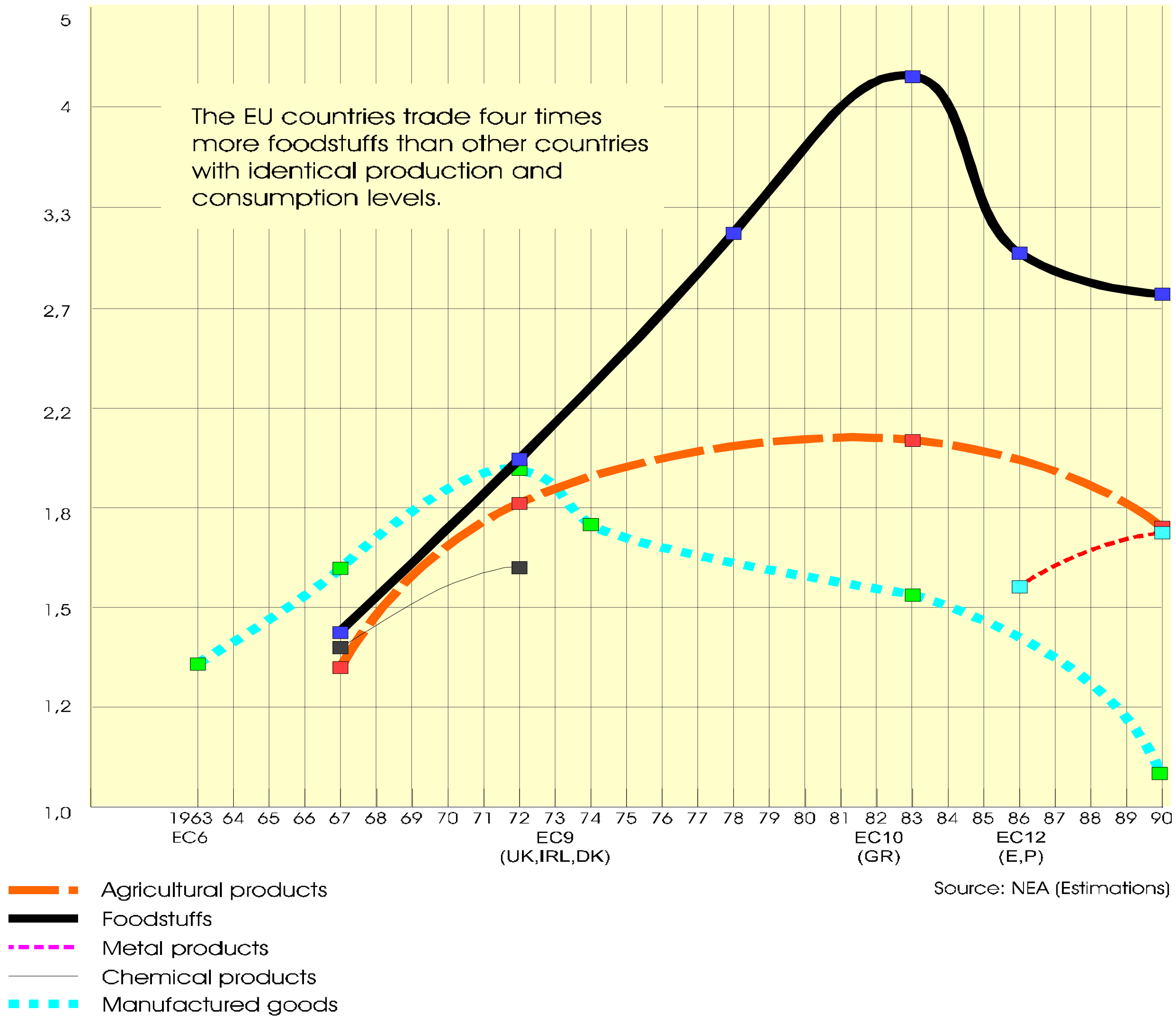
Figure 6. **The EU integration multiplier on trade**



3. A PERSPECTIVE TOWARDS THE FUTURE

3.1. Scenarios and strategies

The conclusion from the analyses of past developments is that several factors have different impacts on the correlation between transport and the economy. In the last decade, this has resulted in a growth of freight transport measured in tonne-kilometres that exceeds GDP growth for the EU-15 countries as a whole. The question is how this will develop further.

To analyse this development in expected trends, some determinants have to be taken as given. Economic, technological and demographic scenarios can be used to develop the future perspective in case no specific instruments for decoupling transport and the economy are applied. This is the reference for the consequence that will occur by applying strategies to decouple the development of the economy and transport. The latter analyses have not yet been quantified on a European level; it is a challenge to develop scenarios in forecasts on a macro level using strategies for decoupling.

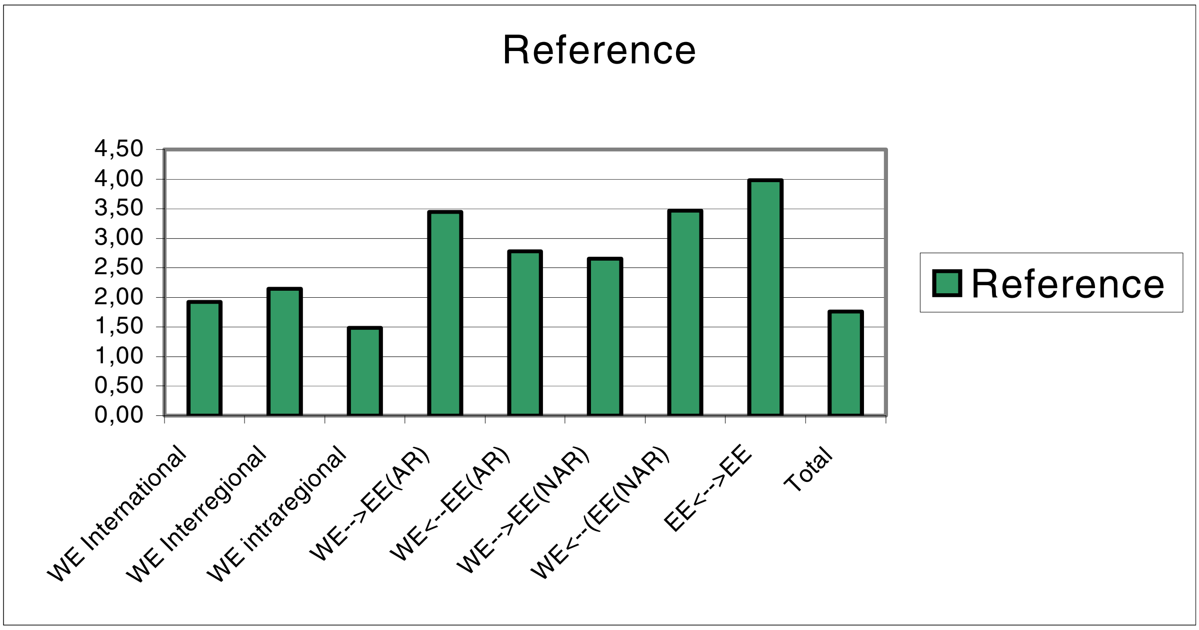
3.2. Future trends

Forecasts made for the European Commission by NEA in 1999 show an increase in transport volumes in tonnes from 76 per cent to 80 per cent between 1995 and 2020, depending on the scenario. For the reference scenario, the growth by type of correlation is given in Figure 7. Given the fact that volumes are rising more strongly over larger distances (such as relations to and from eastern Europe) compared to shorter distances (such as intraregional transport), the average transport distance will rise, leading to an even higher growth than 80 per cent, measured in tonne-kilometres.

The growth in freight transport is faster than the growth in passenger transport. In relation to the growth in GDP, the growth of freight transport measured in tonnes is 10-20 per cent lower than the GDP growth; however, measured in tonne-kilometres, the growth in freight transport and GDP are almost the same. Several factors contribute to the ongoing trend whereby growth in freight transport is almost on a par with GDP growth:

- The further development of the EU. Both the enlargement with new members and the further liberalisation of the internal market have effects on international transport volumes and the enlargement of transport distances. The differences in labour costs between Member States will further stimulate separation of consumption from production.
- It is also expected that the process of globalisation will continue. The difference in labour costs in different parts of the world is a stimulus for trade.
- The trend of decreasing generalised transport costs will continue. Here, the combined effects of new infrastructure, better use of existing infrastructure and the ongoing liberalisation of the transport sector on transport costs will be larger compared to the upwards effect on prices, due to the internalisation of external effects.

Figure 7. **Growth of transport volumes (tonnes) between 1995 and 2020 reference scenario**



Source: NEA report, "European Transport Forecast 2020 – Freight Transport" (1999).

Explanation of abbreviations:

WE: EU-15
EE: Central Europe
AR: Accession Region 1st phase (Poland, Hungary, Czech Republic, Slovenia, Estonia)
NAR: Other Central European Countries
Classification based on the information at the time of the project (1999).

3.3. Instruments for decoupling

The trends leading to the growth in freight transport, as mentioned above, can be regarded as a reference for future developments. These trends are largely uninfluenced by transport policy instruments. The enlargement of the EU, for instance, has several important benefits which outweigh the negative effects of the accompanying enlarged transport volumes.

Decoupling economic growth and transport growth is stated as a desirable development; it is not within the reach of transport policy instruments, as stated in the White Paper, *Time to Decide*. The subsidiarity principle is important here. One European dimension is infrastructure charging; moreover, policy instruments developed in other contexts can have their influence on the transport system. The White Paper further refers to the national and local level; here, policies should be formulated which take into account factors contributing to increasing demand for transport services.

On the one hand, transport growth is not an objective in its own right. As Phil Goodwin describes in reporting the conclusions of the ECMT Seminar of 16 December 2002 in Brussels, "Managing the Fundamental Drivers of Transport Demand", transport growth is only an objective insofar as it develops a better quality of life and more efficient economies. On the other hand, neither is decoupling transport growth and growth in GDP an objective in its own right. Decoupling is a derived objective from the aim to decrease the negative impacts of transport.

Without intending to propose the acceptance of forecast freight transport growth as inevitable, nor to give up the objective of decoupling growth of transport from growth of the economy, it is worthwhile to mention the following trends which contribute to reducing the negative effects of freight transport:

- Modal split policies. Shifting to environmentally friendlier modes reduces the negative impacts;

- Technological developments make it possible to reduce negative impacts;

- Spatial planning is an instrument to divert negative impacts to places where it causes less damage.

These developments contribute to a decoupling process between transport growth and the development of its negative impact.

3.3.1. Modal split

Modal choice in freight transport in a do-nothing scenario shows a trend towards road transport, based on the following developments:

- The shift of the economy towards sectors where road transport is relatively strong;
- The rising ratio of value to weight, leading to increased costs of time. This is in favour of road transport;
- The completion of the TEN network for motorways.

These effects are compensated by specific actions:

- The pricing instrument internalising external effects;

- Specific actions mentioned in the White Paper, *Time to Decide*, concerning revitalising railways and linking up (environmentally friendly) modes of transport. Sea motorways and the Marco Polo programme on intermodal transport are examples of specific actions.

It is expected that by applying these actions the growth in the modal share for road can be stopped; the share should remain at the present level. Compared to the do-nothing scenario, the effect is considerable.

The statement that the modal shift to road can be stopped relates to the average situation in Europe. In central and eastern Europe, the process of restructuring economies is still ongoing, and the shift from rail to road transport in these regions will not be stopped with the present share. It can be expected that equilibrium can be found here on a level of modal shares comparable to those of western Europe.

3.3.2. Technological developments

Technological developments lead to a safer, cleaner and more energy-efficient transport system. A policy instrument here is to stimulate these developments, both through research programmes and by stating clear objectives to the industry. These developments have a major impact on the global environment, on the local air quality, on the use of classical energy resources and on the number of fatal accidents.

3.3.3. Spatial planning

The influence of spatial planning on the freight transport system is largely focussed on local effects. By separating freight flows from housing areas the air quality in these areas is improved. Also regulating the planning of the production locations of dangerous goods and the transport flows to and from these plants will diminish risks.

3.3.4. Decoupling economic growth and transport

Policy instruments for decoupling growth and transport are already applied on a national, regional and scale level. Examples are the revitalisation of city centres and the development of advanced city logistics using information technology in virtual transport flows, instead of actual transport. In the Netherlands, for instance, there is a subsidy programme called "Transport saving" concerning initiatives for decoupling by private firms. However, there is a general feeling that, compared to passenger transport, decoupling in freight transport is a more difficult process.

The Commission is organising research activities to make inventories of what happens in the Member States and to disseminate practices and regulations. A sectoral approach is common practice, whereby new logistical concepts are shown as both being profitable for the sector and making use of less transport.

Decoupling long-distance freight transport from economical development by applying policy instruments on an international scale is only in a beginning stage. The pricing instrument can be used to optimise the transport in the production chain, taking the external impacts into account. Starting this process is already foreseen in the reference forecasts; when applied gradually, it is not expected that this will lead to a dramatic reduction in economic growth. However, the effect on the total volume of freight transport will probably be limited.

The process of further globalisation can lead to strong growth in trade and transport flows where differences in production cost levels in combination with free trade continue to exist. Developments here are not primarily driven by transport policy arguments, but do have an impact on transport flows. But, also within an enlarged Europe, differences in wage levels and working conditions do exist and this will contradict the process of decoupling. On the other hand, a process towards harmonization would reduce the need for transport.

It is a challenge to develop further transport policy instruments for decoupling. They should facilitate the market by choosing production and distribution patterns which use lower transport volumes while maintaining economic growth. Information technology could be applied, separating actual flows from information flows and thereby reducing transport. The application of these techniques should be stimulated by promoting research programmes and organising pilot projects.

4. CONCLUSION

Freight transport will remain a prominent activity in our society: a world without freight transport is beyond imagination. The trends show a continuation of growth in GDP. Measures to reduce the negative impacts of the growth of transport now concentrate on modal-split policy, transport system technological developments and spatial planning. This leads to a process of decoupling between transport growth and environmental impacts. Further, the trend in rising traffic victims will be reversed by these measures. Developments in this field look promising. The White paper, *Time to Decide*, shows clearly the international dimension of the instruments. They contribute to achieving the Kyoto criteria; it is doubtful, however, whether the set of measures is sufficient to meet the Kyoto criteria to its full extent.

Decoupling growth of freight transport from the growth of the economy still has the status of a desirable development. It has already become a research topic and a topic for pilot projects. At the national, regional and local levels, one can see projects and measures supporting this process. On an international level, the pricing instrument has a limited influence on the development of transport; other transport policy instruments influencing, on an international scale, the process of decoupling transport growth from the growth of the economy still have to be developed. Given the subsidiarity principle, it even can be doubted whether Europe will be able to contribute here.

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A Transport System Model that is More Compatible with the European Macroeconomic Environment

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SUMMARY

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1. INTRODUCTION – HOW CAN WE ASSESS THE EFFICIENCY OF THE EUROPEAN TRANSPORT SYSTEM?

One problem in economics that is always topical is the assessment of projects developed by firms, sectors or regions. In view of the importance and complexity of the role played by transport in the economic and social life of countries, we need to be able to determine the degree to which the transport sector meets the desires and expectations of society. By the same token that a country's industrial or agricultural system can be qualified as either good or bad, its transport system too merits scrutiny. In practice, transport offers society far less satisfaction than other products, services or sectors (the electronics industry, car industry, tourism sector, etc.). This degree of satisfaction also evolves in response to economic growth, level of well-being, international integration and globalisation. In any case study there is always a risk of formulating highly subjective opinions. For example, researchers focus on the marginal weakness or lack of infrastructure in under-developed countries, while the transport systems in rich wealth countries attract attention due to their impact on the environment, safety or even the beauty of the landscape, etc.

Assessments and comparisons of overall transport[1] systems are relatively rare. The results of benchmarking depend to a large extent on the aggregate of the indicators used, and even a long list of indicators cannot guarantee that an evaluation will be reliable and objective. The conclusion reached may be tendentious, particularly if the analysis focuses on a specific aspect of the operation of transport systems such as the environment[2]. On the other hand, a general assessment of the system, even if it is objective, may well be too abstract and therefore of no political, economic or social utility.

The transport systems currently in place in Europe figure prominently in the thoughts of both citizens and entrepreneurs. However, establishing a synthesis on the basis of these individual opinions is difficult in terms of both methodology and the work involved in conducting the necessary surveys. Individuals and firms focus on the perceived benefits and shortcomings of the transport system in different areas such as accessibility, safety, costs, trip times, flexibility, etc. They are not really interested in the indicators used by researchers, namely, network density, equipment productivity, modal structure, intensity of environmental nuisances, etc. The problem lies in finding a way of integrating the opinions of consumers, firms, public institutions and researchers into a coherent whole within which opinions are ranked in a logical order. It would seem that consumers attach a high value to the final aspects of transport activity, whereas they consider intermediate indicators (describing the internal aspects of the sector) to be of secondary or ancillary importance. As a general rule, improving intermediate indicators will improve the final values of transport (that is to say, those desired by consumers) but, in at least one case, the outcome contradicts this rule[3]. We need to bear in mind that the desires of transport users are often unrealistic, either because they are not technically feasible or because they are too expensive.

The quality of the European transport system and the assessment of that system during the first decade of the 21st century will have to meet the needs of a newly enlarged European Union. Accordingly, the evaluation of changes will have to consider not only the new Member States but also the current system in the EU15 Member States. Because of the increased complexity and diversity of the systems within this group of 25 countries, transport links within the EU15 area will need to be strengthened. The history of successive enlargements has consistently shown that, in contrast to the situation in the new Member States, growth in trade in the original Member States during the initial accession stage outpaced both economic growth (GDP)[4] and infrastructure capacity. The enlargement strategy for the period 1998-2004, however, has focused on modernising cross-border transport networks within candidate countries[5] and apparently makes no provision for changes in the cross-border networks within the EU15 area[6]. Such a strategy will result in wider disparities in terms of network quality and a general decline in the uniformity of the transport system within the enlarged Europe.

During the period 2004-2010, the transport system within the EU25 area must be capable of:

- promoting higher volumes of trade in goods and services and greater and more dynamic passenger mobility compared with the spatial framework of the EU15 prior to 2004;
- making more rational use of the strengths of the modes and forms of transport, enterprises and transport techniques available, while meeting requirements in terms of the environment, energy consumption, safety and the desired quality of services;
- ensuring quicker and cheaper deliveries of products to world markets than those offered by competitors from other continents;
- helping to reduce regional disparities, thereby facilitating new investments and the creation of new jobs;
- operating on a basis that ensures acceptable working conditions and pay in all Member States with regard to all modes of transport;
- making better use of research findings and innovations;
- making greater use of exchanges of good practices.

2. DECOUPLING GROWTH IN THE TRANSPORT SECTOR FROM ECONOMIC GROWTH – IS IT NECESSARY OR FEASIBLE IN EUROPE?

Freedom is one of the values that is most highly prized by Man. Freedom, however, can be significantly constrained or even lost through immobilisation as a result of the application of formal instruments (prison) or denial of access to transport. There are very few historical examples of regulation of demand for passenger transport[7]; demand for freight transport, too, has rarely been regulated. In practice, however, there are good reasons for regulating supply in a market economy, particularly if the market equilibrium needs to be restored because of over-supply.

The compatibility of macroeconomic growth with transport growth is a problem that has already been analysed several times within the framework of the overall equilibrium of the economic system[8]. This equilibrium still exists despite the major changes in the shares accounted for by different sectors in both GDP and employment (declining shares of agriculture and industry compared with growth in the services sector). However, the position of the transport sector in the macroeconomic system is quite different to that of many other sectors. Long-term statistical data indicate that economic development runs parallel to development in transport. Some researchers have even suggested that growth in transport is a necessary precursor to economic development. The opposite argument advanced by the European Union, recommending that growth in transport be slowed down compared to that of GDP[9], seems debatable and further investigation is needed of the real reasons for such a strategy. The ecological arguments set out in support of this view must be compatible with macroeconomic, social and technical requirements. Over the next decade, Europe will need to accelerate growth rates and reduce economic disparities between countries and regions. Achieving this goal might not be feasible if transport were to prove a barrier to development. The hypothesis whereby transport is a necessary factor in economic growth needs to be treated with great caution.

2.1. Is there excessive or spurious demand for transport in Europe?

The postulated existence of an irrational demand for transport[10] needs to be verified as part of an in-depth analysis based on practical case studies. The balance between transport and the macroeconomic system has three specific aspects:

1. Transport demand that is compatible with the intensity of output of goods and services;
2. Transport supply that meets demand;
3. Infrastructure capacity that matches traffic density.

The first two aspects cannot be readily analysed and designing appropriate indicators is a highly complex task. The variations in output of goods and services from one sector, region or country to another are so great that establishing a simple rule will have to be a task for the future. While it might be feasible to set rational standards relating to the energy and labour needed to produce a given good, as well as the wastes arising in its production, setting standards in terms of tonnes or tonne-km in the transport sector remains a fruitless exercise. It is possible to determine whether transport demand is met by supply from a methodological standpoint, although time-consuming surveys need to be conducted to define and assess the level of indicators. Empirically, far more is known about the degree to which infrastructure is matched to traffic intensity[11].

The first step towards determining the scope for a slowdown in transport demand in relation to economic growth consists in analysing the trends in transport intensity in European countries. Such an analysis requires access to reliable and comprehensive statistics relating to:

- the volume of goods transported in tonnes via all modes (rail, road, inland waterways, maritime cabotage, pipelines, air);
- the number of tonne-km carried by the above modes;
- the value of GDP expressed in a single currency and constant prices.

The greater availability of such statistics which has become apparent over the past few years in Europe allows us to chart the trends in two specific indicators over the period 1990-2000: (1) number of tonnes per 1 000 USD of GDP[12]; (2) number of tonne-km per 1 USD of GDP in the EU15 and in Poland. It is very useful not to limit the scope of the analysis to indicator (2), since we need to consider the gradual decoupling of economic growth and growth in transport in terms of whether we need to reduce the number of tonnes transported or the distance travelled per tonne.

Table 1. **Trends in freight transport in six modes and trend in GDP in constant prices within the EU15 and Poland over the period 1990-2000**

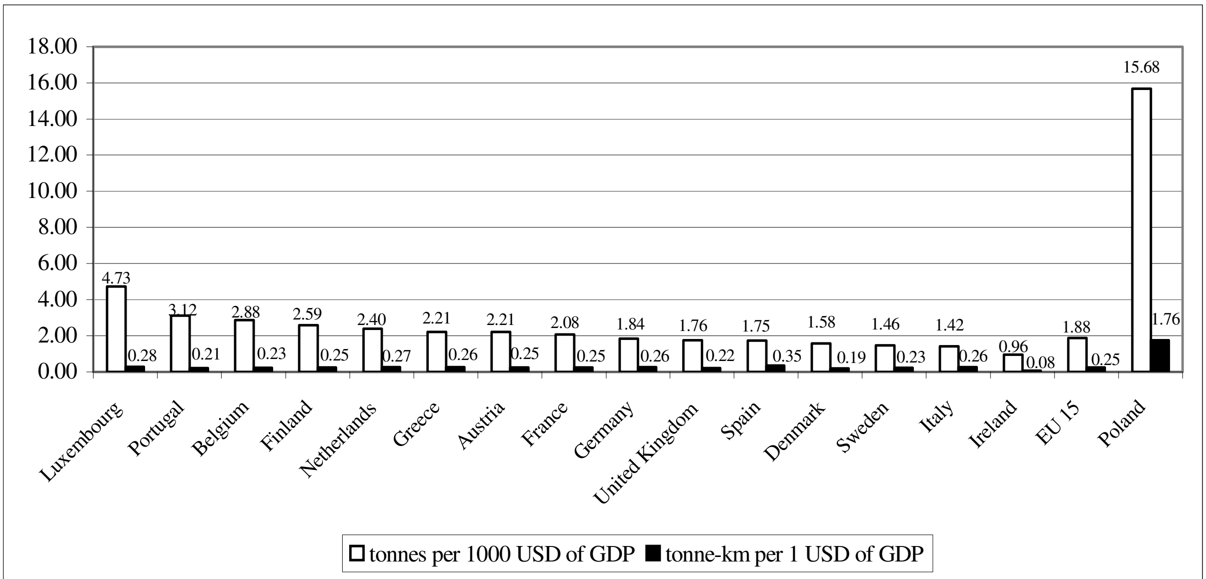
EU15	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**Average annual change (1990-2002) % per year**
Tonne billions (6 modes)	13.6	13.6	13.7	13.5	14.1	14.6	14.4	14.7	14.8	15.3	15.4	1.28
Tonne-km billions	1 614.6	1 628.6	1 645.3	1 631.0	1 719.8	1 783.3	1 799.6	1 878.0	1 954.2	2 019.1	2 087.0	2.60
Average distance EU-15 in km (6 modes)	119	120	120	121	122	122	125	128	132	132	136	1.30
Per billion USD of GDP (1990 prices and exchange rates)	6 742.3	6 772.5	6 805.0	6 838.4	7 023.9	7 209.3	7 332.7	7 527.7	7 738.9	7 942.2	8 205.6	1.98
Tonnes per 1 000 USD GDP – EU 15 average	2.01	2.00	2.02	1.98	2.01	2.03	1.96	1.95	1.92	1.93	1.88	-0.69
Tonnes per 1 000 USD GDP – Ireland (EU minimum)	*1.86*	*1.78*	*1.80*	*1.47*	*1.35*	*1.39*	*1.34*	*1.19*	*1.11*	*1.03*	*0.96*	-6.39
Tonnes per 1 000 USD GDP – Luxembourg (EU maximum)	*5.34*	*5.14*	*5.22*	*5.17*	*4.93*	*5.05*	*4.81*	*4.79*	*4.70*	*4.71*	*4.73*	-1.19
Tonnes-km per 1 USD GDP – EU 15 average	0.24	0.24	0.24	0.24	0.24	0.25	0.25	0.25	0.25	0.25	0.25	0.60
Tonnes-km per 1 USD GDP – Ireland (EU minimum)	*0.11*	*0.11*	*0.12*	*0.10*	*0.10*	*0.11*	*0.10*	*0.09*	*0.09*	*0.08*	*0.08*	-3.16
Tonnes-km per 1 USD GDP - Spain (EU maximum)	*0.33*	*0.34*	*0.34*	*0.33*	*0.34*	*0.36*	*0.34*	*0.34*	*0.34*	*0.35*	*0.35*	0.81
Poland	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	
Tonne billions (6 modes)	1.6	1.5	1.4	1.3	1.3	1.4	1.4	1.4	1.3	1.3	1.3	-1.97
Tonne-km billions	138.8	116.0	112.5	118.0	126.3	134.8	141.1	148.4	151.0	146.5	148.9	0.71
Average distance in km (6 modes)	86	80	83	89	96	99	104	107	113	112	112	2.73
Per billion USD of GDP (1990 prices and exchange rates)	59.0	58.8	58.6	58.4	62.1	65.8	69.8	74.6	78.1	81.3	84.5	3.66
Tonnes per 1 000 USD GDP	27.40	24.67	23.23	22.70	21.26	20.59	19.48	18.51	17.08	16.08	15.68	-5.43
Tonne-km per 1 USD GDP	2.35	1.97	1.92	2.02	2.03	2.05	2.02	1.99	1.93	1.80	1.76	-2.85

Source: University of Gdańsk, based on: EU Energy & Transport in Figures 2002; ECMT Statistics 1985-1996. ECMT 1999, http://www.oecd.org/cem/stat/transport; Trends in the Transport Sector 1970-1997, ECMT, Paris 1999; UIC International Railway Statistics – Summary 1998-2000, http://www.uic.asso.fr/d_stats/online/synth2000.xls; OECD in Figures 1999, http://www.oecd.org/std; OECD Main Indicators, February 2002; Rocznik Statystyczny GUS 2002; Rocznik Statystyki Międzynarodowej GUS 1997; Oesterreichisches Statistisches Zentralamt - Allgemeine Statistik. http://www.oestat.gv.at; Institut National de Statistique 2003 (Belgium), http://www.statbel.fgov.be/figures/d74_fr.asp; Denmark Key Figures for Transport 2002: http://www.dst.dk/665; Finland in Figures 2002, http://www.stat.fi/tp, http://tilastokeskus.fi/tk/tp/tasku/taskuf_liikenne.html; Mémento des Statistiques des transports, OEST, Paris, December 1994; SNCF Annual Report 2000 & 2001; Federal Statistical Office, Germany, http://www.statistik-bund.de (October 2002); National Statistical Service of Greece, http://www.statistics.gr; Greece in Figures 2002, http://www.statistics.gr/Main_eng.asp; CSO Ireland: Principal Statistics 2002, http://www.cso.ie/principalstats/yearbook2002.html; Istituto Nazionale di Statistica 2002, http://www.istat.it; Luxembourg in Figures, STATEC 2002, http://www.statec.lu; Statistics Netherlands - Key figures 2000, http://www.cbs.nl; Instituto National de Estatistica, Portugal 2002, http://www.ine.pt/prodserv/quadros; Instituto Nacional de Estadistica 2002, http://www.ine.es/en/espcif/espcif02_en.htm; The Swedish Transport. Sector Today. SIKA Rapport, 2001, http://www.sika-institute.se/english_fr.html; United Kingdom in Figures 2002, http://www.statistics.gov.uk/CCI/nscl.asp?ID=5001; Transport Statistics Great Britain: 2002 Edition, Department for Transport, http://www.transtat.dft.gov.uk/tables/tsgb02/index.htm.

The statistical data available on the EU15 over the period 1990-2000 indicate a declining trend in the number of tonnes transported per 1 000 USD of GDP (-0.69 per cent) accompanied by growth in the average distance transported (+1.3 per cent). In terms of results, the indicator of the number of tonne-km per 1 USD of GDP was rising at a rate of 0.6 per cent a year. The question is therefore whether or not this situation is compatible with the strategy objective stated by the Göteborg Council with regard to decoupling. Were this not to be the case, it would be necessary either to accelerate the decrease in the volume of tonnes or to halt the growth in the average distance travelled. The European Commission is aware that a simplistic solution would be to introduce legislation to reduce the mobility of persons and goods while at the same time imposing a new modal split. However, the Commission does note that *"by implementing the 60-odd measures set out in the White Paper there will be a marked break in the link between transport growth and economic growth, although without there being any need to restrict the mobility of people and goods. There would also be much slower growth in road haulage thanks to better use of the other means of transport (increase of 38% rather than 50% between 1998 and 2010). This trend would be even more marked in passenger transport by car (increase in traffic of 21% against a rise in GDP of 43%)[13]."* Achieving such a strategic goal would mean that by 2010 the volume of freight would amount to 1 350 million tonnes and 178 billion tonne-km, which would still be less than the outcome were the current trend to continue.

It should be possible to maintain this downward trend in the number of tonnes hauled per 1 000 USD of GDP through the development of logistics systems and strategies, technological progress, the development of human resources in industry, elimination of declining industrial sectors, greater use of economies of scale, increased share of services in national product (tertiary sector), waste disposal and recycling, increased activity afforded by telecommunications, use of the Internet, relocation, etc.[14] These changes will primarily take place in countries currently acceding to the EU in that transport intensity levels in those countries are five to eight times higher than those within the EU. For example, it would be both unacceptable and impossible for the volume of tonnes hauled in Poland in 2010 to remain at 16 tonnes per 1 000 USD of GDP if the value of that indicator in other Member States were to remain below 1.9 tonnes. Figure 1 illustrates these disparities in 2000:

Figure 1. **Transport intensity in 2000 in EU15 and Poland**



European statistical data can be used to derive a rule to the effect that very high rates of GDP growth are accompanied by increasingly slower growth in freight transport. The country that best illustrates this observation is Ireland, where annual growth of +8.21 per cent a year over the period 1990-2000 was accompanied by a decline of -6.39 per cent in the number of tonnes hauled per 1 000 USD of GDP and an annual decline of -3.16 per cent in the number of tonne-km. The opposite can be seen in Italy, where GDP growth of merely +1.37 per cent was accompanied by respective growth in these two indicators (tonnes and tonne-km) of +1.24 per cent and +1.54 per cent a year. Table 2 provides further details in support of these two observations which allow us to draw the following preliminary conclusion: Strong acceleration in macroeconomic growth will enable the link between the transport sector and the economy as a whole to be completely severed. However, this strategy will fail if administrative instruments or economic, fiscal and financial measures are used to lower the volume of transport flows.

Empirical studies based on statistical data for the EU15 plus Poland show that trends in transport and GDP over the period 1990-2000 vary substantially from one country to another. The case of Ireland (described above) shows a certain degree of similarity with that of the following countries (see Table 2): Finland; Netherlands; Portugal; Belgium; United Kingdom; Sweden. The case of Italy (described above) appears to be mirrored in the following countries: Denmark; Spain; Greece. The third type of trend observed is a decline in the volume of transport (in tonnes) accompanied by an increase in tonne-km: Luxembourg; Austria; Germany; France. Lastly, the fourth type of trend (reduction in the number of tonnes accompanied by growth in the number of tonne-km) was totally absent during the decade analysed. Among EU countries, the trend in indicators in Poland was similar to that found in Ireland.

Table 2. **Trends in freight transport in six modes and trend in GDP in constant prices within the EU15 and Poland over the period 1990-2000**

	GDP (constant prices 1990)	Tonnes hauled	Tonnes-km	Average distance of transport	Tonnes per 1000 USD of PIB	Tonne-km per 1 USD of PIB
Ireland	8.21	1.30	4.79	3.44	-6.39	-3.16
Luxembourg	5.34	4.08	6.10	1.94	-1.19	0.72
Netherlands	2.82	2.10	2.74	0.63	-0.71	-0.08
Denmark	2.71	5.59	5.28	-0.29	2.80	2.50
Portugal	2.63	1.10	2.30	1.19	-1.49	-0.31
Spain	2.46	3.34	3.30	-0.04	0.85	0.81
Greece	2.33	2.90	3.03	0.12	0.56	0.68
Austria	2.28	1.98	2.86	0.86	-0.30	0.57
Belgium	2.07	0.35	1.38	1.03	-1.69	-0.68
Finland	2.06	0.08	0.92	0.84	-1.94	-1.11
United Kingdom	1.92	-0.39	1.60	2.00	-2.27	-0.32
Germany	1.88	1.00	2.89	1.87	-0.87	0.99
France	1.82	1.49	2.53	1.02	-0.32	0.70
Sweden	1.63	-1.48	1.18	2.70	-3.06	-0.44
Italy	1.37	2.63	2.94	0.30	1.24	1.54
EU15	**1.98**	**1.28**	**2.60**	**1.30**	**-0.69**	**0.60**
Poland	**3.66**	**-1.97**	**0.71**	**2.73**	**-5.43**	**-2.85**

Source: See Table 1.

Decoupling transport growth and macroeconomic growth cannot be based on the argument that increased traffic levels are not matched by infrastructure capacity. If traffic is objectively necessary, then all measures must be taken to ensure that infrastructure capacity is matched to the needs of the economic and social system.

The decoupling strategy must be compatible with the spatial changes in Europe as a result of enlargement. Over the period 2003-2010, the continued increase in the average distance of transport movements will need to be viewed as the outcome of growth in trade flows between the EU15 and new Member States and also of the expected recovery in the activities of railway and shipping companies (short-sea shipping). There are, therefore, no grounds for either supporting or arguing strongly in favour of a decrease in such distances, particularly in the case of international transport.

It is also necessary to determine whether the *acquis communautaire* in the field of transport contains the requisite instruments for implementing the strategy of decoupling transport growth from economic growth. Approximately 350 regulations and directives in the road sector (including legislation regarding the technical aspects of vehicles, inspection procedures, the environment, etc.) are of a restrictive nature and therefore penalise growth in road haulage. Despite this, however, the share of road in the modal split continues to grow at the expense of rail and inland waterways, its competitors. The conclusion to draw from this is quite simple: the *acquis communautaire* is not compatible with and does not meet the requirements of the decoupling strategy, despite its complexity and highly detailed regulatory programme. This regulatory failure is attributable to the fact that the *acquis communautaire* applies solely to the supply of transport, but that does not justify introducing new regulations aimed at slowing transport demand. The best solution would be to let the market optimise the consumption of transport services by other productive sectors and society.

2.2. The discrepancy between infrastructure development and traffic growth

The strategy of decoupling macroeconomic growth from transport does not exclude the need for investment in transport infrastructure in Europe. At the same time, since the period 2003-2010 is the most ambitious stage in the history of enlargement of the European Union, and in response to a higher level of investment activity, this strategy must also serve to reduce existing disparities between Member States, both new and old, and to eliminate a number of bottlenecks.

The provision of infrastructure within the EU15 over the period 1990-2002 remained well below the level needed to accommodate traffic levels. This has been demonstrated in several reports that have endeavoured to describe infrastructure needs[15], determine the number of sections affected by bottlenecks and analyse the scope for funding infrastructure following enlargement[16]. The drawback to these analyses is the lack of indicators describing the intensity of use of rail, road and inland waterway infrastructure over 1 km. The information quoted in the European Commission's 2001 White Paper shows that there are bottlenecks on 7 500 km of road (i.e. 10 per cent of the network) and 16 000 km of railway track (20 per cent of the network). These figures are fairly astonishing and appear to be exaggerated in the case of the railway network, which in Europe is constantly shrinking. It is difficult to compare traffic intensity over 1 km of road and rail networks, firstly, because traffic structures[17] are different and, secondly, because the road and rail networks do not have the same capacities over 1 km. By taking account solely of freight traffic on the two networks, we obtain the data given in Table 3.

Table 3 cannot be used to determine whether priority should be given to investment in either road or rail infrastructure, despite the fact that the number of tonne-km carried on the rail network in 2000 was 4.7 times higher than that on the road network; it should also be noted that there is no reason to restrict investment in the road networks of Luxembourg, Italy and Germany, which have the highest traffic densities in Europe. Table 3 also draws attention to a very important point: **over the period 1990-2000, while the intensity of freight traffic over 1 km of the road network increased by 40 per cent, that of rail freight traffic increased by merely 4 per cent and in some countries even decreased by between 5 per cent and 37 per cent**. The growth in freight traffic has been accompanied by similar growth in passenger traffic, as in the case of Belgium, where car traffic grew by 28.9 per cent and coach and bus traffic by 25.9 per cent[18]. This is despite the fact that, since 1999, EU policy has given priority to investment in rail[19]. Such a priority is too simplistic, however, and will not solve the problem of lack of infrastructure capacity in Europe.

Table 3. **Trend in freight traffic intensity over 1 km of road and rail network in Europe over the period 1990-2000**

Tonne-km thousands over 1 km of national network	Road traffic			Rail traffic		
	1990	**2000**	**2000:1990**	**1990**	**2000**	**2000:1990**
Austria	126.7	165.1	1.30	1 912.1	2 820.1	1.47
Belgium	279.1	330.9	1.19	2 414.5	2 221.8	0.92
Denmark	193.0	335.2	1.74	1 043.9	989.3	0.95
Finland	329.9	355.2	1.08	1 431.7	1 726.5	1.21
France	199.9	271.2	1.36	1 504.1	1 881.5	1.25
Germany	324.4	534.6	1.65	2 491.4	2 131.0	0.86
Greece	110.5	159.7	1.45	260.5	164.1	0.63
Ireland	42.9	71.0	1.66	303.0	255.9	0.84
Italy	572.0	777.3	1.36	1 206.0	1 394.0	1.16
Luxembourg	464.3	835.4	1.80	2 616.2	2 492.7	0.95
Netherlands	258.5	366.5	1.42	1 097.2	1 352.8	1.23
Portugal	93.2	121.7	1.31	518.3	775.8	1.50
Spain	164.1	242.7	1.48	797.9	879.7	1.10
Sweden	190.8	230.8	1.21	1 768.8	1 831.5	1.04
United Kingdom	348.6	402.6	1.16	963.7	1 116.1	1.16
EU15	**253.1**	**353.4**	**1.40**	**1 591.0**	**1 657.1**	**1.04**
Poland	**184.8**	**293.4**	**1.59**	**3 184.8**	**2 578.2**	**0.81**

Source: See Table 1.

Investment in infrastructure could improve the modal equilibrium in the European system, provided that we respect the priorities set out in Article 5 of Decision No. 1692/96/EC of the European Parliament and of the Council of 23 July 1996 on Community guidelines for the development of the trans-European transport network[20], which are as follows:

(a) Establishment and development of the connections, key links and interconnections needed to eliminate bottlenecks, fill in missing sections and complete major routes;
(b) Establishment and development of infrastructure for access to the network, making it possible to link island, landlocked and peripheral regions with the central regions of the Community;
(c) The optimum combination and integration of the various modes of transport;
(d) Integration of environmental concerns into the design and development of the network;
(e) Gradual achievement of interoperability of network components;
(f) Optimization of the capacity and efficiency of existing infrastructure;
(g) Establishment of and improvement in interconnection points and intermodal platforms
(h) Improved safety and network reliability;
(i) The development and establishment of systems for the management and control of network traffic and user information with a view to optimizing use of the infrastructures;
(j) Studies contributing to improved design and better implementation of the trans-European transport network.

These priorities cannot readily be reconciled with the 1999 EU financial standard, whereby road investment must not exceed 25 per cent of the total investment and rail must account for at least

55 per cent. The argument advanced in support of such a solution is that extending the road network is not a long-term solution to problems with congestion in most regions, because new roads generate additional traffic[21]. On the other hand, why give priority to rail investment when there is already excess infrastructure capacity and a number of lines need to be closed?

In practice, most investments in transport infrastructure in Europe are funded and decided at the national level according to the criteria of traffic intensity and rate of return on projects. In 1996, such investment amounted to 70.4 billion euros[22], whereas Community-funded investment amounted to approximately 7 billion euros a year[23]. National funding therefore accounts for over 90 per cent of total expenditure.

The constantly recurring problem is how to find the additional resources needed to finance transport infrastructure. The total cost of projects relating to the trans-European network is estimated to amount to between 400 and 500 billion euros. Other projects relating to the upgrading and additions to networks are even more expensive. This dilemma will become even more acute after enlargement of the European Union, which will require extension of the trans-European transport network to the "future Member States" and additional investment of around 90 billion euros by the year 2015 (of which 36.3 billion euros for Poland) to finance the construction of: 18 030 km of road; 20 290 km of railway track; 4 000 km of inland waterways; 38 airports; 13 maritime ports; and 49 river ports[24]. Under such conditions, national public funding -- and to an even greater extent Community funding -- will clearly be insufficient to cover all the expenditure. It is for this reason that the European Union is trying to get the private sector involved in network funding by encouraging public-private partnerships (PPP). However, there will clearly be a greater chance of successfully involving the private sector if the risks are properly identified and divided between the parties. It is the responsibility of the public sector to minimise the political, regulatory and planning risks relating to the project, whereas the risks relating to design, funding, construction and traffic should be borne by the private sector[25]. The outlook for PPPs in investment related to enlargement remains fairly limited. When operational programmes for the transport sector in candidate countries were drawn up in 2002, the financial tables under headings other than financial support from the EU and budgetary resources were the hardest ones to complete.

As there is no significant scope for increasing infrastructure funds, it will therefore be necessary to concentrate the investment effort on a smaller number of projects. Such a solution was considered in the 2001 White Paper by the European Commission, in which the Commission proposed to modify the priorities of the trans-European network in order to optimise network capacity by concentrating investment on: construction of a rail network primarily for freight; rail connections to ports; air/rail integration; intelligent transport systems.

Given that completion of the 14 Essen projects has posed many problems and is well behind schedule, it is surprising to see new projects proposed before the previous ones have been finished, particularly in view of the fact that some of these new projects do not appear to be urgent. Nonetheless, the Commission has proposed adding a further six new projects and new sections to two existing projects: the high-capacity rail link through the Pyrenees; the global satellite radionavigation and positioning system (Galileo); the eastern European high-speed train/combined transport system; the Fehmarn Belt bridge/tunnel between Denmark and Germany; improved navigability on the Danube between Straubing and Vilshofen; interoperability of the high-speed Iberian rail network; adding the mixed freight/high-speed line between Montpellier and Nîmes; extending the Brenner project from Munich to Verona to add the Verona-Naples route and the Bologna-Milan branch. These new projects require a total investment of more than 66 000 million euros to be assembled from national, regional and Community public and private funds (the interoperability of the high-speed Iberian rail network will cost 29 000 million euros).

These proposals by the Commission need to be accompanied by projects arising directly from enlargement in 2004; they need to include the network described in the TINA report. If not, Europe will always remain divided into two halves: one with good infrastructure and one with bad infrastructure.

3. TO WHAT EXTENT CAN TRANSPORT ENHANCE THE COMPETITIVENESS OF THE EUROPEAN ECONOMY?

It should be recalled that the impacts of European integration are usually of lesser significance than those of globalisation. The economies of scale generated through the standardization and distribution of a product or service are much greater at the global level than at the regional level (e.g. Europe). European competitiveness can be enhanced in relation to Europe's American or Asian competitors, but not in relation to the entire world.

Although several research papers have been written on international competitiveness, this concept still lacks relevance and is not yet sufficiently clearly defined or generally accepted. It may be noted that the concept of competitiveness is harder to define at the national level of countries than at the firm level. Any analysis of national competitiveness must take account of the various factors which determine the standard of living of the population, namely, growth, employment and income distribution. The competitiveness of a region or country is apparently reflected in its ability to promote factors which are determining for its long-term economic growth; these factors include productivity, efficiency, specialisation, profitability, etc[26].

It would seem that, in the analysis of international competitiveness, a distinction must be drawn between two types of comparison, aimed respectively at:

- solely establishing disparities between countries by means of a series of general macroeconomic and social indicators;
- identifying and measuring the capacity of a country to strengthen its presence on world markets.

In the second case, the list of useful indicators is shorter but the indicators are more refined and difficult to calculate, due to the lack of specific statistical data. These indicators cannot be replaced by figures reflecting the final economic outcomes: rate of GDP growth; unemployment rate; impact of exports on the GDP of a country; trade balance; market share of the most significant products in human life, etc. Specific indicators relating to the notion of competitiveness involve economic parameters such as: flows of foreign direct investment (FDI); labour productivity; unit labour costs; share of R&D in total output costs of sectors; import penetration rates or, in other words, the share of the domestic market accounted for by foreign firms, etc.

3.1. Transport-dependent components of European competitiveness

The role played by transport in the creation of European competitiveness was first perceived after the acceleration in the trend towards globalisation, which revealed several strengths, but also certain weaknesses, in the European economy. Despite the publication of several reports and documents on this subject, the global role of transport does not seem to have been properly understood or described. The White Paper published by the European Commission in 2001 was an attempt to tackle this issue, but one that ultimately allowed itself to be sidetracked. Instead of stressing the need for the European Union to speak with a single voice about maritime safety or the requirements of the Galileo programme, the White Paper should have shown:

1. which indicators describing European competitiveness are directly or indirectly dependent on transport;
2. which transport parameters can enhance the competitiveness of the European economy.

The relationship between transport and international competitiveness in Europe can be seen in the influence that products and services offered on markets have on prices, the increase in their relative quality and the increased speed and depth of market penetration. These positive impacts play an extremely important role in trade and are provided almost exclusively by means of transport. Telecommunications, Internet or postal services can be used to distribute and disseminate technological discoveries, software, patents and information. Competition at the world level is increasingly a contest between producers of extremely lightweight products and services, with high unit values and requiring very few tonnes of transport capacity. This trend has led to reduced demand for maritime transport and a stagnating air freight market.

In some modes of transport, Europe will always be weaker than her world competitors, as in the case of the railways, whose operating parameters are far lower than those in the United States. However, there is no reason why European maritime and air transport should not be world leaders in terms of competitiveness. The aim is not so much to impose European regulatory approaches within the world arena with respect to these two modes, but rather to increase their productivity by modernising all aspects of their technology as well as their management. Europe already possesses a good industrial basis for the development of these two modes of transport.

Transport undoubtedly remains a major factor in the competitive strategies of transnational firms. One of the factors facilitating the globalisation process is the reduction in transport costs. Between 1985 and 1992, the price, in real terms, of maritime freight fell by 25 per cent, that of trans-Atlantic air freight by 30 per cent and that of trans-Atlantic passenger transport by 50 per cent[27]. It would be interesting to know to what extent European transport has helped to bring about this reduction in costs. In the maritime shipping sector, for example, the registration of vessels under flags of convenience would appear to be responsible for lower costs, given the declining number of ships registered under European flags. The situation is better in the air transport sector, where Europe has both the fleet resources and organisational and managerial know-how to achieve lower costs.

The factors that have the greatest impact on European competitiveness in world markets generally owe more to technology or organisation than to the geographical aspects of transport. Of these factors, FDI (foreign direct investment), labour productivity and ICT (information and communications technologies) and their dissemination would currently appear to be the key determinants of enhanced international competitiveness in Europe.

The existence of economically attractive sectors and locations in Europe offers scope for increased foreign direct investment (FDI). According to a recent report by the Commission's departments, between the early 1980s and 1990s, stocks of foreign direct investment in the world increased in value terms four times faster than world GDP and three times faster than world trade. However, what is even more important for the European Union is the disproportionate growth it has enjoyed in inbound FDI which, over the period 1984-1990, *increased sevenfold* and meant that Europe accounted for a growing share of total world FDI flows. The share of world FDI flows accounted for by Europe continued to grow throughout the 1980s up to 1993, rising from slightly over 25 per cent to over 44 per cent of world flows (particularly into the United Kingdom). Most FDI flows into the European Union were directed towards the services sector which, from 1984 to 1993, accounted for 63 per cent of aggregate FDI flows, whereas manufacturing industry accounted for merely 31 per cent. This discrepancy is partly a reflection of the dominant position occupied by services in the developed economies. However, since services are usually less readily exportable than manufactured products, FDI flows are, in many instances, the sole means of supplying foreign markets with services, which enhances the preponderance of such FDI flows compared with FDI directed at manufacturing sectors[28]. The transport sector in the EU, however, is not a type of service sector that attracts a significant amount of FDI.

The second factor that has had a major impact on European competitiveness is labour productivity. The trend in the indicators describing this factor is favourable to Europe, but the share of this trend accounted for by transport, which is not readily quantifiable, cannot be particularly high. In fact, the most significant impact of transport in this area is to be seen in instances of increased congestion, greater time losses and breakdowns in logistics systems (due to social tensions, strikes, etc.). During the second half of the 1990s and after a period of major economic slowdown, growth in labour productivity within the EU slowed (declining by an average of 1.9 per cent during the first half of the decade to 1.2 per cent over the period 1995-2001); in contrast, growth in employment rose dramatically (from a decline of 0.6 per cent during the first half of the decade to 1.2 per cent over the period 1995-2001). At the same time, the United States experienced high rates of growth in both labour productivity (which increased from an average of 1.2 per cent over the period 1990-1995 to 1.9 per cent over the period 1995-2001) and employment (which rose from 0.9 per cent to 1.3 per cent)[29].

The third significant factor in European competitiveness, ICT, relates more to the transport system manufacturing industry than to transport services *per se*, although the production of transport equipment accounts for merely a few per cent of world markets. Insufficient innovative activity, under-investment in the ICT sector and poor diffusion of ICT is a key determinant of Europe's recent under-performance in terms of productivity. The EU lags behind the United States in the economic and commercial exploitation of innovations and in innovative activity as measured, for example, in terms of the number of patent applications filed. Over the period 1992-99, expenditure on ICT accounted for 5.6 per cent of the GDP of the EU, whereas expenditure in the United States amounted to 8.1 per cent. The EU lost an average of 0.3 to 0.5 of a percentage point of economic growth during the 1990s, due to insufficient investment in ICT[30].

The role of ICT in enterprises, *inter alia*, consists in processing information and reducing storage costs. Deliveries of materials and semi-finished goods are made at more frequent intervals but in smaller quantities, thereby avoiding the use of bulk transport and reducing transport costs. During the second half of the 1990s, the EU experienced strong productivity growth in the areas of transport and storage, post and telecommunications, as well as in the production and distribution of gas, electricity and water. However, the relatively small share of GDP accounted for by each of these sectors tends to limit their impact on overall growth in productivity[31].

Even though transport has a fairly restricted field of influence, efforts must be focused on those aspects of transport that are capable of strengthening the competitiveness of the European economy. Transport services in Europe are considered to be lagging in terms of the process of opening up markets to competition[32]. The shortcomings of the European systems are as follows: an excessively complex and detailed regulatory system which adds to costs but fails to achieve the expected outcome; employees with lower skill levels than in other sectors, and mutual acceptance of diplomas and certificates that still remains limited in scope; take-up of logistics solutions still lagging behind practices in the United States; transport intermodality still at the planning stage with very few practical applications; insufficient account taken of network congestion in investment strategy; tax burden and social contributions regime applicable to transport enterprises that are not properly correlated to the lower prices and revenue resulting from extremely fierce competition in markets.

3.2. European transport modes that are weaker than their global competitors

Transport modes play a differentiated role in competitive strategies in Europe. The prerequisite for increased international competitiveness is an efficient transport system, offering rapid and easy access to markets. In the confrontation between the EU, the United States and Japan, the choice of modes would seem at first sight to be restricted to maritime shipping and air transport. International transport movements, however, virtually never begin or end in a port or airport. In many cases, greater effort and time are spent on operations in the hinterland than on the main transport movement by boat or by plane. In this respect, the search for the weak points in the system must address all modes of transport, including road transport, which cannot be treated as a strictly inland mode of transport. In door-to-door intermodal transport chains, consideration must be given not only to modes but also to transport nodes: maritime ports, major airport hubs, inland logistics platforms. How can we rank transport system components by order of importance and quality in our competitive strategies? Possible criteria include: the impact of this component on the total costs of a transport chain; the impact of this component on the total time required for a typical intermodal operation; the role of the weakest or missing link in the system; the role of catalysts in the development of a new technology, etc.

The limited scope of this report precludes an in-depth discussion of this topic. We can merely postulate, therefore, that the root causes of the shortcomings of the maritime shipping sector in the EU[33] are deeper and more complex than the low economic attractiveness of Community flags compared with flags of convenience might seem to suggest. It is not sufficient to promote short-sea shipping, develop and support training programmes, pursue a campaign in favour of high-quality maritime shipping, or support technological R&D directed at maritime transport, as well as supporting the quality of services and vessels and productivity[34]. The main problem in this area is concealed by the low cost-competitiveness of the Community fleet. While action to combat unfair pricing practices outside the European Union, coupled with a co-ordinated approach to combat the discrimination practised against EU vessels by third parties, are undoubtedly necessary, we cannot simply ignore other actions aimed at reducing the costs of maritime shipping operations by vessels registered under EU flags.

Rail is also one of the weaker modes in the European transport system, but one which could play a greater part in trade between the EU and the Far East. This calls for far more than simply ensuring the interoperability of the high-speed rail network in Spain, it calls for action to ensure conventional interoperability throughout the entire Eurasian corridor. Ensuring such interoperability is an extremely difficult and costly undertaking but one which, in the long term, would pave the way towards a powerful, efficient transport system, generating high levels of demand.

4. TRANSPORT AS A MEANS OF REDUCING MACROECONOMIC DISPARITIES IN EUROPE

Reducing economic disparities within Europe is as important a goal as the strengthening of European competitiveness in world markets. It could be argued that Europe's position in the world will be stronger once there are fewer disparities between both countries and regions within the Community.

4.1. Macroeconomic disparities in the enlarged European Union before and after 2004

Europe, prior to the planned enlargement in 2004, is characterised by both major macroeconomic disparities and disparities within the transport sector itself. The macroeconomic disparities are commonly illustrated by means of indicators such as[35]: per capita GDP in €[36]; rate of unemployment as a percentage; labour costs (€/h); FDI as a per cent of the EU total; net trade balance with the rest of the world; degree of openness to the world (average exports and imports compared with GDP); saturation of households with technical tools; level of consumption of a basket of products and services per inhabitant.

The disparities between the original 15 Member States and the ten new EU Member States are generally so great (1:4 or more) that it will be necessary to use all the instruments of regional policy, sectoral policies and the structural funds to achieve a situation comparable to that of the EU 15 in 2002.

Transport can play a significant role in achieving this objective provided that transport activities are supported by appropriate macroeconomic and political measures. Besides liberalising the supply of transport services, it will also be necessary to ensure the free movement of labour in order to hasten a general reduction in the cost of the working hour. At present (2001 data), the average cost[37] varies from 2.42 €/h in Latvia to 8.98 €/h in Slovenia and 28.53 €/h in Germany[38]. This enormous disparity within the internal market can significantly disrupt competition. Cheap transport services offering greater accessibility and flexibility will be one of the factors that will attract investment to those regions in the enlarged Europe where labour costs are low and provide a highly competitive basis for economic activity.

There will also be substantial disparities in the transport sector after enlargement in 2004, both with regard to the density and quality of infrastructure and in terms of labour costs and productivity. This latter indicator is also highly differentiated within the EU 15 (see Tables 4 and 5). In several instances, existing disparities are the outcome of natural and technical differences between transport modes and cannot be narrowed.

Table 4. **Indicators of labour productivity in the European transport sector in 1999, 1 000 €/person**

	Rail	Pipelines	Road passenger transport	Road haulage	Maritime transport	Inland waterways transport	Air transport	Tourist offices and agencies	Other ancillary transport activities	Total transport
B	38.1	2 250.0	39.4	124.3	2 994.0	187.5	276.1	506.8	216.0	**146.9**
DK	180.3	505.0	61.2	96.3	745.8	170.0	186.1	356.0	192.0	**183.9**
D	40.4	672.0	63.7	81.2	255.4	170.6	187.1	144.8	111.7	**91.6**
EL	9.5	n.a.	9.2	10.4	1 338.7	n.a.	103.9	120.0	26.3	**39.2**
E	31.0	300.0	29.5	67.6	164.8	10.0	155.2	258.3	145.3	**87.4**
F	74.1	456.9	60.5	89.2	332.8	132.4	212.9	261.9	173.2	**118.1**
IRL	50.0	n.a.	47.3	80.7	168.8	n.a.	242.9	340.6	230.2	**144.9**
I	36.8	311.5	31.6	98.0	186.0	73.5	346.0	273.7	133.4	**101.9**
L	74.2	n.a.	39.0	134.0	n.a.	14.0	343.8	351.7	180.0	**155.8**
NL	98.3	1 800.0	31.1	80.9	466.5	136.9	152.7	139.9	98.4	**98.0**
A	40.1	442.9	45.6	96.4	n.a.	223.3	255.1	318.4	277.6	**114.0**
P	46.0	n.a.	23.4	56.0	216.2	31.7	112.0	223.6	113.5	**71.7**
FIN	42.5	n.a.	49.2	93.0	252.9	63.3	150.7	228.8	185.5	**115.3**
S	110.2	133.3	70.4	104.2	244.5	76.2	197.5	319.5	240.4	**148.3**
UK	160.5	68.0	80.2	104.0	290.4	2 070.0	317.2	491.4	164.2	**183.9**
EU-15	**57.1**	**449.8**	**50.2**	**84.7**	**355.0**	**136.7**	**226.3**	**296.3**	**141.5**	**114.7**
Poland	**11.1**	**35.0**	**10.3**	**16.9**	**24.6**	**19.9**	**146.7**	**26.9**		**17.8**

Source: University of Gdańsk (2003). Calculations on which the statistics given in Table 1 are based.

Table 5. **Indicators of road haulage activities in Europe in 1999**

Country	Employment (1 000 persons)	Turnover in € millions	Transport on national soil in 1 billion tonnes-km	Labour productivity in 1 000 € per person	Labour productivity in 1 000 t-km per person	Average price in € per t-km
B	57.4	7 136	36.8	124.3	641.1	0.19
DK	40.3	3 882	16.9	96.3	419.4	0.23
D	381.0	30 927	341.7	81.2	896.9	0.09
EL	105.6	1 100	17.7	10.4	167.6	0.06
E	292.2	19 747	111.0	67.6	379.9	0.18
F	305.1	27 216	260.3	89.2	853.2	0.10
IRL	11.9	960	6.1	80.7	512.6	0.16
I	298.7	29 274	232.8	98.0	779.4	0.13
L	4.8	643	2.2	134.0	458.3	0.29
NL	108.5	8 778	48.6	80.9	447.9	0.18
A	45.7	4 406	16.8	96.4	367.6	0.26
P	50.0	2 800	14.1	56.0	282.0	0.20
FIN	36.8	3 421	26.5	93.0	720.1	0.13
S	62.1	6 472	33.7	104.2	542.7	0.19
UK	297.0	30 899	156.7	104.0	527.6	0.20
EU15	**2 097.1**	**177 661**	**1 321.9**	**84.7**	**630.3**	**0.13**
Poland	221.5	3 736.0	45.0	16.9	203.4	0.08

Source: University of Gdańsk (2003). Calculations on which the statistics given in Table 1 are based.

Table 4 illustrates the astonishing disparities in labour productivity to be found within the EU15. In the road haulage sector, for example, the indicator for Greece is 12 to 13 times lower than that for Belgium or Luxembourg. These differences can clearly be attributed to a number of factors: prices on the domestic market; average distance travelled annually by lorries (km); average load carried by a lorry (tonne); statistical systems and the quality of the management of road haulage movements. Road haulage is the most sensitive transport sector from the standpoint of EU enlargement in 2004 in that it employs 2.1 million workers and comprises 459 544 enterprises. The disparities in labour productivity in this sector are caused by disparities in the number of t/km per worker as well as disparities in the price per t/km. According to Table 5, the greatest disparity is 1:5.35 (Greece 167.6 and Germany 896.9) and the second largest is 1:4.7 (Greece 0.06 and Luxembourg 0.29). It needs to be determined whether Greek transport statistics are constructed in accordance with the same criteria as those for other EU Member States. However, an analysis of the situation in the EU without using Greek data reveals a disparity in the price per tonne-km of 1:3 (Germany and Luxembourg being the two extremes)[39]. This shows that the emergence in this market of new competitors, i.e. the acceding countries, will not really affect market equilibrium.

4.2. Transport investment as an effective means of reducing disparities

Reducing the disparities between the regions within Europe requires higher levels of investment in under-developed regions. However, funding capacity is highest in the wealthiest countries and regions, which are already saturated in terms of road networks and railway track. Investment in road networks in the EU15 amounted to 45 000 million € in 1997 (0.65 per cent of GDP[40] and 11 416 € per km of existing network). Investment in the Polish network in 1997 was supposed to amount to 2 800 million € but in reality was no more than 796 million € (the situation was the same in the other central European countries). However, a network in a good state of repair requires less work than a network neglected for decades. Most of the road networks of the central European countries are in extremely poor condition and require per-km expenditure that is five to ten times higher than in the EU15 area. In view of this, even within the framework of an enlarged EU, improving the quality of these networks will be a fairly slow process.

Accession to the EU will allow the level of investment in transport infrastructure in the ten new Member States to be increased. Over the period 2004-2006, the Community will provide substantial aid to investment in that 70-85 per cent of expenditure will be devoted to infrastructure of international importance. This aid will only help bring about a fairly modest reduction in existing disparities, however, in that it will only allow an improvement in the quality of the main international corridors. Full convergence will be possible once several tens of thousands of kilometres of new road have been built in the central European countries.

The European Council, which met in Copenhagen on 12 and 13 December 2002, set out the financial framework for enlargement over the period 2004-2006 and ensured that new Member States would receive aid for transport infrastructure development worth an estimated €5 350 million (approximately 25 per cent of the sum for structural support after capping)[41]. Half of this sum available to Poland will allow investment in transport infrastructure during this period to be doubled from €1 421 million to €2 970 million (in 1999 constant prices) and the share of community aid in total expenditure will increase from 12 per cent to 43 per cent[42]. By virtue of this aid, we can expect to see a significant improvement in the quality of the network of roads of European importance located on the territory of new Member States. Improvements to the network of roads of national, regional and local importance, as well as to the rail network, will be possible in the more distant future.

5. JUDICIOUS INTEGRATION THAT PRESERVES THE DIVERSITY OF EUROPEAN TRANSPORT SYSTEMS

The main obstacle to European integration in the transport sector is the diversity of technologies and techniques, an unfortunate legacy from the past. It is clear that failure to implement the interoperability programme will rule out any possibility of creating a genuinely free market for international rail transport. The technical aspects of road haulage and air transport are now almost completely standardized at both the European and the world level. While it is relatively easy to standardize technical components, more complex systems need to be specified on an individual basis. But to what extent should diversity in national or regional transport systems in Europe be eliminated or subjected to standardization that, in many instances, is extremely costly?

It would seem advisable to maintain a reasonable degree of diversity. Diversity is often the main engine for progress[43] and, in the case of transport, provides a basis for healthy competition. The *acquis communautaire*, the most powerful instrument for standardization in Europe, is already very extensive but fortunately does not cover all areas of transport activity. Logistics systems, IT solutions, ancillary transport activities, urban transport equipment, the operation of maritime ports, intermodal techniques are all examples of elements or forms of transport in which standardization has made very little progress. A number of new concepts (similar to that of containers) may extend the scope of standardization in the future. At all events, a cautious approach needs to be adopted to the elimination of diversity.

6. CONCLUSIONS

The analyses presented in this report are an attempt to determine the appropriateness of the solutions recently proposed by the European Union with regard to the relationship between transport and the macroeconomic environment as well as to the role of transport in the process of globalisation. The conclusions that may be drawn, after taking account of less readily available facts and statistics, challenge the ideas which are set out in the common policy and which are reflected in the research priorities with regard to transport. It would seem that the best solution to all existing problems would be to significantly increase macroeconomic growth in the integrated Europe.

NOTES

1. See R. Deiss (2000), "Benchmarking European Transport", in: *Transport Benchmarking: Methodologies, Applications and Data Needs*, ECMT, Paris, ISBN 92-821-2258-1, pp. 35-85.

2. See A. Dom (2000), "Are we going in the right direction? Indicators of transport integration and the environment in the European Union", in: *Transport Benchmarking: Methodologies, Applications and Data Needs*, ECMT, Paris, ISBN 92-821-2258-1, pp. 117-125.

3. For example, reducing ecological nuisances conflicts with the access to private car ownership on which society places such high value.

4. For example: growth in trade between Spain and the EU during the period 1988-96.

5. See TINA programme (The Transport Infrastructure Needs Assessment), formerly at http://www.tinasecretariat.at/mtofwork 12-03-2000.

6. In the "White Paper" published by the European Commission in September 2001 [COM(2001) 370], the new transport infrastructure investment projects only concern existing EU Member States: a high-capacity railway crossing through the Pyrenees, whose route is to be decided by the countries concerned; a new high-capacity West-East railway line for freight and passenger traffic from Stuttgart-Munich and Salzburg-Linz-Vienna (this project involves 780 km of track, to be either upgraded or constructed for high-speed traffic, as well as tracks for freight transport), in light of the future enlargement of the EU, this corridor could be extended towards Budapest or even Bucharest and Istanbul; construction of a bridge/tunnel to cross the natural barrier of the Fehmarn Strait between Germany and Denmark; improved navigability on the Danube between Straubing and Vilshofen in Germany (70 km); the Galileo global satellite radionavigation project; interoperability of the Iberian high-speed rail network.

7. The travel permits issued for work purposes in Soviet Russia during the 1920s are one such example.

8. See A.O. Hirschman (1956), *The Strategy of Economic Development*, New Haven, Yale University Press; ECMT (2002), *Transport and Economic Development*, *Round Table 119*, Paris; H. Baum (2000), "Decoupling transport intensity from economic growth", in: *Key Issues for Transport Beyond 2000*, 15th ECMT Symposium, 7-9 June 2000, Thessaloniki, OECD Publications, Paris, 2002, pp. 231-259.

9. "Presidency conclusions -- Göteborg", 15-16 June 2001; SN 200/1/01 REV 1, Point 29. http://ue.eu.int/fr/Info/eurocouncil/index.htm 03.01.2003; White Paper *European Transport Policy for 2010: Time to Decide*, Commission of the European Communities, Brussels, 12/09/2001, COM(2001)370.

10. See P.B. Goodwin (1996), "A programme of action for European transport", Special ECMT Round Table on European Transport Policy, Paris, 15 May. The author estimated that, in the case of car trips, 20 per cent were indisputably necessary, 20 per cent were not really necessary and 60 per cent fell between these two extremes.

11. The European Commission estimates that 7 500 km of roads, i.e. 10 per cent of the network, is affected by daily congestion; 16 000 km of railway line may be considered to be bottlenecks, i.e. 20 per cent of the network; 16 of the main airports within the Union have reported delays of over 15 minutes on over 30 per cent of their flights. White Paper, *European Transport Policy for 2010: Time to Decide*, Commission of the European Communities, Brussels, COM(2001) 370, 12-09-2001.

12. Since the euro is a recent innovation and cannot yet be used for long-term analysis, we have based our calculations on the USD.

13. 2001 White Paper, *op. cit.,* Policy Guidelines of the White Paper, Section IV.

14. See H. Baum, "Decoupling transport intensity from economic growth", *op. cit*., pp. 237-250.

15. See ECMT (1995), *Trends in European Transport and Infrastructure Needs*, OECD publications, Paris, ISBN 92-821-2199-2.

16. See ECMT (1995), *Transport Infrastructures in Central and Eastern European Countries -- Selection Criteria and Funding*, OECD publications, Paris, ISBN 92-821-22203-4.

17. While road traffic is dominated by private cars, there is a better balance between the relative shares of freight and passenger traffic in the rail network.

18. Belgium -- road traffic http://statbel.fgov.be/press/fl015fr.asp 16-01-2003.

19. Regulation (EC) No. 1655/1999 of the European Parliament and of the Council of 19 July 1999 amending Regulation (EC) No. 2236/95, laying down general rules for the granting of community financial aid in the field of Trans-European Networks, Official Journal No. L 197 of 19/07/1999 pp. 1-7. Article 4, paragraph 3, of the revised regulation states that the funding for transport infrastructure projects throughout the period referred to in Article 18 should be used in such a way that at least 55 per cent is devoted to railways (including combined transport) and a maximum of 25 per cent to roads.

20. Official Journal No. L 228 of 09/09/1996, pp. 1-3.

21. Questions and answers on the revision of the TEN-T guidelines. http://europa.eu.int/comm/transport/library/questions-reponses-ten-t-fr.pdf 16-01-2003.

22. *EU Energy & Transport in Figures 2001*, Table 3.1.5. This expenditure was accompanied by around 179 billion euros spent on car purchases by households.

23. See http://www.europa.eu.int/comm/transport/themes/network/english/hp-en/bfin/tn_16_en.html According to this source, the EU budget for 1995-2000 earmarked a total of €1 830 billion for the TEN-T. The European Regional Development Fund (ERDF) and the European Union's Cohesion Fund contributed a total of some €14 billion for projects of common interest in the "cohesion

countries". The EIB gives loans at preferential rates of interest (€8.477 billion in 1996-97) and the EIF guarantees loans (to the tune of €358 million in 1996-97).

24. Data taken from the TINA (Transport Infrastructure Needs Assessment) report, formerly (2000) at: http://www.tinasecretariat.at/mtofwork.html

25. Trans-European networks: http://www.europa.eu.int/comm/transport/themes/network/english/hp-en/bfin/tn_16_en.html

26. "European competitiveness in the Triad: macroeconomic and structural aspects", *European Economy, Supplement A, Economic Trends*, No. 7, July 1998. http://europa.eu.int/comm/economy_finance/publications/supplement_a_en.htm 17-01-2003.

27. Alexis Jacquemin (1999), "Compétitivité européenne, comportement des entreprises et cohésion sociale", Working paper (French text only), http://europa.eu.int/comm/cdp/working-paper/competitivité_européenne.pdf 17-01-2003.

28. "European competitiveness in the Triad: macroeconomic and structural aspects", *op. cit.*

29. "Productivity: The Key to Competitiveness of European Economies and Enterprises", Communication from the Commission to the Council and the European Parliament [SEC(2002) 528], Commission of the European Communities, Brussels, 21-5-2002, COM(2002) 262 Final.

30. *Ibid.*

31. *Ibid.*

32. "The competitiveness of European enterprises in the face of globalisation -- How it can be encouraged", Communication from the Commission to the Council, the European Parliament, the Committee of the Regions and the Economic and Social Committee, COM(1998) 718 Final, 20-01-1999.

33. Maritime shipping plays a major role in the external trade of the EU, accounting for 70 per cent of foreign trade with third countries. Over a billion tonnes of freight are loaded and unloaded annually in EU ports.

34. See "Maritime transport", Directorate-General for Energy and Transport, European Commission http://europa.eu.int/comm/transport/themes/maritime/english/mt_13_en.html 31-11-2001.

35. See "EU Enlargement. Key Structural Data for the 10 Acceding Countries", http://www.europa.eu.int/comm/eurostat/Public/datashop/print-product/EN?catalogue=Eurostat&product=1-05122002-EN-BP-EN&mode=download

36. GDP in the acceding countries in 2001 amounted to 31 per cent of the EU average in Latvia and 68 per cent in Slovenia.

37. "EU Enlargement. Key Structural Data for the 10 Acceding Countries", *op. cit.*

38. EUROSTAT, Economy and Finance 2002, No. 3.
http://www.europa.eu.int/comm/eurostat/Public/datashop/print-catalogue/EN?catalogue=Eurostat&theme=2-Economy%20and%20Finance

39. The price per tonne-km in Germany is only 10-20 per cent higher than the price in countries such as Poland, Hungary or the Czech Republic.

40. See *EU Transport in Figures*, October 1999, Table 1.2.

41. "Presidency conclusions – Göteborg", 15 and 16 June, SN 200/1/01 REV 1.
http://ue.eu.int/en/Info/eurocouncil/index.htm 03.01.2003
and data from the Office of the European Integration Committee in Warsaw (January 2003).

42. Data provided by the Ministry of Infrastructure in Warsaw, January 2003.

43. See René Dubos (1972), *A good within*.

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5. *EU Energy & Transport in Figures, 2002*.

6. *EU Transport in Figures*, October 1999.

7. EUROSTAT, *Economy and Finance 2002,* No. 3.
http://www.europa.eu.int/comm/eurostat/Public/datashop/print-catalogue/EN?catalogue=Eurostat&theme=2-Economy%20and%20Finance

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18. ECMT (2002), *Transport and Economic Development, Round Table 119*, OECD, Paris.

The Economic Cost of Congestion When Road Capacity is Constrained: Lessons from Congestion Charging in London

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SUMMARY

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1. INTRODUCTION

Economic objectives are always important policy considerations, and sometimes the most important. In much general discussion, it is assumed that improvements in transport -- almost always perceived as reductions in transport cost -- will assist economic growth. It is common experience that congestion is widespread, and there are methods of calculating the economic cost of congestion, so policies which reduce congestion should be good for the economy. For many years, it was the case that the interest groups which expressed these views most forcefully were the business interests for whom economic growth was directly relevant, and these groups often took it for granted that "transport improvement" meant "road building".

So politicians at national or local level were often faced with arguments that "businessmen" (who surely know all about the economy) were in favour of constructing major road projects to improve the economy, in contrast with "environmentalists" (who often reject economic reasoning) being against these projects.

This simple picture is no longer true. For a number of reasons, the argument has been turned on its head and there are views that (in some circumstances) road building can be bad for an economy, not good for it, and traffic restraint can be good for an economy, not bad for it. These conceptions are not nearly so obvious, and it is sensible to consider why the shift has happened, and whether it is valid. This is especially true when considering the case of congestion charging, where the argument is used that *increasing* transport prices, and reducing traffic, may be the optimal way of improving economic efficiency.

This paper reviews the role that the cost of congestion has played in this argument, with special reference to the experience in London[1]. The hypothesis developed here leads to the conclusion that congestion charging will be good for the London economy, but it is still a hypothesis, not yet demonstrated in practice.

2. THE "COST OF CONGESTION"

For over forty years, the idea of the "total cost of congestion" has had an important influence on transport thinking, with figures often being quoted in the order of £20 billion per year for the UK as a whole, though estimates from different studies (the CBI, the British Road Federation, academic economists and government agencies) actually vary quite widely. Transport for London, as part of its background work in relation to charging and other policies to reduce traffic congestion in London, commissioned a review of these different estimates which have been produced over the years, explaining their differences and coming to a view about their significance for London.

In the course of that literature review, the author came to the conclusion that the most widely quoted studies may not be very useful for practical purposes, since they rely, essentially, on comparing the existing traffic conditions against a notional "base" in which the traffic volumes are at the same high levels, but all vehicles are deemed to travel at completely congestion-free speeds. This situation could never exist in reality, nor (in the author's view) is it reasonable to encourage public opinion to imagine that this is an achievable aim of transport policy. Such huge, but non-achievable, benefits inflate the currency of debate and distract attention from the value-for-money of real policies.

However, among the many estimates, there were a few which take an entirely different approach. In these, the idea of a totally congestion-free target is ignored, and emphasis is put on the *change* in congestion which would be realistically achievable as a result of implementing specific, more or less ambitious transport policies, such as road building, public transport improvements and transport prices. The most useful applications of this approach have been developed in connection with congestion charging. The figures are, of course, typically smaller than the unrealistic estimates produced by comparing against zero congestion, though typically much larger than the benefits which are produced, in urban conditions, by road construction projects. They are also much easier to interpret and much more relevant for real policy purposes. Thus it would be better to shift the focus from the "*total* economic cost of congestion" to "the economic value of the savings in congestion that could be achieved with congestion charging", with particular reference to central London.

This brings us to a widely-quoted figure of about £100m per year, usually described as "£2m per week," which was used publicly by the Mayor and others in debate. It was cited in the Mayor's Draft Transport Strategy (January 2001, p. 307). The figure was within the range calculated earlier by the Government Office for London (Road Charging Options for London, 2000), on the basis of modelling and forecasting by consultants. It had therefore been seen as a sort of technical consensus between TfL and the Government, and the starting point for discussions about changes in detailed design of the scheme, exemptions, etc., which are not considered here.

The technical reports of modelling and forecasting on which the £100m a year figure is based have mostly been carried out by government agencies and their consultants, but there is also work carried out by academics, business and other stakeholder groups, including companies located in central London, as well as related experience such as the results of applying traffic restrictions (for reasons of security) in the City of London, the effects of town centre traffic restrictions on shopping patterns and the effects of changing other transport prices, such as fuel price and fares.

An interesting feature of both GoL and TfL figures was that, on inspection, the technical reports give figures, estimated by consultants, which are significantly *greater* than the "£100m a year" which has been so widely used. Thus the Government Office for London estimated an overall economic benefit of £125m to £210m, which, after subtraction of the operating cost estimated at £30m to £50m, comes to a net benefit of £95m to £160m -- under the usual convention, if one wanted to cite a single round figure one would take broadly the middle of the range, say roundly, £130m (ROCOL, Table 3). TfL then carried out separate calculations, on rather different assumptions, especially about the design of the scheme[2], and different methods of calculation. As it happens, the range of estimated benefits were very similar, since increased estimates on some aspects were broadly offset by reduced estimates on other aspects: the TfL forecast came to a range of benefits of £140m to £210m (*How the congestion charging scheme supports the Mayor's strategies for London*, 2001, ch. 10, para. 68, Background Technical Paper, para. 84). TfL have assumed the same collection costs as GoL did, and on this basis the mid-range net benefit would come to £135m.

Thus GoL and TfL reports both produce, in spite of their different assumptions and methods, mid-range estimates of net benefit in the order of £130m a year. It therefore needs some explanation why "£100m per year" has become the most commonly cited net benefit. Careful study of the GoL and TfL technical reports in sequence demonstrates that there had been a rather systematic tendency for successive reports to revise the calculated benefits downwards. However, this had *not* arisen primarily because of changes of substance in scheme design, or enhanced modelling capability.

In fact, a substantial part of this apparent "downward revision of the benefits" has been due to an understandable desire by their authors always to err on the side of caution: therefore, each time a range of results has been produced, only the lower end of that range has been taken forward into the next stages of consideration, with a resulting "ratchet" effect whereby the estimates have *appeared* progressively to decline. This is particularly true of the discussions about the models' sensitivities to price, as commented below. While understanding the desire to act responsibly and cautiously, the author thinks this process has had the unintended effect of appearing to make the benefits less than the technical work has produced. If the mid-point in the originally estimated range of costs and benefits had been used, this would have given a net benefit as calculated of over £130 million per year (low assumptions) to £250m (high assumptions), rather than £100m -- a significant "safety margin" of benefit of at least £30m, or 30 per cent, and perhaps much more.

However, it is necessary to consider this in more detail on its merits, with reference to how the calculations were actually done, considering especially aspects which may have been underestimated, or not included at all, in the calculations. With all due caveats about the uncertainty involved in all forecasting exercises, *overall, the author's assessment is that the benefits as calculated are underestimates, not overestimates.* This is for the following reasons.

The GoL/TfL appraisal has followed conventional (pre-1998) principles that the revenue raised from charges has a benefit at its face value, offsetting the loss at face value of those paying it. This is valid in the context where such revenue is not hypothecated, and at the margin may equally well be used for reducing taxes or transfers to affected parties. However, following the Transport White Paper in 1998, converted into law in the London and Transport Acts, this is no longer appropriate: the reinvestment of net revenue into complementary transport measures is now a legally required and inherent part of any urban congestion charging scheme, at least for its first ten years.

Therefore, the net benefits generated by those measures themselves should be taken into account. The existence of such benefits is recognised in the commentary to the GoL appraisal, but their worth is not included in the evaluation. Examples given by GoL include improvements to the quality of public transport beyond those that occur simply as the result of reduction in congestion, and improvements for cyclists and for environmental schemes. In the TfL appraisal, more attention is paid to these but they are divided into two separate categories in the calculations.

Certain benefits from changes to public transport, mainly buses, planned to cope with the immediate expected degree of transfer from the car in the first one to three years, *are* included in the larger figure. The benefits to bus passengers from these improvements, as well as from the direct effects of reduced congestion, are estimated at £10m-£20m per year (and included in the £100m). But allowance is not made for the *additional* measures made possible by spending the extra revenue (e.g. para. 88, Underground; para. 95, Buses; para. 97, Other rail capacity; para. 103, Stations; para. 111). The reason why these are not included is because they are not immediate effects of changes for which the design is already established, but occur some years down the line during the "later part of the Mayor's Transport Strategy's ten-year horizon".

They are, however, in the author's view, an intrinsic part of the congestion-charging package. There are also many opportunities for relatively cheap, small-scale measures (bus lanes, speed cameras, better enforcement, signal improvements, etc.), which can produce rapid net benefits of between two and four times as great as those expected of major infrastructure construction, so any revenue which assists in expansion of such schemes can produce benefits of appreciable size. The author would provisionally assess them at £25m to £50m per year, based on a conservative 10 to 20 per cent return on the expenditure. Allowing some discount because they arise a few years later, he takes the figure of £25m forward, as a benefit, directly made possible by congestion charging revenue, not included in either GoL or TfL calculations.

The appraisal counts the "direct" economic benefits of time and cost savings to transport users in accordance with standard practice. However, for some years, there have been suggestions that these do not take full account of the wider economic benefits: reducing transport costs ought to improve business efficiency by better access to labour and produce markets, and by the pressures of competition over a wider area. If this is so, then the initial trigger of better transport will lead to a higher rate of economic growth, with long-term benefits which are greater than the initial improvement. Such suggestions are usually (correctly, in my view) countered by the argument that to include them would be double-counting, since they are simply a different way of looking at the cost and time savings. However, since 1999, the Government Advisory Committee, SACTRA, has established that there are some circumstances when it is proper to count these effects as *additional* benefits to be added to the direct ones. Identifying these circumstances is not standard practice, as they depend on the relationship between prices and costs, both in the transport sector itself and in other sectors which use transport, and often the available information is not sufficient.

SACTRA drew particular attention to some cases where there is least doubt about the effect and, of these, one case exactly corresponds with the London situation: namely, where, at present, transport prices are currently less than the full internal and external marginal costs, and the policy intervention is directly aimed at reducing this discrepancy. In this case, a reduction of traffic levels leading to increased speeds and reduced costs will lead to "second-round" improvements to business efficiency, and additional benefits over the original cost-benefit calculations. (In these circumstances also, reducing direct transport costs *without* correcting the price structure could make things worse, not better, by generating more traffic that is not paying its full economic costs.).

Examples of the sort of effect are reflected in the estimate, cited by the Adam Smith Institute, which suggests that the direct costs and prices are less than half the costs of congestion to businesses, with the greater share being the effects on business conditions, labour mobility and improvements to markets. This is broadly consistent with the approach taken in surveys of employers by the CBI. It does not necessarily follow that these additional benefits would be in the same ratio -- though if it did, this effect alone would more than double the calculated benefits -- but there is a *prima facie* case that the effect is a significant one. Therefore, additional, wider economic benefits are expected which had not been included in the assessment. Even if the multiplier on direct benefits is only 1.1, this would imply an extra £10m of benefit.

Although environmental benefits have been, in accordance with normal practice, considered from a qualitative point of view, no allowance has been made for the economic consequences of environmental improvements, such as a reduction in time off sick as a result of less stress and other impacts on health. Recent evidence suggests this may be a substantial figure, comparable in nature with the accident costs which are already included but, in some circumstances, bigger in size. Central London employers are increasingly conscious that this sort of cost may be at least as important to their employees' efficiency as the well-established benefits of reduced average journey time. More broadly, European research suggests that the environmental costs which would be reduced by congestion pricing would add significantly to the congestion benefits. The minimum estimate made, using very low "environmental values" would give an extra 10 to 20 per cent, and other researchers suggest that the figure would be an extra 30 to 100 per cent. (Such figures do not include reliable allowance for the "value" of profound global effects such as climate change, which is difficult to treat in relation to any one city.) The modest 20 per cent figure gives an extra £20m of benefit.

The type of model used to make the calculations has a tendency to underestimate price elasticities. This will tend to underestimate the benefits in terms of congestion relief, which is very sensitive to traveller responses: recent research suggests that there are some 15 to 25 different behavioural responses, of which the following are likely to be *greater* than has been allowed (for technical reasons connected with the modelling) in the forecasts: changes to frequency of travel; switches to walking and cycling; changes to complex travel patterns involving swapping or consolidating trips between members of households. Inclusion of each of these will tend to increase the estimates of sensitivity to price and service changes, and therefore widen the potential mechanisms for congestion reduction. This partly explains why the original estimates made by a model specifically designed for congestion pricing gave net benefits some 40 per cent greater than those currently used (and up to double), largely because of its greater sensitivity. The estimates had been revised downwards in order to correspond with more traditional models, but it cannot be taken for granted that the traditional assumptions were "right" and the new ones "wrong". My view is that these traditional approaches themselves tended to err on the low side. (This is reinforced by the long tradition of underestimating induced traffic and the more recent tradition of underestimating the sensitivity of demand to price, which is widely discussed in the literature.)

Assessing the size of this effect depends on diagnostic tests on the various models' implied price elasticities: in advance of those tests, the author does not feel confident in making an explicit calculation, but returning to the middle (though not the top) of the range, as actually calculated by the models, would recognise this effect.

A further effect arises from the international experience whereby reducing traffic levels in town centres (most commonly by means of pedestrian shopping areas and associated complementary measures) tends, after a settling-in period, to increase the attractiveness of the area and therefore increase the numbers of shoppers visiting. While this is not strictly a *net* benefit (since shoppers have been attracted away from other areas), it does help to protect the importance of central area economic activity, which is itself a contribution to sustainable transport strategy.

Each of the above effects, in principle, interacts with each other, in most cases reinforcing rather than damping the benefits: for example, any wider economic benefits will accrue not only from the direct congestion effects but also from the complementary improvements to other transport facilities, which in turn will also tend to raise the level of road user response.

An exact value for the effects of some of these additional or omitted benefits cannot be calculated precisely in advance of further detailed modelling, some of which would be costly and indeed innovative. But we can say with some confidence that the figures should be quite large by comparison with the direct, and very cautious, estimates made of travel benefits themselves. Considering the additional elements discussed above and deliberately taking a cautious figure for each of them, would justify roundly £40m to compensate for the downward "ratchet" on elasticity, £25m for the benefits of ploughing back revenue, £10m for wider economic benefits and £20m for associated environmental benefits: these sum to £95m, without taking into account any interaction between them, for which £5m would be a very modest figure indeed, giving a round total of £100m. Taking the middle or higher end of the range of uncertainty of each of these additional elements would double or treble the extra benefits.

The benefits would tend to build up over a period, rather than all happening instantaneously: research on other pricing effects suggests that about 50 per cent of the full benefits will develop in the first two or three years, and probably with 90 per cent of the benefits within five years, though some impacts continue developing over a much longer period. Although this dynamic process of build-up is not allowed for in the computer models used, one way of interpreting these figures is that the "£100m a year" commonly quoted is broadly an estimate of the partial, short-term benefits, which then build up to double this figure over a small number of years. The qualitative judgements by TfL are consistent with this interpretation.

Therefore to the best of the author's judgement, a figure of £100m for the extra benefits, not included in the calculations, is a robust and cautious figure. The author would anticipate that estimating them more precisely, using formal and large-scale computing methods, would show a larger figure than this, not a smaller one. So, in very round terms, the benefits would be £200m a year rather than the £100m used.

If an underestimate of the benefits had put the scheme at risk -- and with it, not only a major part of the Mayor's strategy but also a large and essential component of the Government's congestion targets -- this would not be caution, but a waste of opportunity. If the central London scheme continues to be successful and proves itself to be popular, this will give greater confidence to other areas, whether in other parts of London or in other cities, to seek their own benefits: success in one place is the key to unlocking inertia in others.

ANNEX 1:

Review of Methods of Calculating the Economic Cost of Congestion

The fundamental defining relationship of traffic engineering is the speed-flow curve. This shows that the more traffic using a road, the slower it goes, the effect becoming more and more severe as the traffic flow approaches the maximum capacity of the network until, finally, overload is so extreme that all vehicles are unable to move. If we extend the idea of travel time to a wider definition of cost, including inconvenience and discomfort, the same process may be taken to apply as a general rule for virtually all forms of transport, and indeed to some extent as a general property of all systems subject to capacity constraints and some degree of random variation.

Thus, congestion is a characteristic of all heavily used transport systems. Its general feature is that users impede each other's freedom of movement. The *general* definition of congestion therefore most usefully relates to this general property of transport systems, namely:

Congestion is defined as the impedance vehicles impose on each other, due to the speed-flow relationship, in conditions where the use of a transport system approaches its capacity.

This definition indicates that the underlying *cause* of congestion does not consist of the transient and immediate triggers which drivers notice when they are in a traffic queue, such as roadworks or taxis or accidents: the cause is because traffic flows are too close to capacity, when any of these transient incidents will have a disproportionate effect.

Estimates of the Economic Cost of Congestion

1958

The first serious method of measuring the amount of congestion and converting it into an economic value, was devised by Glanville and Smeed (1958). They proposed:

"The calculated total cost of delay depends on what is regarded as a reasonable speed for traffic. Under light traffic conditions on good roads, the average speed of traffic is about twenty-five mph (40 km/h) in built-up areas, and forty mph (65 km/h) in non built-up areas. Taking these as standards, calculations give a cost of £125 million in urban areas and £45 million in rural areas, making a total of £170 million per annum".

This figure made no allowance for non-working time: if this was included at the same (high) value as working time, the figure would increase to £500 million (so, roundly, £300m to £400m, using current conventions that non-working time has a value, but less than half that of working time).

Roundly, this would imply over £100 million a year for London.

1964

The Smeed Report (MoT, 1964) was the first government study of road pricing (though much disliked by the Prime Minister, Sir Alec Douglas Home, who had to deal with it). It estimated that, in Central London conditions, congestion costs -- defined as "the costs of the delay to the rest of the traffic" (but only counting motor vehicle traffic) -- of each additional vehicle were 4 pence per mile at 20 mph, rising to 6 shillings a mile at 8 mph.

If half the urban areas became charging areas, pricing at optimum prices -- 6 pence per mile was given as an example average -- this would give an economic benefit in saved time of £70 million per annum as a minimum. Sensitivity testing gave a likely spread of £109m to £213 million, and concluded "A fair estimate probably lies within the range £100 to £150 million" (App. 3, para. 7).

Roundly, we might say £60m to £100m for London -- not that this is an estimate of the value of achievable reduced congestion, not the value of total congestion as in the 1958 estimate.

1988

The British Road Federation (original source undated, but usually referred to as 1988) made a calculation, using essentially the same method as Glanville and Smeed, and concluded:

"*The additional cost over and above that experienced in free flow conditions is defined as the congestion cost. This amounts to £3 billion per year in the conurbations alone*", and £15 billion per year for the UK.

A more detailed breakdown gave a national figure of £3.2 billion, of which Greater London was £1.45 billion, i.e. 45 per cent of the total, of which £725 million was in central *and inner* London, £726 million in outer London.

This figure of £15 billion per year has become the touchstone of subsequent work, appearing and reappearing over subsequent years -- sometimes updated by inflation, sometimes by traffic growth, and sometimes not at all[3]. It is quite often difficult to tell exactly which source is referring to which, as much of the following literature has been composed of pamphlets and institutional submissions, with rather informal referencing style, and overlapping authorship.

1989

The CBI (1989) reported: "*Every British household has to spend at least £5 per week more than it need do on goods and services to meet the costs to business of congestion…this is equal to 2p on the basic rate of income tax.*"

They describe costs of lost hours of production due to late arrival of staff, vehicle maintenance and repairs, fuel consumption, overtime payments, stock levels, purchase of additional vehicles "*and perhaps another dozen 'hidden' considerations*" -- "*the real cost to British business could be in the region of five times the £3 billion pounds per year currently used as the indicator*."

(This is confusing, as the £3 billion referred to conurbations, the method was completely different from that used by the BRF in the previous year -- and included many categories of cost not included by the BRF. How both sources have become interchangeably known as the origin of the famous £15 billion puzzles the author).

The CBI method -- not used in any other exercise -- was to ask its member companies to assess the extra distribution costs in London compared with elsewhere in the country. Not enough is known about how the companies interpreted the task to assess the method, but samples were given as follows:

- British Gas: "We estimate our total additional transport costs are 20% up at £2 million per year";
- Marks and Spencer: an extra £2 million p.a.;
- Royal Mail letters: £10.4 million;
- Sainsbury's: £3.4 million;
- Computer Cab Co.: £5.3 million;
- BT: £7.25 million.

The CBI concluded "Delivery, service and sales costs are on average 20% higher in London and the South East than anywhere else in the country."

1990

The Chartered Institute of Transport (1990, 1992) estimated the effects of congestion charging in a London-wide system at 10p per pcu-km in congested conditions, down to nothing in entirely uncongested conditions, assuming that this would mean 20 per cent of London's 100 million vehicle-kilometres per day being exposed to charge, giving benefits of £254 million per year (1990 prices?) of which over 56 per cent (£143 million) would accrue to commercial vehicles. (The CIT noticed that cars would pay the larger share, but commercial vehicles get the larger share of the benefit. This arose from assumptions about demand elasticities, values of time, etc.)

1993

Newbery (1995) proposed £19.1 billion for 1993, of which more below.

1994

The Centre for Economics and Business Research (CEBR) showed in 1994 that increasing road investment by 50 per cent over planned (i.e. Roads to Prosperity) levels would reduce the increase in costs of road use which would otherwise happen. However, congestion would still worsen by 5 per cent during 1990-2010…a 50 per cent cut in planned road spending would worsen congestion by an extra 8 per cent over that which would already happen (146-147).

1994

The House of Commons Transport Committee collected together a number of papers of evidence with additional estimates, or reinterpretations of earlier evidence:

Department of Transport: economic benefit from a cordon charge or distance charge for central London, £100m to £160 million per year, 1991.

London Transport: a London-wide scheme would achieve bus journey times of 25 per cent (two minutes per mile) in the centre down to a marginal change in the outer suburbs, giving benefits to bus operators and their passengers of £100m to £300 million per year, 1993 prices, before any allowance is made for spending revenues on better services, etc.

IHT

"Almost a decade ago the British Road Federation estimated that the economic costs of congestion in London were about £1.5 billion a year. In 1989, the CBI estimated that congestion cost £10 billion per year in London and the South East."

CIT

"…benefits -- congestion relief, environmental improvements and revenue -- could be so high that within two years the system would have paid for itself and positive benefits reaped thereafter…"

1997

NERA estimates by Dodgson and Lane (1997), criticised Newbery's method, which they said gave an artificially inflated figure because it multiplied the high marginal cost per vehicle by all the vehicles. They describe the cost of congestion as the number of vehicles multiplied by the difference between the average generalised cost per vehicle in free-flow conditions and in the actual conditions (as distinct from multiplying by the marginal costs of congestion which, they claim, is implicitly done by Newbery), and disaggregating for many road types and vehicle types.

Their figure amounted to £7 billion -- about a third as great as Newbery's allowing for dates. However, it would necessarily be less than Newbery's, if their description of his method is accurate. More important, it is less than half the BRF/CBI figure, which is puzzling as the method -- at least in words -- sounds the same.

1997

The UK Department of the Environment, Transport and the Regions, DETR (1997), suggested that, under current growth trends, traffic levels would increase for various road types by 31 to 117 per cent by 2031, and consequently journey times would increase, to double their present level for urban motorways in the peak hour, but only by 5 per cent or so for off-peak travel on rural principal roads. Overall, this would imply a further increase in the costs of congestion, as calculated, by about 100 per cent, though this was not made explicit.

2000

The DETR (2000a, b, c) defined congestion in a way which is closely connected with the earlier studies, but not easily compared with them. Their definition was "average time delay per vehicle-km", defined in turn as "the difference between the actual speed encountered and the free flow speed", but all expressed as an index, or a percentage change on that index.

Calculations say that the index for the whole of London in 1996, ranged from 221 off-peak to 697 peak, compared with a nationwide average of 100 -- i.e. using this indicator, in some sense London congestion was from two to seven times worse, and the London figure would by 2010 increase by 6 per cent in the worst scenario studied, and decrease by 47 per cent in the most favourable one, consisting of network-wide charging and substantial infrastructure improvement.

Table 1. **Changes in road speeds and journey times, 2000 to 2010, as a result of the 10-Year Plan, underlying the forecast congestion changes**

	All roads in area type				Road type			
	Total	**London**	**Conurbs. & large urban**	**Other urban**	**Rural**	**M-ways**	**Inter-urban trunk**	**Rural B & minor**
Average speed, 2000 k/hr	55.2	28.9	38.8	44.6	77.6	90.4	80.6	64.0
Average speed, 2010 k/hr	55.6	30.7	39.7	43.9	77.1	89.2	81.6	63.7
Change in speed k/hr	+0.4	+1.8	+1.1	-0.7	-0.5	-1.2	+1.0	-0.3
Change in time per km	**-1.6 secs.**	**-7.3 secs.**	**-2.0 secs.**	**+1.2 secs.**	**+0.3 secs.**	**+0.5 secs.**	**-0.5 secs.**	**+0.2 secs.**
Expressed as "change in congestion"	**-6%**	**-15%**	**-8%**	**+7%**	**+16%**	**+13%**	**-5%**	**+20%**

(Note that in December 2002, the Department for Transport revised these forecasts. An exactly comparable table is not available, but using the same method it is now clear that congestion will get *worse* in the period 2000-2010, even if all the schemes and projects in the 10-Year Plan are successfully delivered, which is unlikely. The revised forecasts are more realistic, and will undoubtedly lead to a reappraisal of many aspects of transport policy. The most important aspect is that, if the reduction of congestion is a necessary condition for contributing to economic growth, there now seems no effective method of doing so, in British conditions, without some degree of demand management of traffic.)

2000

The *ROCOL* (2000) exercise estimated that the charging scheme would produce net economic benefits of £95m-£160m per year. The benefits included in the calculation are: travel time and reliability benefits to cars and commercial vehicles, time savings to bus passengers and road accident savings.

Their focus was mainly on shorter-term effects. Their methods, if they had been able to allow for longer-term build-up, would have enhanced the benefits rather than reducing them.

Rearranging the figures given in para 5.3.31, Table 5.9, these estimates were as follows:

Table 2. **ROCOL economic impacts of congestion charging**

	Car users, £m/year	**Public transport passengers, £m/year**	**Commercial vehicles, £m/year**
Travel time benefits	40-65		60-90
Reliability benefits	10-20		20-30
Service quality		4-8	

These are the actual resource benefits, measured by "consumer surplus", i.e. what people would be willing to pay to achieve them. The effects of collecting the charge itself then have to be taken into account, since it will typically be higher than the above amounts, but only a small proportion of it is used up in costs of the scheme, the remainder then -- under the terms of the scheme -- not being lost to the system, but recycled back into further benefits called “associated transport measures” in the assessment, including ten high-quality bus routes, reduced bus fares, alleviation of overcrowding on the tube, reallocation of road capacity, etc. The short-term focus of the study did not allow full value of these associated measures to be taken into account, hence the conclusion: “The net effects of the associated measures on the economic and financial impacts of the core scenario are small” (para. 5.4.10 -- though the higher bus speeds give “benefits tentatively estimated at £10m-£20m per year”, which is by no means trivial).

Extension of the scheme to inner London as far as the North and South Circular roads -- although this is not currently planned -- would approximately triple the net revenues, and increase the overall net benefits to some extent.

The two main differences between these estimates and the “total costs of congestion” estimates are: (a) No attempt is made to assess the total cost -- only the estimated benefit and the estimated cost of realisable schemes. The author thinks this is correct. (b) The travel time savings are assessed in a way broadly consistent with the other estimates, but extra allowance is made for reliability and for service quality. This also seems legitimate.

2000

Mumford (2000), for the Adam Smith Institute, refers to estimates by the British Chamber of Commerce in conjunction with Alex Laurie (untitled, undated) that the cost of congestion to business may be broken down into:

- Increased costs/prices 41%;
- Lost business opportunities 23%;
- Reduced labour mobility 20%;
- Withdrawing from/entering markets 11%;
- Other 5%.

(Such dimensions are usually lacking in conventional estimates, so this would imply the total figure would be much greater). He also updates other figures:

“Updating to 1999 prices the Newbery estimates from 1993, the NERA figure from 1995 and the CBI estimate from 1994, it would seem *that in the year 1999 congestion cost society £18 billion.* This…represents about 2% of current GDP…”.

He says “An end to urban congestion would not just reduce the social costs of road transport by around £18 billion: it would also…”. But that “not just” begs the question.

2001

Sansom *et al.* (2001), of the Institute for Transport Studies, Leeds University, publish estimates for 1998, not of the total cost, but of the marginal cost.

Rounding their “low” estimates (in this study there was very little difference between their low and high figures), they give figures as shown in Table 3.

Table 3. **Marginal external costs of congestion, 1998, for London and conurbations**

Category	Percent of national v-km	Costs, pence/v-km
Central peak	1%	86
Central off-peak	3%	47
Non-central peak	4%	23
Non-central off peak	8%	11
National total	100%	10

They also disaggregate, for example, giving an estimate for "inner London motorway" on a Saturday of 15 pence per pcu-km.

The Leeds authors re-estimate and update Newbery's results (with caveats). Their figures are higher than Newbery's -- for example, their 11 pence/km compares with their updated Newbery figure of 5 pence, and their figure for peak period urban central areas is also greater, albeit with a somewhat different definition of size of urban area which reduces comparability. The Leeds authors comment:

"As the figures in Newbery (1990) are based on the same methodology as that in this study, the main reasons for the larger marginal congestion costs in this study is the growth in traffic over time. The Newbery (1990) figures were based on 1985 traffic data and in the period to 1998 traffic growth and changes in speeds have been substantial."

They comment that the orders of magnitude are similar to advice given by the DETR of values to be used for assessing the decongestion benefits of "major rail-based urban public transport".

In the Leeds approach, for 1998, the marginal congestion cost alone is then 2-3 times greater than the total revenue from vehicle excise tax, fuel duty and VAT on fuel duty taken together. This applies to all classes of motor vehicle -- the ratio being different, but all "undercharged" in this sense.

Table 4. **ITS "low" estimate of marginal congestion costs for London**

Area and road type	Congestion cost pence per car km
Central London	
Motorway	54
Trunk and principal	71
Other	188
Inner London	
Motorway	20
Trunk and principal	54
Other	94
Outer London	
Motorway	31
Trunk and principal	28
Other	40

Their congestion costs are overwhelmingly greater than the sum total of their other external costs (accidents, air pollution, noise, climate change) and infrastructure costs: all these other factors barely add up to more than a penny or two per vehicle-kilometre. (Some of these cost estimates are, of course, subject to considerable discussion, but that is beyond the scope of this paper[4].) The marginal revenue in fuel duty (and VAT on it) is estimated at 4.5 pence per vehicle-kilometre on average, so, broadly, we can say that fuel tax provides revenue in the order of 3 to 25 per cent of the cost of the extra congestion each vehicle causes.

Note that although the discrepancy is greatest in the central area, these figures imply that, overall, the scale of the problem is greatest in the smaller roads in inner and outer London, where such a high proportion of the total traffic is located.

2001

Leach (2001) cites a number of references whose original sources have not been checked:

- The Smith Group (1999), who estimated UK 1998 congestion as £20 billion out of a total £30 billion for all external costs (method not known);
- Peirson and Vickerman (1997) as estimating that marginal congestion costs in pence/passenger-km (nb not vehicle?) were 15p London peak, 1.7p London off-peak;
- Lex (2000) £23 billion per year.

He quotes CBI (1989) as estimating £15 billion in England, of which about two-thirds in London and the South East….£10 per household per week spending "more than it needed to on goods and services to meet the extra cost to business of road (and rail) congestion.

2001

CEBR and Healey and Baker (2001) cite the Mayor's transport strategy as "20-30% reduction in congestion within the charged area. Costs of implementation £50m (+£150m for associated road management), and running costs £50m per year."

Using CEBR models, they estimate speed changes as follows:

Table 5. **CEBR estimate of effect of congestion charging in London on day-time speeds, 2005**

	"Base case" (i.e. without charging), mph	**With charging, as proposed by Mayor**
Charging area	8.7	9.5
Inner zone	13.0	12.9
Outer zone	18.2	18.2

(They describe potentially important spin-off effects in increasing rental values, but do not address the question of whether these are additional value, or conversion of time savings.)

Discussion

It will be seen that there are three broad groups of study cited above:

a) Studies calculating a global congestion indicator; these are usually by comparison with free-flow conditions;
b) Studies calculating a marginal cost of congestion for an additional vehicle;
c) Studies calculating the change in cost due to a specific intervention (e.g. congestion charging, road building, public transport improvement) for comparison with the cost of doing so.

The first group produces figures which differ, after allowance is made for differences in detailed assumptions, inflation, etc., by factors of two to four. If the figure mattered, it would be very important to track down the reasons for the discrepancy but, as argued below, this would be a waste of time because the indicator is not helpful. Indeed, one of the reasons why such different estimates have coexisted side by side is because nothing actually follows from any particular figure: any policy conclusions which might follow from £15 billion or £7 billion or £23 billion, are identical or derive not from the numbers but from the separate policy preferences of the authors.

The second group, by contrast, are vitally important as a building block in searching for good pricing rules, especially in distinguishing between different areas of London, different vehicle types, road types, times of day, etc. The figures are much more important to get right[5], or at least to try to get agreed, as they do influence policies. They do not give useful estimates themselves of any global congestion costs or benefits, and do not need to do so.

The third group, in the author's opinion, are the only ones usefully leading anywhere. They compare achievable benefits against the costs of achieving them.

The flaw in "total congestion cost"

The author argues that the method of calculating the "total" costs of congestion is wrong. This relates not only to NERA's criticism of Newbery, but to the underlying concept itself.

The erroneous calculation

The method of calculating congestion costs, due to Glanville and Smeed, is based on the following formula:

<u>(Time at "target" speed)</u> - <u>(Time at actual speed)</u>

multiplied by

<u>(Volume of traffic)</u>

equals

<u>(Total Congestion Delays)</u>

What this means is that the target speed changes, congestion costs as calculated can increase even if nobody is actually worse off. Consider peak-period traffic travelling at 20 km/h on a 30 km/h local road. Then we redesignate the road as 60 km/h, and implement improvements allowing an actual peak speed of 25 km/h. According to the formula, congestion costs are now greater, although in fact every vehicle is travelling faster.

This occurs even if the volume of traffic does not change. However, if traffic grows, then the congestion cost must grow with it, even if speeds do not fall -- or even if they increase, but by less than the volume of traffic.

So the calculation would say that a growing volume of traffic, using a continually improved road system, at continually increasing speeds, could still be suffering an increased total cost of congestion.

And, conversely, if we revise downwards our accepted "target" speed (as is widely done in speed restrictions), or if we alter road design in such a way that the free-flow speed of traffic falls (as is widely done in traffic calming) then in either case the calculated total cost of congestion to the economy would appear to fall.

In summary, statements of the form "congestion costs the economy £15 billion a year", updated from time to time by inflation, imply an annual dividend of £1 000 waiting to be distributed to each family or, as CBI says, £5 a week or £10 a week on the shopping bill. This is a fiction. It is calculated by comparing the time spent in traffic now, with the reduced time that would apply if the same volume of traffic was all travelling at free-flow speed, and then giving all these notional time savings the same cash value that we currently apply to the odd minutes saved by transport improvements. But this could *never* exist in the real world -- not for reasons of practical difficulty, but because it is internally inconsistent. If all traffic travelled at free flow speed, we can be quite certain that there would be more of it, at least part of the time saved would be spent on further travel, and further changes would be triggered whose value is an unexplored quantity. It is an apparently precise answer to a phantom question. It really does not matter whether "the answer" is £7 billion or £23 billion.

NOTES

1. On 27.2.2003, London introduced the largest congestion charging system so far seen in the world, based on a cordon round the central area and a £5 (7 euro) flat charge per day per vehicle. At the time of writing this paper, the charge has seen an easier first period than expected, with slightly higher reductions in traffic than forecast, and less public opposition than its opponents had hoped for. But it is not expected that it will be possible to review the scheme properly until a full year (or more) has passed. Latest available results will be reported to the Symposium: this paper makes use of the calculations and assessments made *before* the scheme was introduced.

2. For example, GoL assumed that only buses and emergency vehicles would be exempt, while in the TfL design about one-third of motor vehicles would either be exempt or would pay a much reduced charge.

3. E.g.: CBI (undated, 1991?) "Ultimately, paying for better motorways will only be acceptable to the CBI if charging does actually deliver benefits such as the £15 billion annual cost of congestion." (para. 8), and CBI (1993), "The CBI estimated in 1989 that road congestion cost the British economy around £15 billion annually", which seems to relate to the BRF source.

4. For example, SACTRA (1999) cite four studies, from Pearce (1993), Mauch and Rothengatter (1995), the Royal Commission on Environmental Pollution (1994) and Maddison *et al.* (1996), giving estimates for these non-congestion elements of external cost, varying from £8 billion per

year to £40 billion per year -- broadly the same order of magnitude as the total congestion costs, which, notes SACTRA, "vary from c. £7 billion per annum (NERA, 1997) to c. £19 billion per annum" (Newbery, 1995). These studies therefore accord broadly the same economic importance to accidents, noise, air pollution and climate change, taken together, as to congestion. This does not come out from the Leeds analyses, but intuitively seems to correspond better with public perceptions of the importance of such issues.

5. SACTRA (1999) drew attention to the probability that there would never be complete agreement on these figures -- but that should not be used as an excuse to do nothing. External costs -- of congestion, pollution, etc. -- still exist as real burdens on the economy, even if their measurement is difficult.

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Decoupling of Economic and Transport Growth:
Background, Findings and Prospects

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SUMMARY

Basel, February 2003

1. INTRODUCTION: DECOUPLING -- WHAT FOR?

The decoupling of economic and transport growth has been the subject of increasingly intense debate in recent years, at least in Europe. The discussion was triggered and has been sustained by a sharp rise in the mobility of people and goods, accompanied by undesirable side-effects in the form of various emissions, transport safety problems and the growing strain on scarce resources. At the same time, important signals are being sent as capacity limits are neared or in some cases even exceeded, bringing a new dimension to the fundamental question of the sense of apparently unchecked growth, already a subject of lively debate in the 1970s.

Even though the critique of growth may hitherto have given the impression of being an inward-looking discussion of abstract principles, its connections with the growth of mobility are nevertheless clear. Fulfilment of the wish for a constant extension of the individual's own radius of action, seen as the epitome of a high quality of life, has been and still is increasingly accompanied by a noticeable impairment of other aspects of quality of life.

People are not only participants in or originators of passenger and goods transport but also victims of it. In the late 1980s and with growing intensity in the 1990s, this dilemma sparked off a debate about the possibility of breaking the link between economic growth and transport growth, by analogy with the energy sector, so as to reap the benefits of economic growth and increased mobility without paying the price of increased exposure to their negative side-effects.

For example, indisputable efficiency gains relating to mobility, such as the reduced specific energy consumption of means of transport and increased infrastructure capacity resulting from the introduction of telematics, encouraged Germany's Federal Government to frame a "decoupling strategy". Drawn up in late 1996/early 1997, it was published in April 1997 in a paper entitled "Mobility -- Benchmarks for a forward-looking mobility research policy[1]". Taking account of the limited options for extending infrastructure and the undesirable effects of mobility, this paper states that "*a forward-looking transport and research policy will have to develop strategies in order to permit future economic growth without a corresponding increase in transport* (p. 8)."

In the same year, a study by Herbert Baum and Markus Heibach on "Decoupling Economic and Transport Growth[2]" noted that goods transport intensity had decreased slightly and that passenger transport intensity had remained broadly constant since the end of the 1960s. The study concerned the original *Länder* of the Federal Republic of Germany and covered the period from 1960 to 1990. In 1998, Gerd Aberle, noting the sharp rise in goods transport since the late 1980s following completion of the single European market, found that *"the decoupling of economic growth and goods transport is not taking place*[3]." That did not prevent Herbert Baum and Judith Kurte, at the ECMT Round Table 119 on "Transport and Economic Development" in 2001, from again finding that: "*The increase in goods transport performance was also proportionately lower than the increase in GDP...*[4]", the "also" referring to the fact that this finding also applied to the increase in goods transport.

The decoupling debate was given a new political dimension at European level by the White Paper entitled "European transport policy for 2010: Time to decide[5]". Published in September 2001, it states that "*greater efforts [will be needed] in order gradually to break the link between transport growth and economic growth...*" (p. 10). A few lines later it adds, rather soberly: "*A complex equation has to be solved in order to curb the demand for transport: economic growth will almost automatically generate greater needs for mobility*" (idem).

So what is the real situation? And what does "decoupling economic and transport growth" really mean? How are things going in Europe? What strategy exists for countering the trend? Those are the questions that are addressed in the rest of this report.

2. WHAT DOES DECOUPLING MEAN?

It is plain from a reading of studies, policy statements and other documents that the decoupling of economic and transport growth spans a wide range of very different notions. Drawing on an earlier paper on the subject of decoupling economic and transport growth[6], this report seeks to bring at least a certain degree of conceptual clarity to the question of what the yardsticks of a decoupling strategy may be.

As far as economic growth is concerned, the most appropriate yardsticks are doubtless Gross National Product (GNP), an indicator of the economic performance of all domestic agents, and Gross Domestic Product (GDP), an indicator of the value-added of all sectors of the domestic economy plus the state and non-profit organisations. However, these indicators do not display any direct causal link with transport trends. It might be supposed that the value-added of manufacturing industry, which includes the mining, processing and construction industries, would be a "harder" indicator of any decoupling in goods transport, since it would provide a direct connection with transport processes, which are very closely linked to the manufacturing industry. Moreover, in our modelling of demand for goods transport we have established very good correlations when imports are added to the value-added of manufacturing industry (which includes domestic and foreign activities). However that may be, GDP serves as the reference value for this paper because it is often used as a synonym for economic growth and appears to be the most appropriate benchmark for passenger and goods transport. That being said, inflation must be eliminated from all these values expressed in money units; consequently, the price trend in a given year (the "real" trend at "constant prices") needs to be taken into account.

There are several possible indicators for assessing decoupling in transport growth. In the previous decoupling debate, there seemed to be widespread unspoken agreement that decoupling applied to goods transport alone. However, in a considerable advance in terms of mindset, the European Commission White Paper explicitly mentions reductions in the mobility of both people and goods in relation to the gradual breaking of the link between economic growth and transport growth as the option on which the White Paper is based (White Paper, p. 11). This breaks the taboo, at least verbally and at European level, on the inclusion of passenger transport in decoupling strategies, and may therefore be regarded as a significant contribution to changing the role of goods transport as a convenient "whipping-boy" in the transport ecology debate.

However welcome this understanding of the decoupling strategy may be, transcending modes of transport, the rest of this paper will concentrate, as agreed, on the decoupling of economic and goods transport growth.

So what are the appropriate indicators of goods transport growth (and, by analogy, of passenger transport growth)? How should the transport trend be described?

- For all transport modes and carriers or just for specific parts of the transport system?;
- In terms of transport volume (tons transported/passenger journeys) or transport performance (the product of transport volume and transport distance)?;
- In terms of improved performance of vehicles, trains, ships or aircraft?;
- Or should transport trends be measured on the basis of their undesirable side effects, like pollution, noise and use of space, which are ultimately a cause or an objective of the decoupling strategy?

Generally speaking, the only reliable indicators are those with a performance component. Consequently, transport volume or the stock of vehicles are not suitable. In our opinion, the most meaningful indicator for assessing the success of decoupling is all-mode transport performance, meaning total tonnes per kilometre (or passengers per kilometre) for all modes combined. These indicators may be supplemented by indicators of efficiency, like utilisation rates (or occupancy rates), or of economic performance, such as total transport-related energy use and exhaust emissions. The performance of the various means of transport also generally appears to be a useful guide, though as it is well-nigh impossible to aggregate the different performance indicators meaningfully and as any assessment of decoupling has to span all transport modes, they are not ultimately helpful for the discussion of the decoupling strategy.

Reducing specific fuel use or specific exhaust emissions from vehicles, ships, aircraft or diesel locomotives may make a useful contribution to the ecological efficiency of transport (provided they are not offset by contrary effects like lower utilisation rates or rising transport distances), but such factors have no contribution to make to the decoupling debate because they are not representative of the overall transport trend in absolute values.

3. FACTS AND FIGURES: LINKS BETWEEN ECONOMIC AND GOODS TRANSPORT TRENDS

The following discussion is deliberately restricted to goods transport because, as already mentioned, that is the agreed focus for this paper. We shall try to consider as many European countries as possible, drawing extensively for quantitative analysis on Prognos AG's "European Transport Report 2002", which was published in the Summer of 2002 and covers past and future trends in passenger and goods transport in 22 European countries, in their socioeconomic context[7].

In order to interpret the following charts and commentaries correctly, the following points should be borne in mind.

- Gross Domestic Product is the reference indicator for all time-series observations, expressed in 1995 prices (real values, i.e. adjusted for inflation).

- The measurements of transport growth differ, as explained below.

- "Decoupling" means that the trend of quotients derived from transport and economic measurement categories is not parallel to the time axis. A rising curve indicates a higher rate of transport growth than economic growth, while a falling curve indicates a lower rate of transport growth than economic growth. The transport policy objective of decoupling economic and transport growth aims to achieve the latter, i.e. a downward trend of the curve over time.

A few preliminary remarks of a more technical nature complete the picture.

- The euro has existed as the single currency only since 1 January 2002. Previous data are based on ECU trends and 1995 exchange rates for each national currency.

- The 15 current EU Member States were not all members of the then EEC at the beginning of the period of the quantitative analysis, and the EU will certainly have more than the current 15 Member States by the end of the forecast horizon.

- The five eastern European countries -- the Czech Republic (CZ), Hungary (HU), Poland (PL) Slovenia (SL) and Estonia (EE) -- are the former eastern bloc countries with which the EU first started accession negotiations. That is why they represent eastern European countries in Prognos European Transport Reports to date. It should also be noted that the Czech Republic has only existed in its present form since 1 January 1993.

- As the five eastern European countries under consideration have been making their way in the new Europe only since 1991 or 1993, there seems little point in carrying out analyses of them with data from the 1980s; consequently, no such data have been used.

- In the 1980s, the western European countries entered a significant phase of their development, characterised in economic terms by the single European market project and, in transport terms, by deregulation of road transport. For that reason, trends in the 1980s have been included in the observations for these countries.

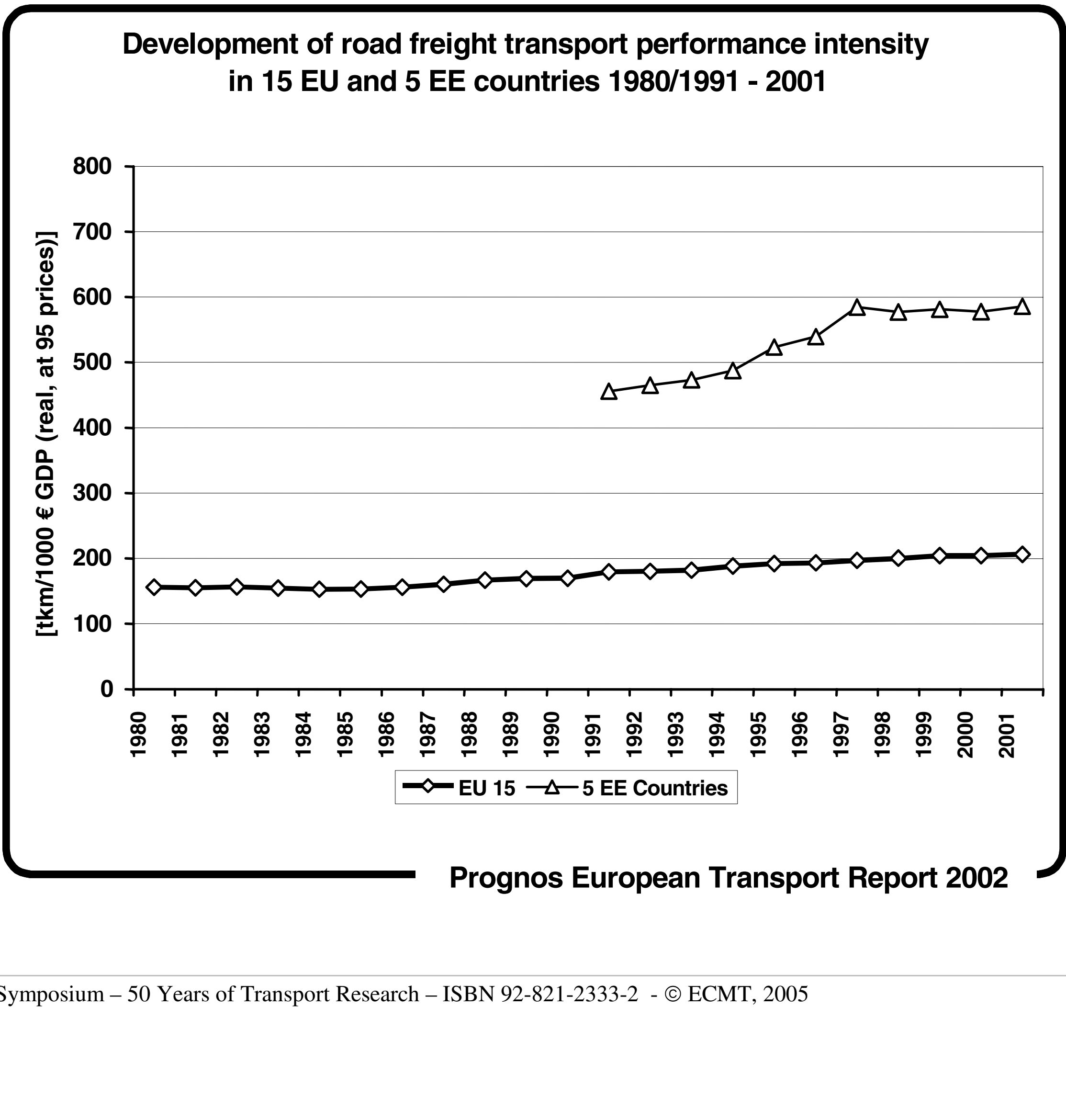
- Lastly, German reunification on 3 October 1990 also caused a time-series break. Consequently, data for Germany until 1990 relate solely to the original *Länder* of the Federal Republic.

Figures 1 and 2 show two modal decoupling paths for all 15 EU Member States and the selected five eastern European countries.

For the 15 EU Member States on average, the intensity of road freight transport performance rose from 156 t-km/1000 € GDP in 1980 to 206 t-km/1000 € GDP in 2001, an increase of over 30 per cent, because road freight transport performance increased by more than 110 per cent over the period while real GDP rose by "only" 60 per cent. This decoupling -- not in the desired direction -- was one of the main triggers of the decoupling debate that is currently being conducted. One primary cause is doubtless the (wholly desirable) economic integration of Europe, one of the effects of which is increased flows of goods. This effect appears to have been amplified by the chronic inability of European rail companies to offer attractive cross-border transport options, even though many of these relatively long international road journeys could certainly have been entirely suitable for rail.

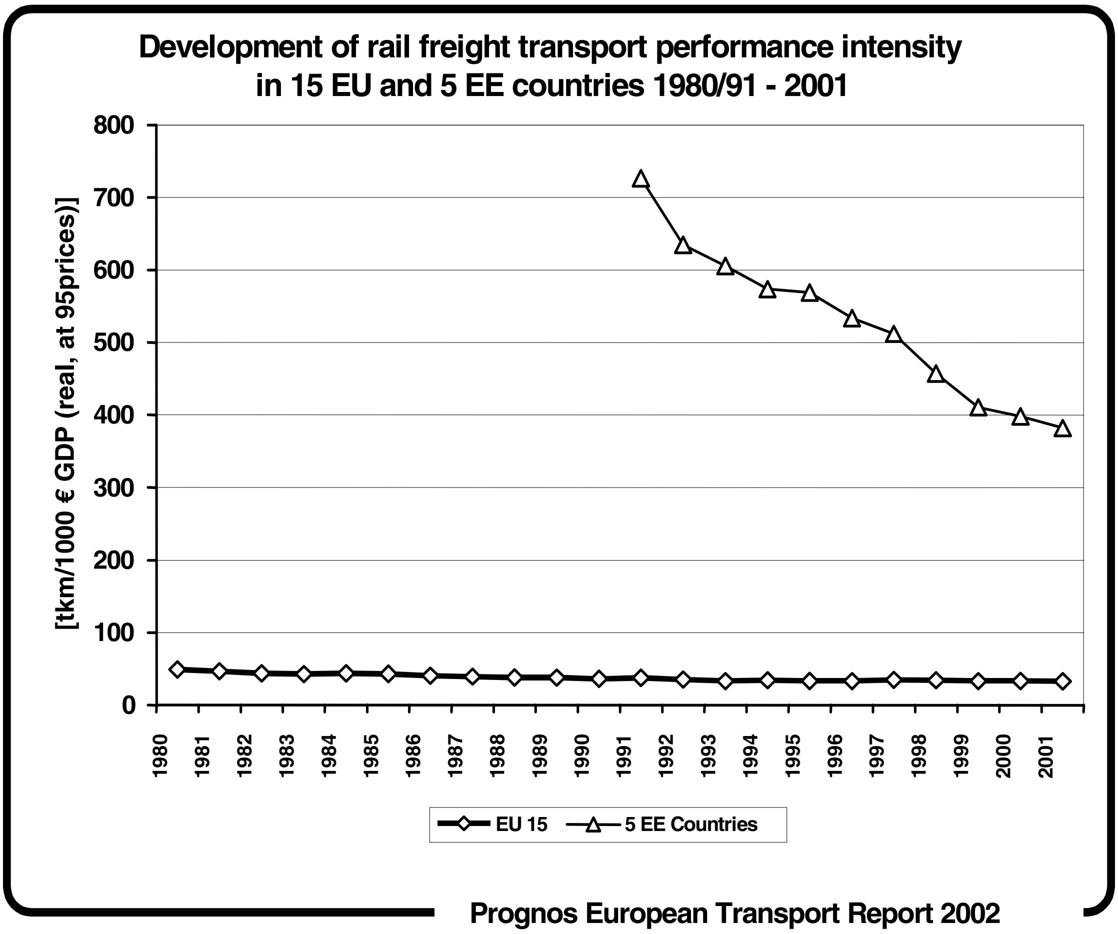
The picture is rather different in the selected five eastern European countries. A rapid decoupling of economic and road transport growth was apparent until 1997, albeit also not in the desired direction. Since then, and at least until now, economic growth and road goods transport growth have risen at much the same pace. The swift rise in the 1990s was only partly due to the opening up of eastern Europe and was probably much more closely linked to the extent of structural change in the economies of the eastern European countries, since the structure of their goods transport tends to be road-oriented, as used to be the case in western Europe. As their economies expanded, calls were made on eastern European countries not to make the same modal choice “mistakes” as in the West -- such demands were frequently to be heard at the ECMT’s International Seminar on “Prospects for East-West European Transport”, held in Paris in December 1990[8] -- but given the prevailing situation they were bound to be unrealistic. The eastern European countries were determined to follow the western model of economic change, and with the change in the structure of goods production came the change in the modal split.

Figure 1. **Trend of road freight transport performance intensity 1980/91-2001 (tkm/1000 € GDP, 1995 prices)**



The cogency of this hypothesis can be seen from Figure 2, which provides the same information as Figure 1, but for rail rather than road freight transport.

Figure 2. **Trend of rail freight transport performance intensity 1980/91–2001 (tkm/1000 € GDP, 1995 prices)**



Bearing in mind what has already been said, the picture is virtually self-explanatory. In the 15 EU countries, the processes described above were linked to a 34 per cent decline in rail transport performance intensity between 1980 and 2001; the decline in the selected five eastern European countries between 1991 and 2001 amounted to 47 per cent. It is another instance of decoupling in an unwanted direction.

But these two modal observations already show the limits of such analyses. The direction of the trend of total transport utilisation, i.e. the transport performance of all overland transport modes, remains unclear. But before considering such observations (which we unambiguously prefer), we should take another brief look at the link between economic performance and vehicle performance trends in road freight transport, as shown in Figure 3.

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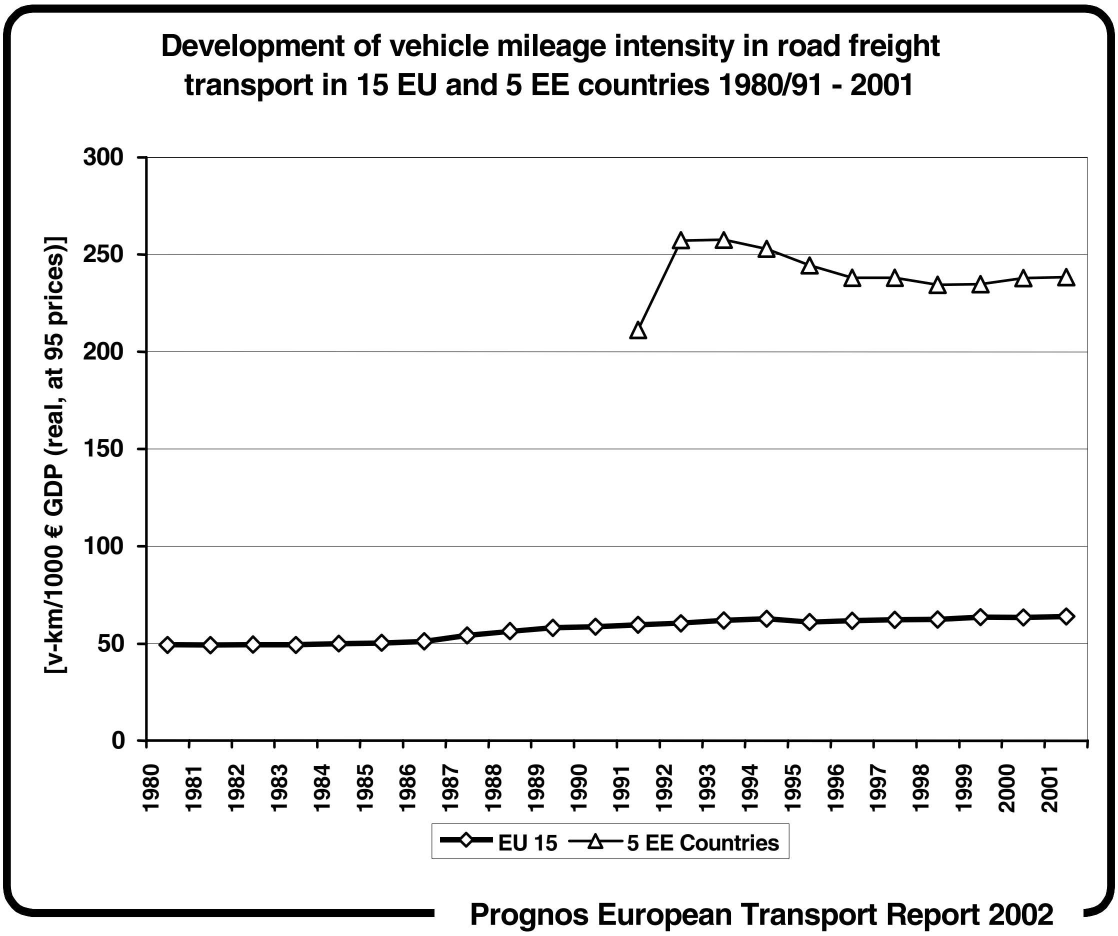
Figure 3. **Trend of vehicle mileage intensity in road freight transport 1980/91-2001 (v-km/1000 € GDP, 1995 prices)**



It is difficult to see from the graph at the given scale -- which brings out the high vehicle mileage intensity in the selected five eastern European countries -- that the indicator also increased by almost 30 per cent in the 15 EU countries between 1980 and 2001, while falling back slightly in the eastern European countries between 1992 and 1998. Comparing this trend with the one shown in Figure 1 leads implicitly to another significant "efficiency indicator": the distance-weighted utilisation rate in road freight transport as a ratio of tonnes per kilometre and vehicle mileage. This broad indicator of productivity in road freight transport has tended to rise slightly in the mean of the 15 EU countries in the last two decades and somewhat more sharply in the selected five eastern European countries. However, the underlying reason for this trend is likely to be the growing significance of larger vehicles and longer distances against the background of a targeted strategy to increase utilisation rates. In principle, road freight transport always strives to make use of any potential for rationalisation. This may have been amplified by the deregulation of road freight transport; consequently it is likely that the observable effect of higher utilisation rates is attributable to a variety of causes, the significance of which differs from one market segment to another.

Having set the scene with regard to the reality of decoupling -- albeit using only partially reliable indicators, however often they may crop up in transport policy discussions -- we can now turn to all-mode observations which highlight the relationship between transport performance in all overland transport modes (road, rail and inland waterways) and real economic growth. It is this indicator which, in our opinion, shows the true link between economic and transport performance growth.

Figure 4. **Trend of all-mode goods transport performance and of real GDP in 15 EU Member States 1980-2001 (1980=100 and 1991=100)**

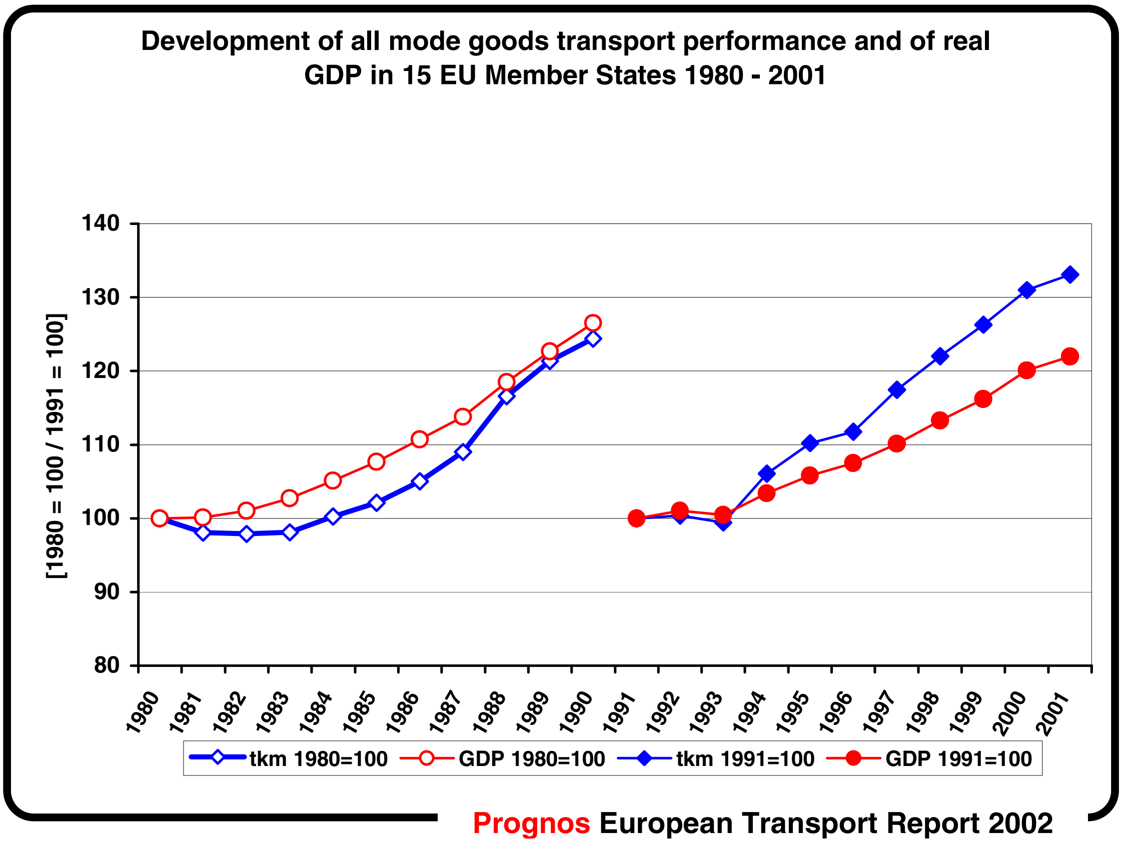


Figure 4 shows this trend for all EU countries in two distinct phases: the 1980s and the 1990s. In the 1980s, following the second oil shock and economic weakness in the early years of the decade, transport growth was initially slower than economic growth; however, the pace of transport growth overtook economic growth from the mid-1980s, more or less in conjunction with the move to complete the single European market. After slow economic growth in the early 1990s, partly attributable to the Gulf war, foreign trade started to grow strongly. With export and import quotas increasing sharply in almost all EU Member States, transport performance growth started to accelerate. One finding is plain: when economies are weak, given the sensitivity of bulk goods transport to economic conditions, transport performance growth is slower than economic growth.

In the same way, Figure 5 shows the trend in selected eastern European countries, albeit (for reasons mentioned earlier) only for the 1990s.

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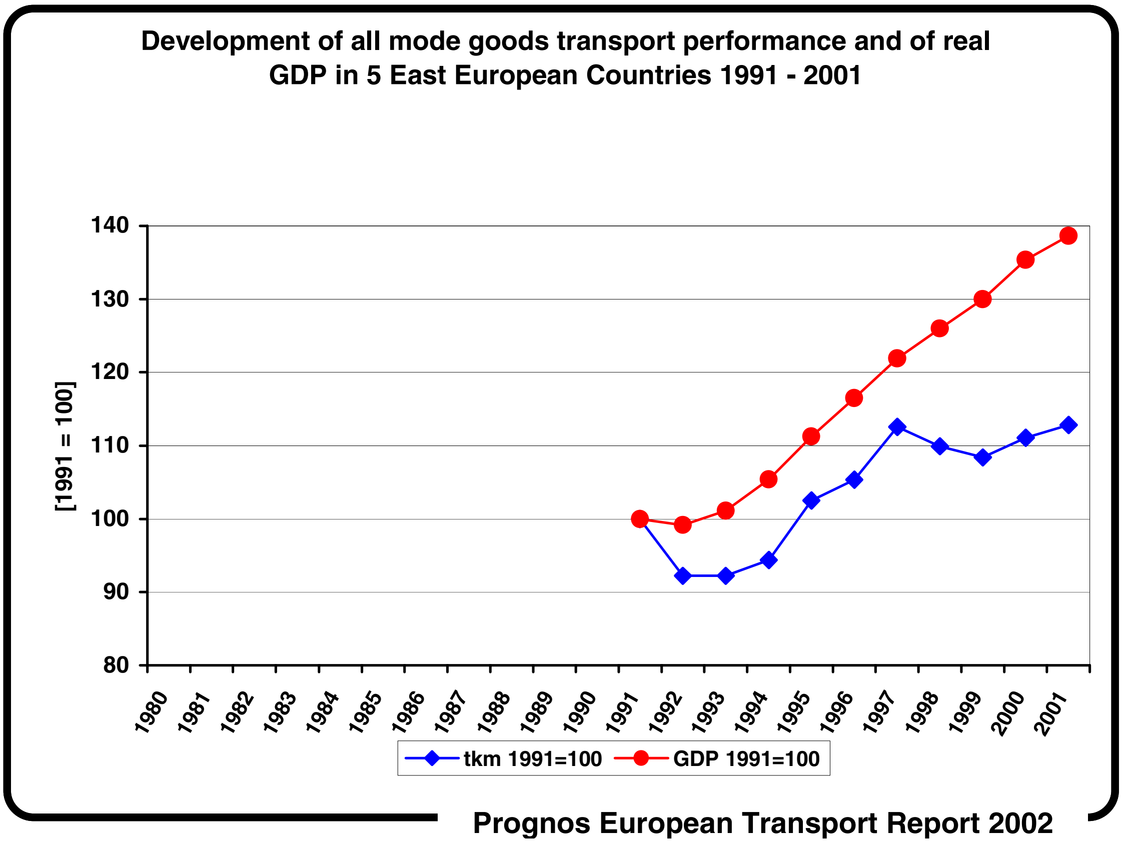
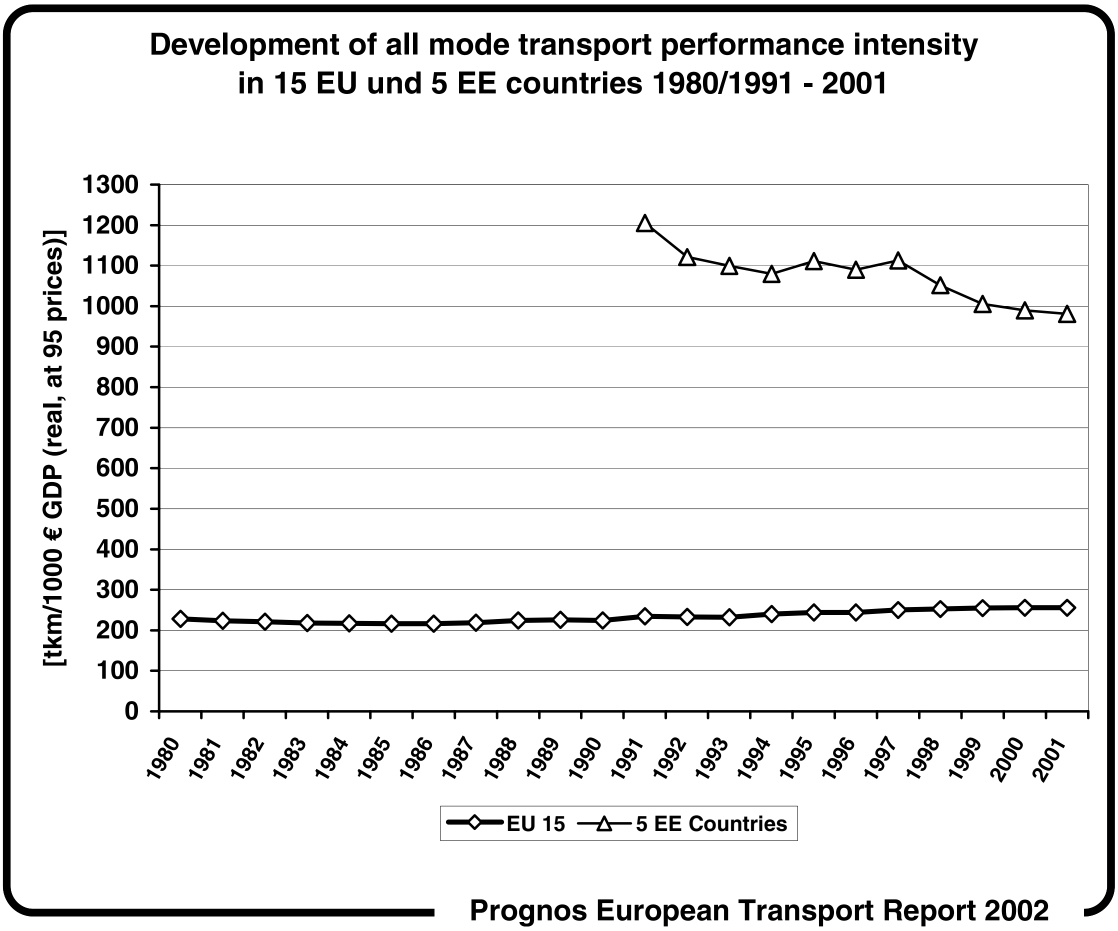
Figure 5. **Trend of all-mode goods transport performance and of real GDP in five eastern European countries, 1991-2001 (1991=100)**



The trend shown in Figure 5 is quite different from the trend in western Europe. The sought-after decoupling of economic and transport performance growth takes place in the eastern European countries, and the trend is actually amplified after 1997. One of the main reasons for this was already perceptible in Figure 2, namely, the sharp drop in rail transport intensity, only partly offset by an increase in road transport intensity.

However, this initial all-mode observation using index values does not offer any view of how the level of transport intensities may differ and actually change over time. By analogy with Figures 1 and 2, this is shown in Figure 6 for all three overland transport modes.

Figure 6. **Trend of all-mode transport performance intensity in 15 EU and five eastern European countries, 1980/91-2001 (tkm/1000 € GDP, 1995 prices)**

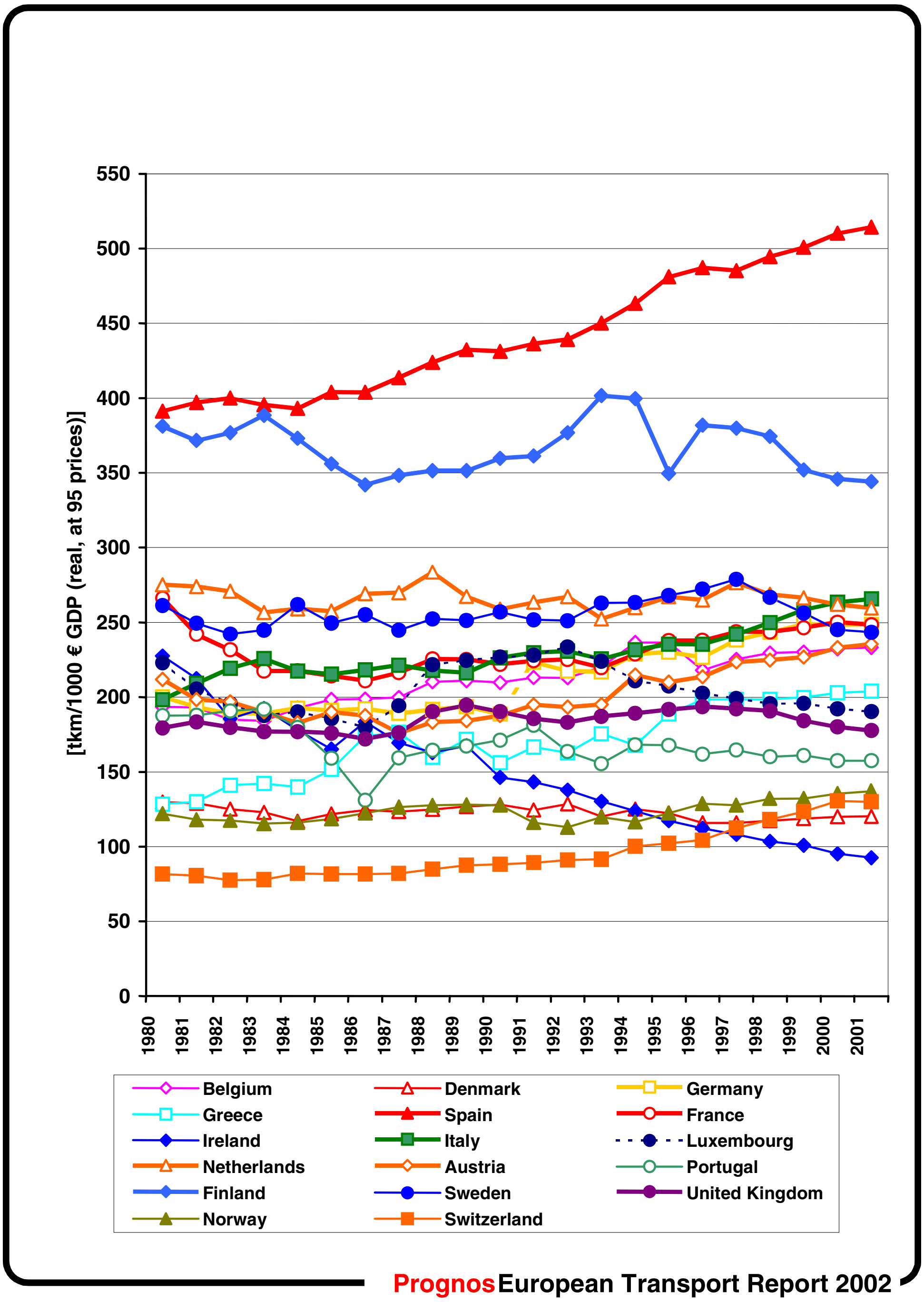


Two significant findings are immediately apparent from Figure 6. First, all-mode transport intensity in the five eastern European countries is substantially higher than in the EU. Second, transport intensity is declining in the five eastern European countries but rising in the EU (or at least the EU average). The scale of Figure 6 is such that it is hard to discern, but transport intensity in the EU increased by 4 per cent in the second half of the 1980s (1986-90) and by a further 9 per cent between 1991 and 2001. In other words, the desired decoupling of economic and transport performance growth has clearly not taken place in the EU in the last two decades, whereas it has occurred in eastern Europe, albeit from a comparatively very high initial level.

Unsurprisingly, trends in individual countries differ widely, as does the level of transport intensity. This can be seen, at least in overview, from the following charts, with a breakdown by groups of countries for western Europe.

Figure 7 is intended to give only a general impression, from which three findings will be commented on here. First, transport intensity trends in the countries of western Europe are indeed very different. Second, there is a wide spread, by a factor of 3 to 5, between countries with low levels (Ireland, Switzerland) and countries with high levels (Spain and Finland). Third, only the two high-level countries display a transport intensity that exceeds 300 tkm/1000 € GDP. One probable reason for this is that they are both relatively large, have relatively low population densities and have few major centres, separated by large distances. (A similar situation occurs in the USA where, according to an earlier study, the all-mode transport intensity is approximately 2.5 times higher than in Spain[9])

Figure 7. **Trend of all-mode transport performance intensity in western Europe, 1980-2001 (tkm/1000 € GDP, 1995 prices)**



Figures 8 and 9 show similar trends to Figure 7, although on a larger scale. This is not the place for a detailed commentary on the results, and many time-series trends may also display inexplicable breaks attributable to data problems[10]. However, it is almost impossible to identify individual trends because each country is affected by specific economic and geographical factors, compounded by differences in economic trends from one country to another. Nevertheless, it is broadly apparent that countries with a relatively small surface area (mostly to be found in Figure 8) display a lower transport intensity than larger countries, a characteristic which seems entirely plausible. As larger countries generally also display a lower degree (though not a lower level) of foreign trade integration, the trend of transport intensity also tends to be rather more constant than in smaller countries.

A look at four of the selected five eastern European countries concludes our analysis of past trends (Figure 10).

Figure 10 does not include Estonia, whose transport intensity is extraordinarily high, at approximately 3 000 tkm/1 000€ GDP. This indicator is at the limit of meaningful interpretation, since Estonia's transport network is used to a considerable extent by transit traffic heading for its ports, which is only very loosely linked to the country's GDP. (The same probably also applies to Luxembourg, whose low fuel prices and good roads attract a great deal of international HGV transit traffic.) All the other four countries show a general decline in all-mode transport intensity, although here again both the level and the trend differ from one country to another, a feature attributable to differences in size, geography and economic structure. As already mentioned earlier, this decoupling of economic and transport performance growth, moving in the desired direction, was linked to a change in modal split which, if it proves to be a lasting trend, is not moving in the desired direction.

Figure 8. **Trend of all-mode transport performance intensity in eight selected western European countries 1980-2001 (tkm/1000 € GDP, 1995 prices)**

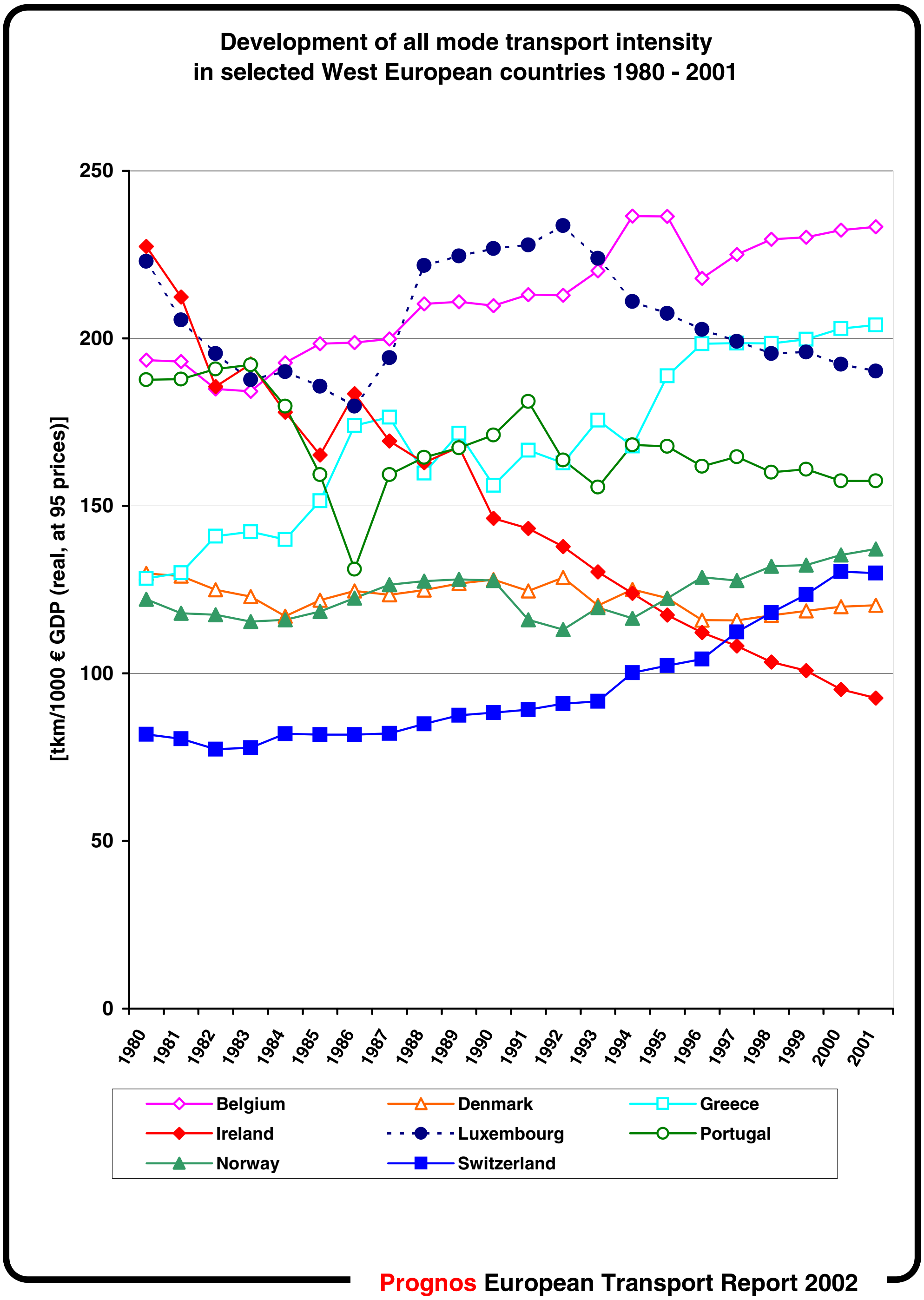


Figure 9. **Trend of all-mode transport performance intensity in seven selected western European countries 1980-2001 (tkm/1000 € GDP, 1995 prices)**

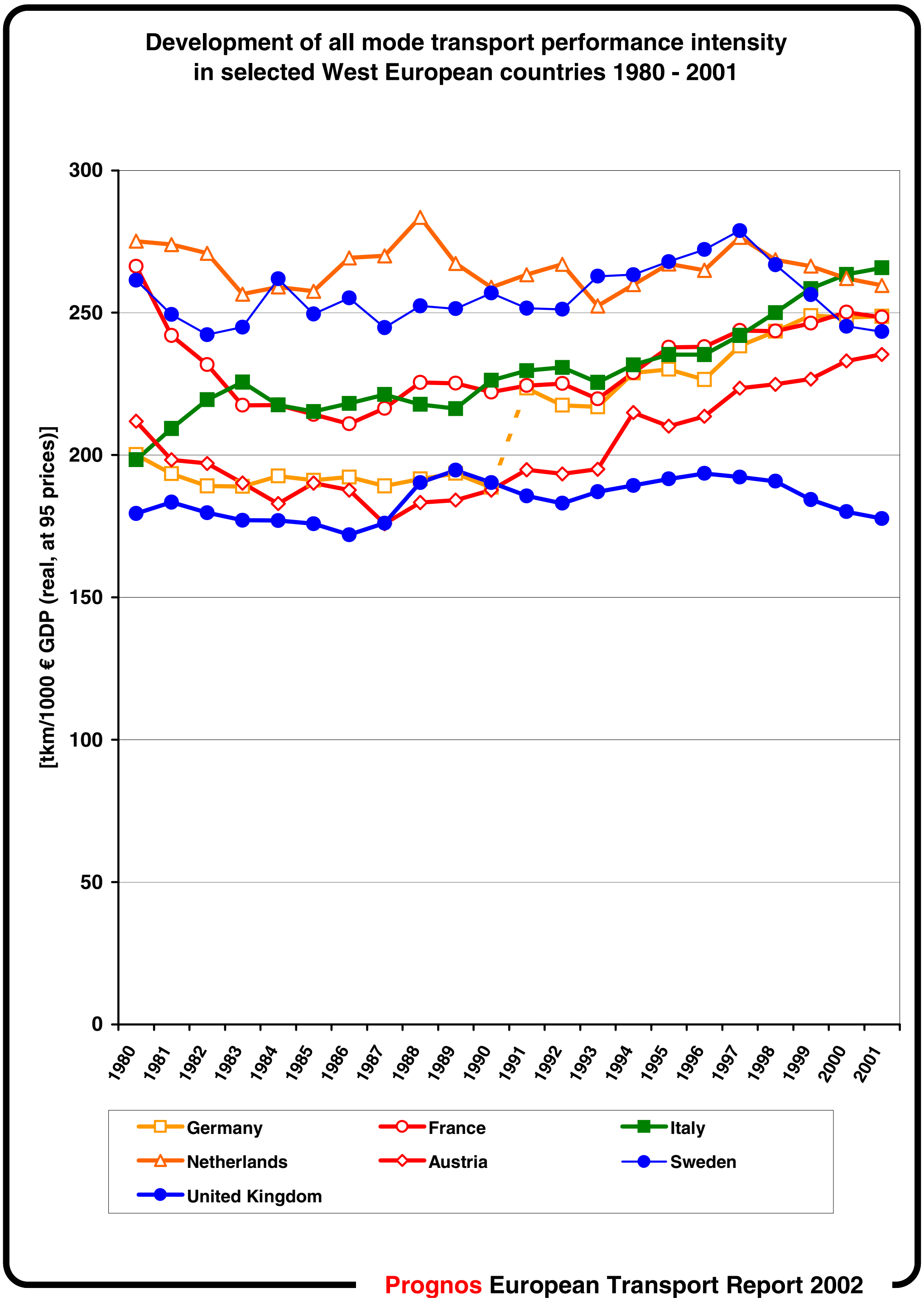


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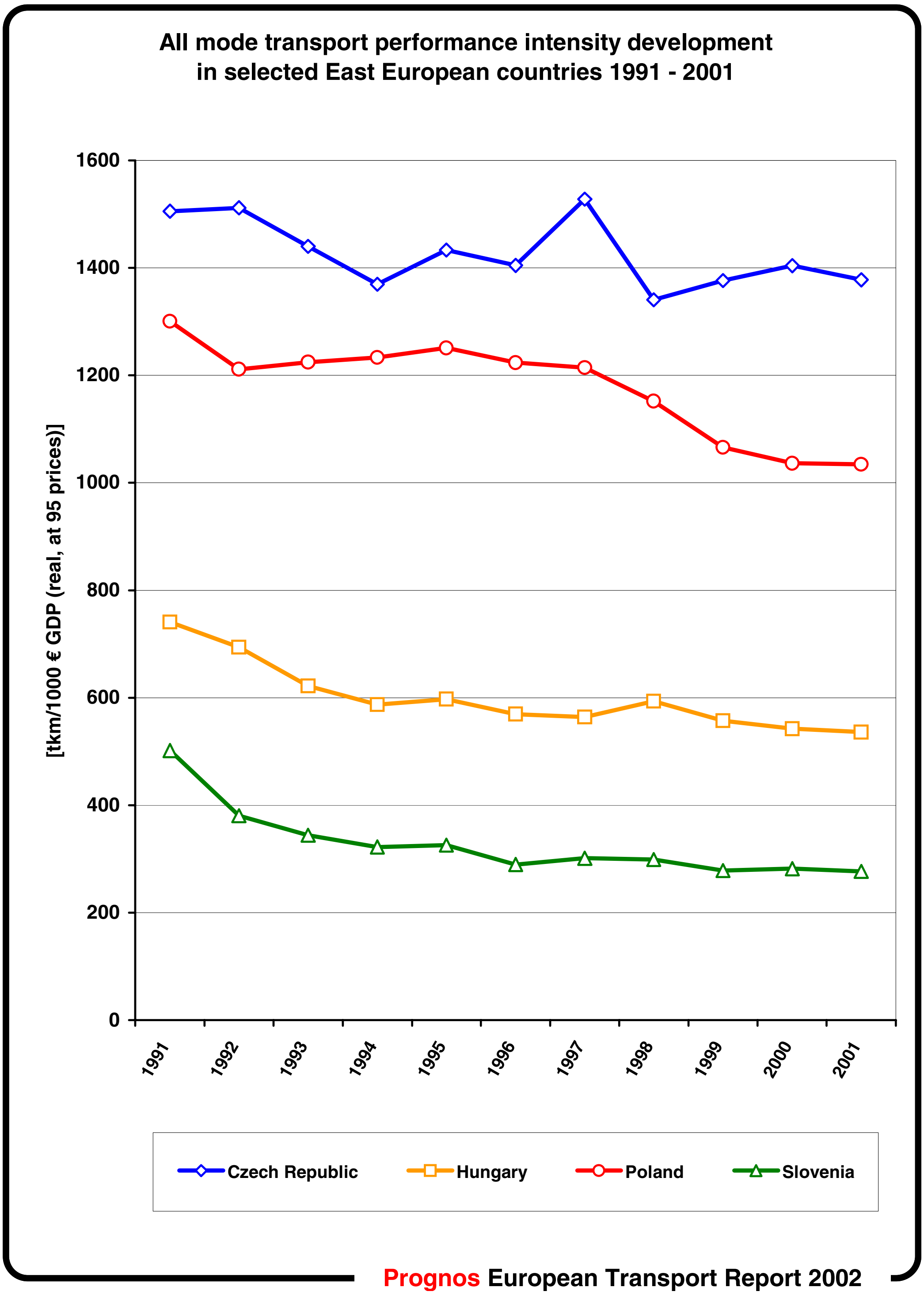
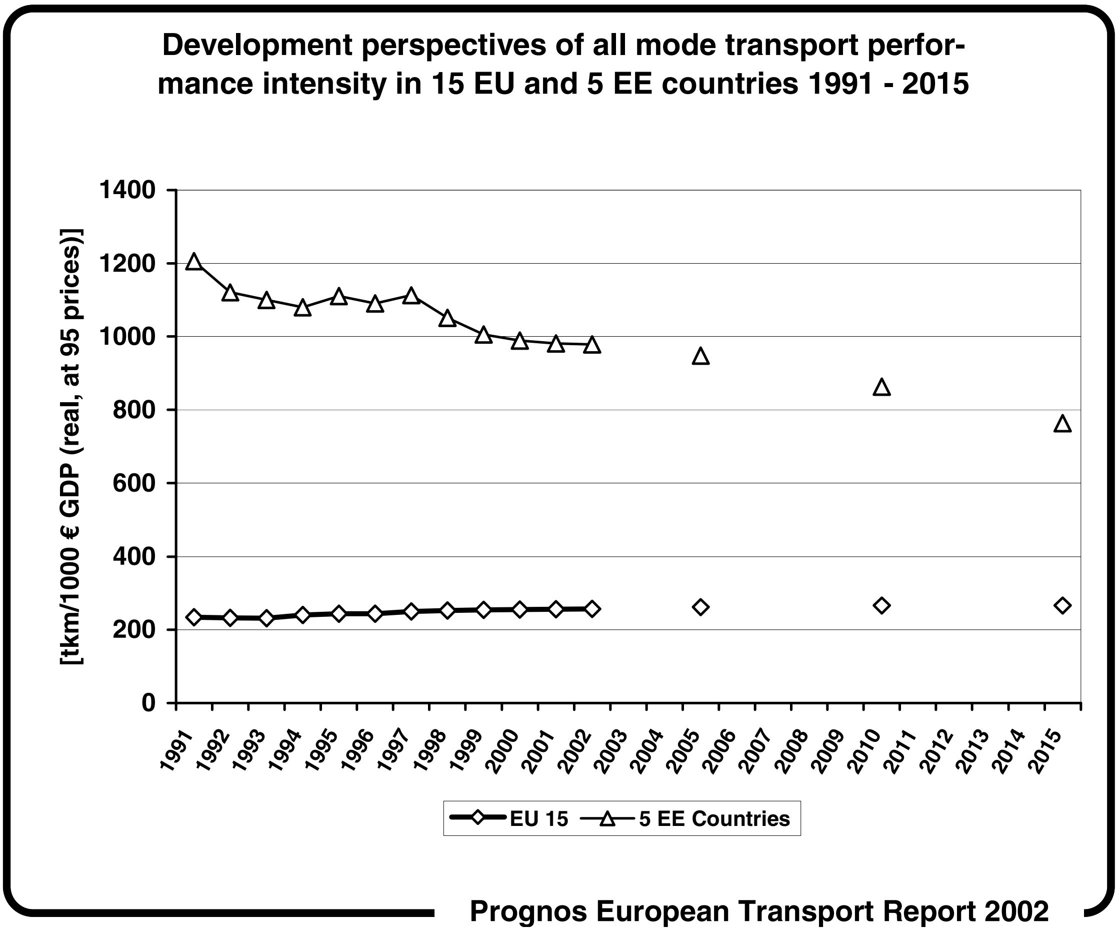
Figure 10. **Trend of all-mode transport performance intensity in four selected eastern European countries 1991-2001 (tkm/1000 € GDP, 1995 prices)**



4. OUTLOOK I: LOOKING FORWARD

The Prognos European Transport Report 2002 gives us not only an interesting perspective on the past but also a glimpse of future trends to 2015, for we have also drawn up country-by-country forecasts which, given their characteristics, may be described as trend forecasts. Figure 11 shows the future development of transport intensity as an aggregate result of these forecasts for the 15 EU and five eastern European countries.

Figure 11. **Trend forecasts for all-mode transport performance intensity in 15 EU and five EE countries to 2015 (tkm/1 000 € GDP, 1995 prices)**



In the five eastern European countries, assuming a comparatively high rate of economic growth (given a further boost by their entry into the EU) and the structural transformation of their economies, transport intensity will continue to fall sharply. (Incidentally, this trend will be accompanied by an increase in road transport as a proportion of the modal split.)

In the EU countries, in contrast, mean transport intensity is likely to rise only very slightly. In trend terms, this does not represent any decoupling of economic and transport performance growth in the desired direction, but rather a lockstep movement. These trends therefore point to a need for further action if, in a situation of on-going transport growth, economic and transport performance growth are to be decoupled.

5. OUTLOOK II: A STRATEGIC VIEW

After the many analyses and in view of the muted prospects for decoupling, at least as far as the current EU Member States are concerned, we should in conclusion take at least a brief look at some of the possible ways in which decoupling could nevertheless be achieved. The European Commission White Paper mentioned earlier puts forward various options along these lines, drawing in particular on the results of the EU SPRITE research project[11] carried out in 2000-2001 by a consortium, comprising ITS (UK), MEP (UK), Prognos (CH/D) and DITS (I), lead-managed by ITS[12].

The SPRITE report rightly points out -- and it is worth recalling the fact here -- that ultimately the real purpose of the decoupling debate is to render the mobility of people and goods less harmful to the environment. The decoupling of economic and transport performance growth is thus just a means to an end. In this context, the SPRITE consortium identified seven exemplary measures which, while being both potentially effective and realisable, would reduce transport intensity and/or environmental damage without (in the SPRITE consortium's view) having a major impact on economic growth. They are:

- Measures to influence the link between mobility habits and transport behaviour;
- Car-sharing;
- Parking space rationing;
- Road pricing in towns and cities;
- Fuel cell incentives;
- High-speed trains;
- Road pricing for goods transport.

These measures are regarded purely as examples of the type of measures that could be taken; while each one individually aims to achieve a certain result, they can be much more effective when integrated into a strategy.

The European Commission’s White Paper adds that measures which involve charging (road pricing in particular) must be accompanied by measures to revitalise alternative modes of transport and targeted investment in the trans-European transport network, in order to achieve a satisfactory result. On this subject, referred to as approach C, the White Paper says: “*By implementing the 60-odd measures set out in the White Paper there will be a marked break in the link between transport growth* *and economic growth, although without there being any need to restrict the mobility of people and goods."* (White Paper, p. 12)

Note the slight distinction: SPRITE was looking for measures that do not affect economic growth; the White Paper gives priority to achieving the goals set without restricting mobility. In the last resort, this particular circle cannot be squared. Thus, it will always be a matter of finding the optimum mix -- normatively based -- of measures that will secure the long-term sustainability of mobility with the least possible restrictions. One point is crucial: changes cannot be made unless action is taken, and that goes well beyond the sphere of purely transport policy. The White Paper rightly mentions the many supporting measures that need to be taken in the framework of an overall strategy. Economic policy should influence structures that generate transport demand (such as just-in-time production methods); urban and regional planning policy should favour a residential mix that reduces traffic; social and educational policy should help to ease congestion through an appropriate organisation of work and school time; financial policy should contribute to the internalisation of external costs; competition policy should help to dismantle distortions of competition between modes of transport; and research policy should help to co-ordinate and optimise the relevant R&D resources.

Let us conclude on the following note. We, as human beings, are and remain the cause of and reason for the mobility whose harmful side-effects started the decoupling debate. If decoupling is to be successful, it must result from a change in our attitudes, from our role as the originators of movements of people and goods and, above all, from our real behaviour with regard to mobility.

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5. European Commission (2001), White Paper -- European transport policy for 2010: Time to decide, Luxemburg.

6. Rommerskirchen, Stefan (1999), Entkopplung des Wachstums von Wirtschaft und Verkehr?, in: *Internationales Verkehrswesen* (51) 6/99, p. 231-236.

7. Grotrian, Jobst *et al.* (2002), *Prognos European Transport Report 2002, 22 West and Eastern Countries 2000-2002 - 2010-2015, Analyses and Forecasts*, Basel; the next report, "European Transport Report 2004-2005" is due to be published in Spring 2004.

8. Cf. ECMT Economic Research Centre (ed.) (1991), *Prospects for East-West European Transport*, proceedings of International Seminar held in Paris on 6-7 December 1990, OECD, Paris.

9. See Rommerskirchen, Stefan, *Entkopplung des Wachstums von Wirtschaft und Verkehr*, p. 236.

10. International transport statistics occasionally display a range of different quality problems, though this is not the place to discuss them in detail. For further information see, e.g., Rommerskirchen, Stefan, Quality of European Transport Statistics -- Requirements, Results and Prospects, in: ECMT/European Commission (ed.) (2000), *Transport Benchmarking -- Methodologies, Applications & Data Needs*, Paris, pp. 83-91.

11. ITS/MEP/Prognos/DITS (2002), SPRITE -- **S**e**p**a**r**ating the **I**ntensity of **T**ransport from **E**conomic Growth, Final Publishable Report, Leeds/Basel/Köln/Rome.

12. ITS: Institute for Transport Studies, University of Leeds; MEP: Marcial Echenique and Partners Ltd., Cambridge; Prognos AG, Basel/Cologne; DITS: Dipartimento Idraulica, Trasporti, Strade, University of Rome La Sapienza, Rome.

Topic 2:

Competition and regulation: Substitutes or complements?

Non-market Allocation in Transport: A Reassessment of its Justification and the Challenge of Institutional Transition

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SUMMARY

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ABSTRACT

Economic theory knows two systems of co-ordination: through public choice or through the market principle. If the market is chosen, then it may either be regulated or it may be fully competitive (or be in between these two extremes).

This paper first inquires into the reasons for regulation; it analyses the reasons for the important role of government in the transportation sector, especially in the procurement of infrastructure. Historical reasons are seen as important factors for bureaucratic objections to deregulation. Fundamental economic concepts are forwarded that suggest market failure and justify a regulatory environment.

The reasons for regulation cited above, however, may be challenged; we forward theoretical concepts from industrial organisation theory and from institutional economics which suggest that competition is even possible on the level of infrastructure.

The transition from a strongly regulated to a competitive environment poses problems that have given lieu to numerous failures in privatisation and deregulation. Structural inertia plays an important role, and the incentive-compatible management of infrastructure is seen as the key element of any liberal transportation policy. It requires that the setting of rules on the meta level satisfies both local and global efficiency ends.

We conclude that, in market economies, competition and regulation should not be substitutes but complements. General rules, an "ethic of competition", have to be set that guarantee a level playing field to agents; it is complemented by institutions that provide arbitration in cases of misconduct.

1. COMPETITION AND REGULATION WITHIN THE SCOPE OF TRANSPORTATION ECONOMICS

1.1. Fundamental questions

Often, the market and regulation are seen as antagonistic principles in organising an economy. However, it is not so much the radical choice between the two but the dose applied which is important. Markets need an institutional framework; thus, a sound analysis on the interaction between competition and regulation has first to tackle with the following questions:

- How is the market identified and delimited?;
- What is the epistemological background: normative economics or empirical social science?;

- Should results or behaviour be explained?;
- Will the analysis focus on the aggregate or the disaggregate level?;
- What does the analysis aim at: ecological or economic sustainability, efficiency, distributive goals?

In this first chapter, we will go through these five points and show that they are important, as they filter the direction of analysis. Before doing so, we will first define what we understand by "competition" and "regulation", as very different interpretations exist for these two *termini technici*.

1.2. Definition of competition and regulation

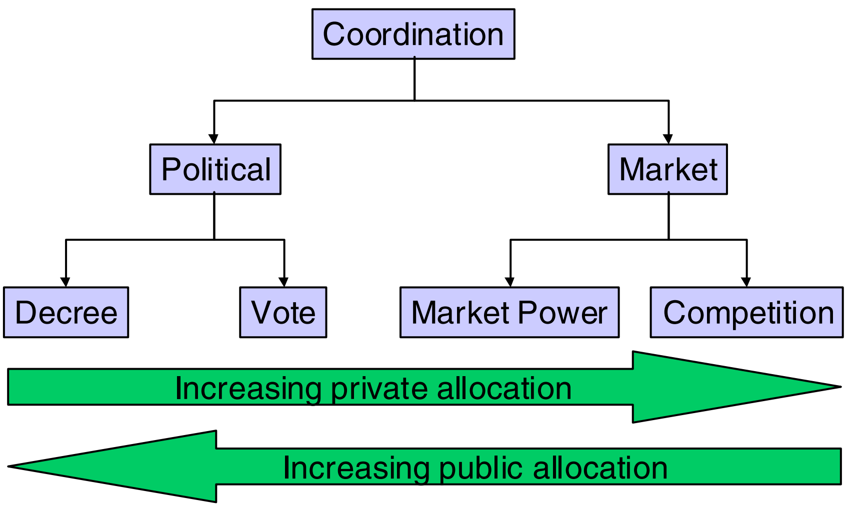
1.2.1. Competition and its intensity

In our definition, competition is an open process which produces results that would otherwise remain unknown. This dynamic and evolutionary view, in the tradition of SCHUMPETER (1912) and v. HAYEK (1945), sees competition as the single most important device of information processing in a market economy that helps to reduce the constitutional non-knowledge of individuals. Following BLUM (2003), it incorporates very different market structures that produce or limit competition -- i.e. monopolistic competition, different types of oligopolistic competition -- and takes account of the benefits and costs of information asymmetry, of path dependency and irreversibilities or external economies. This strongly contrasts to "neoclassical" competition, which is just the implementation of a pre-known result given by the technology of supply and the preferences of demand.

If competition is given by two processes, innovation and transfer (of market shares), then we learn that the intensity of competition is given by the speed in which pioneer profits are eroded. This further implies that the antagonism between regulation and competition must necessarily include innovation and transfer in the sense of a failure or socially undesired results.

Competition, in fact, is only one means of co-ordination. As Figure 1 points out, co-ordination has non-market and market facets -- and markets may be competitive or not, be they political or economic.

Figure 1. **Types of co-ordination**



1.2.2. *Two types of regulation*

Regulation is the process of setting and enforcing rules; in political economics, it refers to public activity claimed to be enacted in the national interest. We distinguish between two fundamentally different types of regulation:

- Constitutional regulation defines the general rules within which economic activities evolve; they are a prerequisite for societal activity and they define the structure of an economy. Here, we will concentrate only on market economies and exclude centrally-planned economies because of the entirely different implication that regulation has in their world[1].

- Procedural regulation defines, on the level below institutional regulation, the way problems are solved; very often, this relates to arbitration procedures. In many cases, it offers voluntaristic potentials for intervention.

A classic example is the way antitrust legislation is set up and enforced in liberal democracies. An antitrust law sets the standards that are to be obeyed by agents; in case of conflict, an arbitration system exists, i.e. a court, that settles open problems. This example is chosen because the major economic problem with transportation lies in a missing tradition vis-à-vis competition, because of economic factors that supposedly rule out allocation through competition, especially issues of natural monopoly and external economies. We will go into this later. Finally, it is noteworthy that the two levels are not independent. Through procedural regulation, a market-oriented constitutional regulation can be entirely offset.

We learn that markets can only function within a framework of rules. This meta structure sets the playing field for policies. Ideally, the meta rules would be self-enforcing; however, some public institutions may need to supervise agents to comply with and impose sanctions.

1.2.3. *Regulatory addressees and instruments in a market economy*

Assuming that the decision for a competitive market economy is taken, which economic structures are addressed by regulation and what are the principal regulatory instruments employed? Usually, we distinguish between structural regulation or conduct regulation (LIPCZYNSKI, WILSON, 2001; VISCUSI, VERNON, HARRINGTON, 2000): the former influences the structure of industry, the latter its conduct. Following the tradition of the Harvard School (MASON, 1939; BAIN, 1968), which proposes a causal relation between market structure, conduct and performance (scp hypothesis), we could also define performance regulation. Finally, the instruments used to enforce these ends are either fiscal or direct enforcement.

Table 1 surveys some of the aspects. However, in a dynamic environment, the Harvard concept may be challenged by a SCHUMPETERian view (1912) starting with innovation that leads a conduct of market dominance and, thus, to increasing market shares. This would suggest a reversal of the scp-hypothesis which was proposed by DEMSETZ (1973, 1974), with two results:

- Most well-known approaches to control market power would become worthless and their policies would be adverse to a dynamic economic development;
- More generally, unless it is clear whether scp or pcs is correct (for instance, compare competition in the railroad industry to that of the airline industry), no clear competition policy is possible.

Table 1. **Categorisation of regulation**

Addressee of regulation	**Measures**	**Examples**	**Instruments**
• Market structure	Market access	Right to build transportation infrastructure	Beauty contest, public monopoly
	Market organisation	Training standards	Enforcement of market shares
	Cartelisation	Forced mergers of private railways	Crisis cartels, public ownership
• Market conduct	Surveillance of pricing, product placement, rebates, etc.	Notification of public authorities for imminent changes	Antitrust; notification
	Surveillance of co-ordination among suppliers	Pricing agreements among competing modes	Antitrust
	Surveillance of obstruction	Crowding out of competitors by ex monopolist	Antitrust
• Market performance	Price regulation	Publicly administered pricing in urban mass transit	Tariffs, subsidies, price caps
	Quantity regulation	Minimal supply levels in mass transit	Supply obligations
	Quality regulation	Security standards for rolling stock	Quality standards

1.3. A filtering process for the analysis

1.3.1. The relevant market

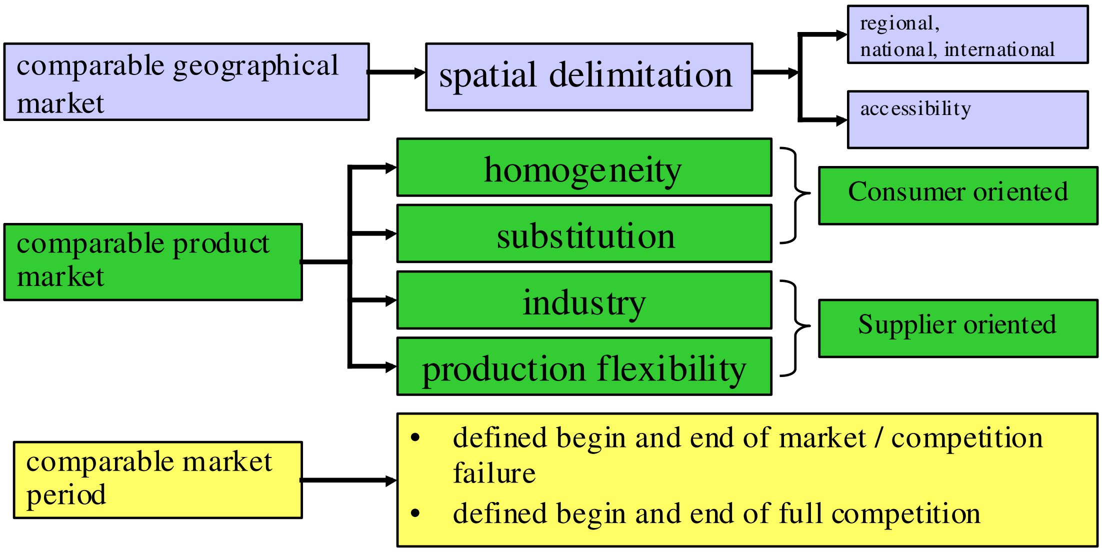
The problem of delimiting the proper market is well-known from the theory and practice of antitrust -- an area which has a direct relationship to the problem of competition and regulation. There are the following issues to be resolved:

- What is, from a purely economic point of view, the proper market delimitation? Theory would argue that, as all goods are connected on the supply side because of the scarcity of good and on the demand side because of the free choice of consumer, the restriction of the analysis to the transportation market, as it is known from many demand models, is incorrect. For instance, newly-induced traffic emerges because of the choice between a gift grandma can send to her nephew or a personal visit that has become possible because of the introduction of a high-speed link (BLUM, 1998b).

- What is, from a regulatory point of view, the proper delimitation?; this is an entirely different story, but not only a policy question because of the theoretical backbone any sensible regulation policy needs. We will see that at least those markets that are strongly connected to or dependent on the transportation market have to be accounted for.

We learn that transportation has alternatives outside the transportation market that have to be included. This implies that theory and modelling should not be restrictive if the competition-regulation antagonism extends into other markets, e.g. supply markets such as construction or markets that make use of the transportation. Figure 2 summarizes these aspects of market definition and projects the relevant market analyzed to a comparable "benchmark" market. Without such a reference -- in the extreme case, it could be a hypothetical construct -- a proper implementation of institutions is impossible. These institutions could cover the framework necessary to constitute competitive markets as constitutional rules or be part of directly intervening policies. Whereas a "real" comparative market with real comparative institutions is directly open to evaluation, a normative construct will have to be subjected to reality.

Figure 2. **The Relevant Market**



1.3.2. Empirical social science vs. *normative economics*

If we look into the multitude of good books and journal publications on transportation, we will discover two entirely different types of analyses[2]:

- Mostly verbal, very deep analyses, often underpinned with thoroughly accumulated statistics, on the problems of transportation (e.g. PUCHER and LEFÈVRE, 1996);

- Rather formal analyses with a strong technological focus on problem solution (e.g. ORTÚZAR and WILLUMSEN, 1990).

Even more interesting is the argument exchanged by the protagonists of these two groups: on the one hand, on missing empirical relevancy and, on the other hand, failing to observe the epistemological rules (MAYER, 1993). It is, in fact, a fight deeply routed in economics between the positivistic school of a descriptive and empirical social science, which has mostly emerged from traditional regional science (LÖSCH, 1962) and evolutionary economics (SCHUMPETER, 1912; V. HAYEK, 1945) on the one hand, and normative economics, which has developed from the rigour of microeconomics and which derives its axioms from postulated efficient and rational behaviour, on the other hand. We see two problems in this antagonism[3]:

- *Problem 1*: It may not be possible to discover norms without empirical research;

- *Problem 2*: Math as formal language is, because of its very rigour, indispensable for advanced modelling; however, it should not be used as an excuse for missing economic content.

We know that, in an evolutionary and dynamic environment, both approaches are necessary. Without normative transportation economics, no sound derivation of the results of certain policy instruments is possible; however, only the evolutionary process of empirical realisation will uncover all rationality traps of policies, i.e. situations in which the sum of locally efficient solutions is globally inefficient. Typically, these traps are produced either by market and competition failure or by regulators employing false instruments, which prevent a reaction through feedback systems that would adjust prices, quantities or qualities. As the competition process is not normative but truly explorative, it will uncover results that would otherwise have remained disguised. Thus, as VISCUSI, VERNON AND HARRINGTON (2000) show, a normative analysis as a positive theory (NPT) is not helpful: There is no sound link between "when should regulation occur" and "when does regulation occur", because no prediction on regulatory performance is possible. And it is not helpful, as "new NPT" proposes, to put the blame of unsatisfactory results on the shoulders of inefficient regulators. Just as the theory of market and competition failure was developed both as a normative and a positive science, the theory of bureaucracy should be accounted for to design structures that reduce mismanagement of resources.

We learn that normative theories on competitive markets and on the behaviour of regulators are both needed to properly analyse the antagonism between competition and regulation. However, they will only provide limited insights until put to the test in reality. Thus, regulatory policies must always be sufficiently open and adaptive to be able to incorporate feedbacks. Unless minimal requirements are met, the use in regulation is very limited, if not dangerous.

1.3.3. Results **vs.** *behaviour*

Transportation planning methods play an important role in transportation science; thus, this economic discipline is very tool-oriented. The major problem with respect to the issue discussed here, competition and regulation, is that the prevailing methodology is rather linear in the sense that feedback from the reaction of agents is not included. As a result, the typical generation-distribution-modal split-assignment model and the typical accident evaluation model do not account for the possibility that the outcome may fundamentally change the economic conditions and thus render the results irrelevant[4]. Thus, this technocratic method, often derived from pure engineering and OR approaches, possesses huge limits of scope, for instance:

- The constant time budget issue: the time spent for transportation is "mechanically" separated from the rest of time, which fundamentally contradicts economic laws and, for instance, modern findings on consumption (BECKER, 1965);

- The newly-induced traffic issue: most models are unable to draw new trips as substitutes for other goods from the rest of the economy.

- The risk homeostasis issue: by comparing accepted risk with target risk, individuals may change behaviour once target risk falls because of protective measures (air bag, seat belts, etc.; see BLUM, GAUDRY, 2001).

We learn that transportation models need a proper micro-foundation and must address behavioural aspects. This does not imply that all models necessarily be aggregate. But they must account for feedback from results to initial conditions.

1.4. Aim and course of the analysis

An important first step to be taken is to decide what ends an analysis of competition or regulation should have. As goals may be contradictory, the consistency of our analysis could be endangered. Here, we purely stick to economic efficiency in a market economy and neglect other supposedly important fields such as distributive equity and environmental sustainability and, of course, non-market economies.

Our approach will first discuss, in the second chapter, reasons for constitutional regulation following the old tradition that basically drove transportation into the arms of government. The pressure for deregulation rose tremendously since the 80s; it was founded on new arguments that will be discussed in the third chapter. Among the major problems is the mastering of the deregulation path, as many general examples show, not only in the so-called reform countries of the East but also prominent special transportation cases in the West, for instance, the railroad business in England. This problem will be addressed in the fourth chapter. In the fifth chapter, we will offer a synthesis of our arguments.

2. JUSTIFICATION FOR A NON-MARKET ALLOCATION IN TRANSPORTATION

2.1. The arguments and their historical background

In the following, we stress three interdependent arguments:

- Transportation and the emergence of the nation state: transportation links had historically always been important for the manifestation of central power. They played a strategic role in the nineteenth century and, for that reason, infrastructure provision came more and more under the authority of the State.

- Natural monopoly: the granting of privileges[5] for infrastructure provision was typical for the state to marry private capital with public necessities. As a compensation, the setting of prices (or more general: market conduct) was supervised and, very often the privileges were only granted on the basis of the obligation to also include or access marginal customers.

- Public good and essential services: the nation state defined certain goods, often for reasons of distributive justice, as being so important and socially valuable that a public provision seemed necessary.

The analysis of the historical background is important as it still affects present policymaking.

2.2. "Etatisme" and the role of the State in the process of industrialisation

Many large infrastructure systems in Europe that dated from the nineteenth century were privately built or built by local governments, often based on monopoly privileges granted for a certain period. Two developments enforced a stronger role of the public, especially the nation state:

- The problem of network integration[6]. The individual networks lacked integration, were often built on incompatible standards. Different modes competed in a ruinous manner: in the US, for instance, the railroad charged monopoly prices in the winter when the competing canals were frozen, to finance the dumping during summer -- which drove the canal system out of business.

- Strategic industrial and military ends. Especially the Franco-Prussian War of 1870-71 and World War I proved the importance of integrated logistics. Already before, the competition for world markets became of prominent importance, especially between the US, England and Germany.

One of the major consequences of this historic background can be seen in the inability of many states, especially those with a strong "étatistic" background, to deregulate and privatise public infrastructure or even rolling stock management -- for instance, France.

2.3. The case of the natural monopoly and economies of scope

The natural monopoly, defined by the sub-additivity of its cost function (BAUMOL *et al.,* 1982) requires regulation once average costs increase right of the average cost minimum. It is well clear that no two firms can produce at lower costs than the one firm that produces for a demand that just hits the average cost minimum. For an increasing demand, this remains true for a limited range. However, the monopoly would not be resistant against an entrant who chooses the minimal cost volume and leaves the rest of the supply unserved or to an other supplier. This "cherry picking" is privately profitable but socially undesirable and necessitates regulation.

Over and above this, sub-additivity can also be seen as a problem of differentiated output (TIROLE, 1989) as the production of two outputs, say freight and passenger transport, may be cheaper than supplying only one output.

The major problem of all regulation stems from the inability of the regulator to obtain and process the necessary information that is a prerequisite of efficient intervention[7] and the disincentive produced for potential entrants. Furthermore, there is no clear-cut linear relationship between structure and conduct, as claimed by the Harvard School (MASON, 1939; BAIN, 1968), as BLUM (2003) points out.

We learn that regulation on the market level encounters tremendous information problems of defining appropriate and efficient strategies, and is prone to false policies. As politicians are more likely to be elected for reasons of stable and reliable infrastructures and services and not for their economic efficiency and as competition in transportation markets is imperfect by nature, over-regulation is a likely outcome. However, this could be beneficial in the case were an added element of economic security, i.e. risk reduction, is put into the system. This would lead to over-investments and thus stable supply without price increases even in periods of peak demand.

2.4. The case for distributive justice and the public good

Costs of exclusion play a dominant role in the discussion of public goods. It is not true that these costs -- and the inability of excluding other users -- enforces public provision. Depending on income, certain individuals might be willing to bear these transactions costs, thus producing a club which allows the exclusion of others. In fact, making public infrastructure a club good (BUCHANAN, 1965) would improve allocation efficiency and generate income for the public. However, government may not be willing to accept this for distributive ends.

Deregulation thus always has an open strategic flank regarding the accessibility of the respective good or service to lower-income households that may make the opening of this market to competition arduous. We learn that infrastructure policy may be economically distorted by distributive considerations which, if followed, prevent the implementation of efficient policies.

3. REASONS FOR DEREGULATION: THE EMERGENCE OF NEW ARGUMENTS

3.1. The arguments and their historical background

The orientation of national economic policies towards deregulation may be traced back to the "Chicago revolution", i.e. the renaissance of free market economics, the ubiquity of most transportation infrastructures and a mounting belief that many problems in the transportation sector related more to a wrong medicine regulation -- than to a disease -- network structure, huge fixed costs, etc. Five aspects play a prominent role:

1. Problems of free market access and market power may be overcome by organising competition for the market with auctions and a franchise bidding. Bidders would be forced to accumulate all the necessary information to calculate the value -- the long-term profit -- of a limited time monopoly. The resulting rent dissipation (POSNER, 1976) would make the public participate from the rents.

2. Limited contestability of markets as a result of the sunk costs of infrastructure may partly be overcome by new organisational structures, i.e. common carriage on networks, thus enforcing a horizontal separation.

3. Network economics may produce threshold effects that further limit supply and enforce certain predatory and penetration price strategies. The resulting essential facilities may pose new problems to regulators.

4. Information asymmetries among agents explain why efficient allocations are impossible to reach under conditions that are too complex.

5. Monopolised and regulated markets may be very advantageous to suppliers that enter an unholy alliance with public authorities: rent seeking and regulatory capture would be the result.

3.2. Contestability and irreversibility

Sunk costs, i.e. costs that cannot be recovered in case of a short-term withdrawal from the market, are prominent examples for entry deterrence. Once sunk costs are zero, competitors are vulnerable to hit-and-run entry (Baumol *et al.*, 1982; Stiglitz, 1987) which allows to transfer the efficiency results from classical microeconomic analysis to this special open market. Incumbents may use sunk costs as a convincing signal to contestants not to enter or expand in a market (Dixit, 1980; Sutton, 1991), i.e. for a first mover, large fixed costs of investment may be advantageous (Milgrom, Roberts, 1982).

The (de-) regulatory answer to this concept was an inquiry into the reasons for market power (Spulber, 1989) and the discovery that the reorganisation of markets could make them more open. The separation of track and rolling stock, for instance of port facilities and ship ownership or airport facilities and airlines, was the logical answer.

We learn that infrastructure management is not a naturally competitive activity because of sunk costs. Thus, an unbundling of activities -- horizontal separation -- and the setting up of a differing institutional structure are essential.

3.3. Essential facilities and innovation

Network economies are characterised by the following properties:

- Investors have to sink large costs;

- Markets only provide room for few, very often only one or two suppliers; the importance of reaching a critical mass that makes the venture profitable is of utmost importance;

- Strong synergies between the standards set on the level of the network and those for the use of the network exist. The restrictions on the level of the network allow a wide range of applications on the level of the use of the network (BLUM and VELTINS, 2002).

A special aspect in the observation of misconduct is the concept of essential facilities, which generate monopolistic structures because of strong external economies. A plaintiff wanting to access an essential facility must prove that:

- the unit is owned by a firm or a person that, at the same time, is a monopolist;
- the request to duplicate the facility is unreasonable;
- the access is blocked by the controlling firm or individual;
- a reasonable regulation of access is possible.

Two major problems arise:

1. The creation of a network -- an essential facility -- must be pursued with great vigour in order to surpass in due time the minimal threshold that only guarantees the long-term profitability of the venture. If the necessary pricing strategies -- predatory and penetration pricing -- are prohibited by an antitrust body for reasons of misconduct, this threshold will never be overcome by any one form, and too many suppliers may coexist in the fragmented market, producing losses as prices are not sustainable, R&D will be neglected and, ultimately, the market will collapse.

2. Government intervention once the market is established may ruin the incentives to enter such a market, i.e. the innovation motive.

We learn that, as a consequence, any regulatory policy in an area of essential facilities must carefully balance the aim of controlling market power and maintaining incentives for market service and R&D.

3.4. Information asymmetry and incentives

From COASE (1937) and WILLIAMSON (1975), we know about the role transaction costs play for the emergence of markets and hierarchies. Hierarchies are the result of economies of scale that are sufficiently elevated to compensate for the large costs of control; if scale economies and control costs fall simultaneously, then a decentralised organisation becomes feasible; and, finally, the absence of scale economies with high control costs enforces atomistic arrangements (BLUM, DUDLEY, 1999). In times of low control costs because of clear-cut authorities and simple technologies, hierarchical systems are efficient -- but the technological revolution and individualism have both changed this. Thus, hierarchies are an invitation to moral hazard: cost targets are not met or cheap materials are used because information is insufficient and control is impossible, as often is the case with the construction of infrastructure.

We learn that information technology plays a dominant role for the proper institutional set-up. Thus, an increased complexity must be met by an efficient and incentive-compatible, decentralised organisational architecture of the infrastructure system.

3.5 Rent-seeking and the motivation of regulators

Rent-seeking, i.e. the aim of generating revenues in excess of the next better alternative, is nowadays considered to be one of the major motives for regulation, especially for maintaining regulation. It makes regulators better off as it generates income and proves the necessity of the existence of a regulatory bureaucracy. Regulated firms often follow a regulatory capture policy because life is easier without competition. Finally, regulators may also see their future in one of the regulated industries, i.e. there exists a transfer of personnel.

Regulators first pursue their own interest, following the theory of bureaucracy (NISKANEN, 1912). Thus, any institutional arrangement must take this motivation into account, i.e. its design must, by its very structure, limit this potential for rent extraction. Furthermore, as regulators distribute wealth among members of society (PELTZMAN, 1976), there exists an intrinsically democratic momentum that needs to be curbed.

Within the context of directly unproductive profit-seeking activities (DUP activities), we have to consider that resources are used that produce no direct socially valuable output (BHAGWATI, 1987) -- but in the long run, certain benefits may emerge, e.g. as is the case in the innovation process. In accordance with this concept, a downstream and an upstream activity (BHAGWATI, 1989) can be distinguished: the lobbying for the rents of running a regulated industry or the lobbying for regulation to improve income in productive activities, e.g. construction industries that serve the procurement with infrastructure.

We learn that deregulation is an uphill fight because of vested interests that profit from any non-competitive situation. The only solution to this problem is to move regulatory issues to a level of fundamental competition norms beyond the daily reach of politicians and bureaucrats.

4. THE CHALLENGE: MASTERING THE TRANSITION PROBLEM

4.1. Transition as a problem of institutional arrangements

The transition from a heavily regulated to a rather free, competition-oriented transportation market poses many problems that are practically insoluble, especially if the issue of proper sequencing has to be addressed. In fact, deregulation in the transportation sector was often accompanied by a further running down in the quality of infrastructure (e.g. the railroad system in England) and was only successful in areas that had already experienced some exposure to competition (e.g. shipments by truck).

The major problem may be seen in the impossibility to change from one structure to the other in a smooth way. We know from network analysis that, for an extended period, fundamental changes in network costs will have no structural effect; then, suddenly, a small change may entirely alter the existing configuration (WATTS, STROGATZ, 1999; BLUM, DUDLEY, 2002). Networks are characterised by inertia, as are the institutions that rule and regulate them. BLUM (1998a) shows that changing levels of congestion may relate to control costs and scale economies of a transportation system and thus necessitate entirely different transportation management systems: the more congestion increases, the more driving space becomes a private good and the easier and less costly it becomes to allocate individual time slots to users. Thus, a link between network structure and institutional arrangements which follow transaction cost theory has to be observed.

We learn that institutional change must take into account the general transaction cost and externality environment of the transportation system. It is not so much the transition from a centrally planned infrastructure master plan that poses problems as the central management of construction and management of infrastructure that is worrisome and that invites rent-seekers[8]. The same holds true for the use of infrastructure, once it is institutionally linked to infrastructure assets, as was historically the case in the railroad sector. It necessitates an entirely different constitutional (ethical) framework, the most important part of which is the incentive and the risk structure.

4.2. Incentive structures: do they exist in the case of horizontal separation?

4.2.1. The procurement of infrastructure with auctions

Two possibilities are open for the management of infrastructure in a world of horizontal separation, i.e. with common carriage: a hierarchical and centralised approach and a decentralised approach.

- The centralised approach reflects the old control structure. The main problem stems from the inability of monitoring agents in complex systems. It could be softened by replacing government with an association (club) of users, but this in itself may produce a formidable barrier to entry if discrimination with respect to access to the club is possible.

- The decentralised approach is based on the setting of standards for infrastructure and for interfaces. Control is decentralised, however, the maintenance of these standards (better: their quality) becomes crucial, which implies efficient "carrots and sticks".

The decentralised approach is compatible with a system of different levels of transportation infrastructure -- local, regional, national -- that are subject to monopolistic competition and which themselves may even be partitioned (BLUM, GERCEK, VIEGAS, 1992). The right to manage a certain infrastructure -- from construction and maintenance to systems control -- is auctioned following some sort of "beauty contest" that guarantees that certain minimum standards are met. By choosing a proper auction design:

- problems of a limited homogeneity of infrastructures may be resolved (local, regional, national; road, rail, canal; hubs);
- adverse selection, which is likely to occur because of information asymmetries, may be reduced;
- "winner's-curse" type problems (THALER, 1992) may be prevented.

Again, the proper definition of the relevant market becomes of utmost importance, i.e. the question of which network or part of a network constitutes a market must be resolved. One aspect for a proper identification could be the necessary level of information that has to be supplied by the system[9].

Auctions in this field would be a help to remedy the information asymmetries, because the true costs of maintaining and further developing infrastructure may be judged differently by public authorities and private bidders. Auctions are a method to close these asymmetries; usually, the initial structure would be that of correlated values; it can be assumed that, in the course of an auction, value judgements would converge and become public. Let us quickly characterise the different designs:

- *The English auction* is open ("first cry") and starts from a minimum offer set by the auctioneer. It is not well able to prevent collusion and may favour dominant incumbents with high value preferences, thus reducing the chances of newcomers.

- *A first-price-sealed-bid auction* allows an allocation according to preferences; it limits the chances of newcomers and offers security against collusion because of the sealed bids. However, information remains private if it had been private before. As a special case, *the Dutch auction* starts with a highest offer. The allocation does not follow the efficiency rule which gives the good to those with the highest preference.

- *A second-prize-sealed-bid auction*, which is comparable to the first price-sealed-bid auction, gives the good to the highest bidder, but at the second highest price. Invented by VICKREY (1961), it has the advantage of offering a dominant bid strategy based on the information deficits of the participants. However and unfortunately, it is not applicable as it contradicts the way public budgets are treated (KRÄKEL, 1993).

It is suggested to run an English auction first to improve the initially private and dispersed knowledge of the infrastructure claim; information is exchanged in each round of the bidding procedure, which guarantees that market knowledge is synthesised and common knowledge is established. In order to produce an efficient allocation, the final rounds should run as a first-price-sealed-bid auction.

4.2.2. Systems management

Systems management can be auctioned in a similar way. This is presently of special importance in the railroad business, where the dominating former monopolists discriminate against entrants via the pricing of tracks and the allocation of slots. It may even be more important to find independent solutions for systems management such as the management of slots for rail and airline traffic that open infrastructure management to the market.

4.3. The importance of a generally accepted market framework

It is of utmost importance to define the rules of the competition, i.e. establish a sound (meta) framework and an arbitration procedure for cases of conflict. Generally speaking:

- Infrastructure management and all derived transportation activities such as rail or road traffic (especially freight) should be subject to the normal antitrust legislation. The setting up of special regulatory bodies is inefficient in terms of bureaucratic sprawl and unjustified in terms of theory: each industry could rightfully point to specifics whose uniqueness justifies special and separate treatment.

- Antitrust policy must define which strategies really amount to misconduct, as the classical structure-conduct-performance approach, which is already unconvincing in general terms, may lead to wrong policy recommendations because of the network structure of the transportation system, especially in essential facilities.

- Auctions should be organised to create more knowledge on the cost of construction, maintenance and management of networks. A regulatory framework has to define right of access ("beauty contest"), periods to be served, the size of the claims (markets), the service qualities, arbitration rules and penalties.

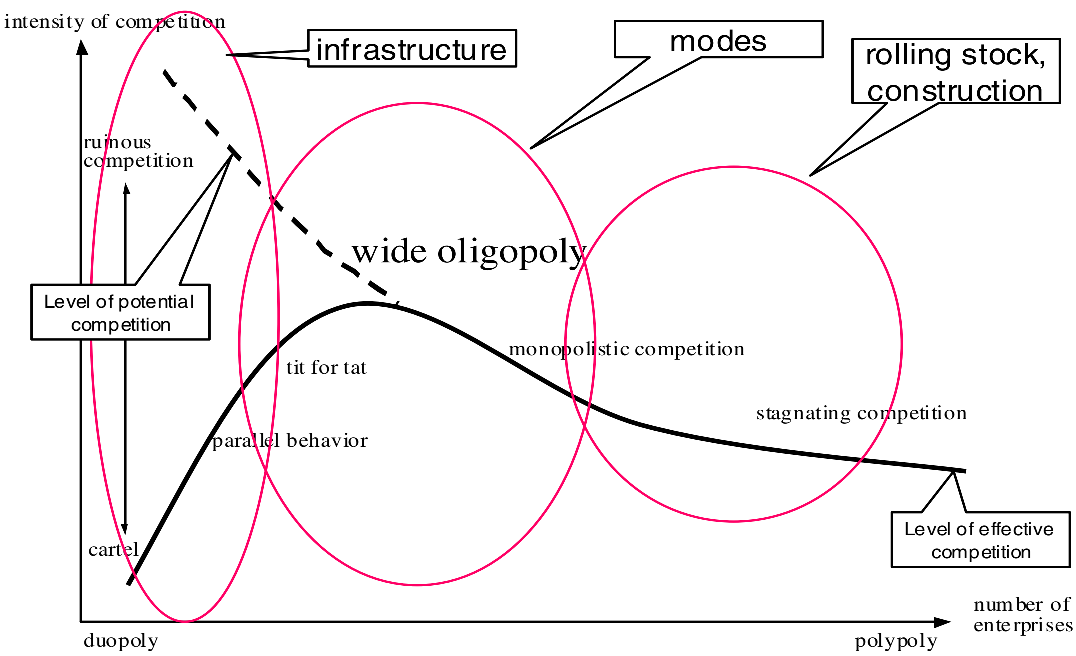
4.4. Regulation in a multi-level transportation system

The vertically interdependent transportation system -- network, modes, rolling stock -- and the supplier industries -- construction, information, car, truck, aircraft and train industries -- constitute a highly interdependent economic bundle. Decisions taken in one field will have effects -- and sometimes backfire -- in other fields. If, for instance, highly innovative services are produced for air travel that allow prices to fall considerably, this affects long-distance rail transport. Prices for trips and for rolling stock may fall in this industry, the latter suppliers perhaps finding it necessary to merge. In the air transport industry, the outcome is more open depending on the additional, newly-induced transport. Competition in networks by large oligopolists who have sunk considerable costs, especially multi-market competition, may encourage friendly behaviour or even tacit collusion. Thus, market structure will have an impact on market conduct which thus needs to be regulated. In general, this overall regulatory complexity necessitates an institutional frame which is not split up.

Figure 3 analyses the interaction of these levels from a general perspective. It is assumed that the narrowest competitive market -- the duopoly -- should potentially have the fiercest level of (cut-throat) competition. However, as entrepreneurs or managers are risk-averse, they will try to reduce such extreme competition, as the outcome could be the destruction of their own company. This implies that the potential intensity of competition[10] falls with the number of suppliers in a market, as the relative influence of individual players declines. Effective competition first rises with the number of players, because collusion is more difficult to organise, and then falls once an "optimal" structure, a wide oligopoly, according to KANTZENBACH (1967), is reached.

Typical narrow markets are network infrastructures; the market for modes is wider and that for rolling stock, aircraft and ships is very large. The three "eggs" depict the situation; regulation may be able to shift the left "infrastructure egg" to the right by deregulating and forming new markets. The right "egg of means of transport" will tend, with increased competition, to move to the left, as will the supplier industry attached to it. The same is likely for specialised construction industries.

Figure 3. **Competition in Transportation Hierarchies**



5. CONCLUSION

Competition requires that rules are set up on a meta level that govern competition in the market, and that institutions are established that regulate arbitration procedures (EUCKEN, 1952). Standards need to be defined as a prerequisite for a unified quality and service standard of networks, especially with respect to interfaces between networks of the same level, those of a different level and the interchange of different networks in hubs. Competition may be enhanced by auctions that, through their design, at the same time improve knowledge on network properties and thus make bidding more transparent, and produce efficient outcomes by extracting the rent from the winner. Interaction between the levels of competition is very complex, as each level has its own market structure, innovation intensity and, thus, intensity of competition (and propensity for collusion). All these levels interact with supply industries, such as construction, rolling stock, aircraft, etc. Increased levels of competition in one field, i.e. infrastructure, may put pressure for collusion in others, i.e. construction. Thus regulation should be institutionalised under one roof.

NOTES

1. Regulation may follow from market (better: competition) failure or be a sign of government failure, i.e. counterproductive public intervention. From a liberal perspective, the latter, taken to its extreme, constitutes the centrally planned economies. However, regulation, as we will later see, has also distorted many liberal economies.

2. Note that a journal like *Transportation Research* has split up its series according to these two lines.

3. For a good textbook which comprises both aspects, see QUINET (1998).

4. The major problem is the use of flat parameters instead of deep parameters, or the inability to grasp the potential of deep parameters; this is exactly the controversy triggered by new macroeconomics in the late 80s. It criticised, for instance, the use of savings rates or marginal propensities of consumption instead of time preferences.

5. Note that this corresponds to the fundamental idea of organising competition for a market if competition in the market seemed unfeasible (franchise bidding).

6. It is noteworthy that these integrated railroad networks often produced profits for their public owners as other efficient means of land transport at that time did not exist, which was another reasons for state control, often expropriation.

7. HAYEK (1945) argues that the public is unable to properly accumulate and process the information which is necessary for an efficient intervention. Thus, all government intervention is inefficient and may be exploited by intelligent individuals, which will ultimately lead to a rationality trap (BLUM, 2003).

8. Following the experiences of the European Investment Bank, an increase in competition lowers construction cost by at least one-third.

9. As a consequence, single airline links may not constitute a market, as even if parallel flights exist, they may not interact because of specific feeder systems.

10. The intensity of competition is given by the speed with which initial innovation rents are eroded by competitors; see KANTZENBACH (1967)

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Infrastructure Funding and Public-Private Partnerships

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SUMMARY

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INTRODUCTION

Towards the end of the twentieth century, the trend that seemed to be emerging in many countries was towards a certain distribution of roles whereby transport operations were assigned to the private sphere and infrastructure to the public sphere. Over the past ten years, however, growth in the use of PPPs has signalled a significant change which completely redefines the issue of infrastructure funding.

1. A MAJOR YET PARADOXICAL TREND

The period 1990-2000 was marked by the growing involvement of the private sector in the financing of public infrastructure investment. This trend has been systematically tracked in developing countries and transition economies by the World Bank[1]. The Bank reported 2 500 projects involving private operators during the period, of which 675 were in the transport sector. Even though transport projects remain a minority in these statistics, investment in transport infrastructure nonetheless amounted to 135 billion dollars.

This trend is also apparent in the developed economies, although initiatives in this area remain limited to a small number of toll highway concessions and to an even smaller number of rail projects that, like Eurotunnel or the Orlyval to Paris link, have not been clear-cut financial successes.

These trends obviously reflect economic rationales which, although they may sometimes prove controversial, can draw on an extensive literature.

The first rationale is that such investment offers private operators the possibility to manage the construction and operation of a given project more efficiently. This argument is based on the premise that the internal rate of return (IRR) for the project will vary according to whether the project is managed by a government administration/enterprise or by a firm that in theory accustomed to constant optimization of its operations. There are many reasons put forward to explain this difference: lower salaries in the private sector for certain types of personnel, greater flexibility, shorter lead times that will speed up the return on the investment, or even a greater capacity to withstand political demands that would entail additional costs (Dewenter and Malesta, 2001).

The second rationale is particularly important in countries with relatively little experience of toll infrastructure. J.A. Gomez-Ibanez and J.R. Meyer (1993) note that tolls are resented on infrastructure owned by the State, but are perceived as normal if the works are financed by a private enterprise. The use of private operators is therefore often the only way in which to make application of the user-pays-principle more acceptable.

The third rationale for the use of private funding is an excessive level of public debt, on the part of either the public operator likely to take charge of the project or the State itself. Even though it is underwritten by the future revenue stream, the additional debt may prove disadvantageous in terms of the adverse impact on the credit rating of a public operator or, as is more generally the case, the government's ability to control public debt[2].

Nevertheless, this development faces an obstacle, particularly in Western Europe. PPPs have started to become attractive at a time when the financial rate of return on projects is at a historic low. In the case of motorways, for example, in countries where the development of motorway networks has primarily been financed through the use of tolls, as in the case of France, Italy and Spain which between them have 28 000 km of motorway, all the major corridors have been in place for a long period of time and the networks therefore already have a high grid density. The links that still remain to be built, either to increase grid density or to open up isolated areas, will therefore carry lower volumes of traffic. While new projects may be justified in terms of their socio-economic return or their contribution to territorial development, their financial rate of return is usually far too low to ensure that they will be self-financing.

The same is true of rail networks. In the conventional rail network, the contributory capacity of carriers, and hence revenue from charges, is at best sufficient to cover the costs of network management and maintenance. In the high-speed network, the commercial success of the South-East TGV during the 1980s was such that construction of a new Paris-Lyon line and the purchase of dedicated rolling stock could be comfortably self-financed. The following projects, however, have proved to less and less financially profitable[3], to the point that there are now no longer any projects which do not require most of the investment to be covered by public funding.

Paradoxically, this situation has seen an increase in the use of PPPs for new projects. In France, for example, the most recent concessions for toll road construction have been awarded to private operators and the future international high-speed train lines (Perpignan-Figueras and Lyon-Turin) are set to follow suit.

Going beyond the case of France, the historical paradox may be stated as follows: PPP mechanisms emerge (or re-emerge) at a time when the number of financially profitable infrastructure projects seems limited or even, in certain countries, non-existent.

We shall demonstrate in the following paragraphs that this paradox may be explained by the mathematical function determining the rate of subsidy required for a PPP project with an inadequate financial rate of return.

2. DETERMINATION OF THE SUBSIDY REQUIREMENT

The aim, in short, is to determine the extent to which the use of a private partnership can reduce the burden on public finances compared with the use of a public enterprises whose debts are guaranteed by the State. To make it easier to state the question formally, we have assumed that a choice must be made between two options stylised as follows:

-- *In the "public" option*, the operator in charge of the project is assumed not to make a profit but is deemed to be able to cover his investment and operating costs, including borrowing charges, with the commercial revenue arising from either tolls paid by users or shadow tolls[4] paid by government. In the case of a loss-making project, it is assumed that government will make good the loss; in addition, the level of subsidy, determined on the basis of an ex ante cost-benefit analysis, must provide a sufficient top-up to the predicted income to allow the operator to cover all his costs.

-- *In the "private" option*, the mechanism is exactly the same except that the private operator's charges include the remuneration of his own capital and therefore allow him to make a profit.

We start out by assuming that the IRR for the project will be the same for both a public and a private operator. While we are aware that this assumption is not necessarily relevant, it will not be removed until paragraph 4.

Accordingly, it is assumed that the public operator will implement the project if the forecast IRR is capable of covering the market interest rate plus a risk premium which takes account of the uncertainties associated with any financial assessment of the project, i.e. uncertainties over costs and over traffic and revenue forecasts. To give a practical example, if the long-term rates on the financial market are 4 per cent and if the risk premium is estimated at a similar 4 per cent, then the public operator cannot commit itself unless the IRR is equal to at least 8 per cent. Any rate below that would have to be compensated by a subsidy to bring it back up to that level.

For the same project, the private operator has to cover the same assumed market rate and risk premium, to which he has to add a profit margin of, say, a further 4 per cent. This means that any IRR of less than 12 per cent will require a subsidy to ensure that the project is financially profitable.

It should be noted that the use of taxpayers' money can in theory be justified, with regard to both a public and a private operator, in terms of benefits that are unrelated to the project's balance sheet and that can be identified through calculation of the economic rate of return (ERR). The project can therefore be assessed not simply from the standpoint of the carrier and his balance sheet, but also from the standpoint of society as a whole. This assessment will address the benefits and costs to all economic agents, for example net loss of income for competing modes or variations in surpluses for users, or even the impact of the project on safety and the environment. Considerations relating to territorial development, which cannot readily be taken into account in a cost-benefit analysis, can also justify a decision to invest.

On the basis of the orders of magnitude mentioned above, we can distinguish three types of project:

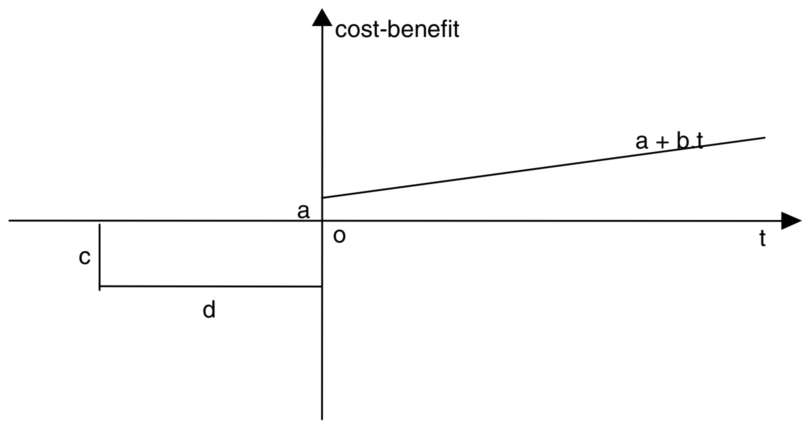
1) For projects with a high rate of return (over 12 per cent according to the suggested orders of magnitude), no public funding is required, irrespective of whether the operator is public or private;
2) For projects with a medium rate of return (between 8 per cent and 12 per cent), the public operator can invest without a subsidy, whereas the private operator needs to demand a subsidy level that will increase the project's rate of return to 12 per cent;
3) For project with a low rate of return (less than 8 per cent), a subsidy is required in both instances, but will be higher in the case of a private operator because, in this instance, the financial rate of return on the project needs to raised to a higher level.

On the basis of our chosen assumptions, and particularly that of equally efficient public and private sectors, this presentation would suggest that the "private" option can be more expensive for public finances than the "public" option. It nonetheless remains a rough approximation in that *it does not detail the relationship between the subsidy requirements and the IRR in question*. We therefore need to determine this relationship in order to gain a clear idea of the challenges for public finances and so that the assumption of equal efficiency can be subsequently set aside.

Accordingly, let us consider a typical project assumed to be completed within a period d representing a number of years during which the annual investment costs c are assumed to be constant. Once the infrastructure enters into service, the net profit earned by the operator is expressed as a and is assumed to grow at an annual rate of b.

This is a stylised, although ultimately classical[5], account of costs and benefits that is represented in Figure 1. If the infrastructure is assumed to enter into service on the date t = 0, the annual expenditure between the dates –d and 0 will be c. From the entry into service onwards, the profit earned is assumed to take the form (a+b.t).

Figure 1. **Cost-benefit function**



The internal rate of return of the project (IRR), that is to say, the discount rate that cancels its net present value (NPV), will therefore be a function of the four parameters c, d, a and b. This rate is to be compared with the rate of return that a (public or private) operator would be entitled to expect.

We shall use the following notation:

α discount rate used to calculate the net present value (NPV);
α_0 discount rate that cancels out the project's NPV, i.e. its IRR;
δ IRR top-up that the subsidy gives to the operator;
τ rate of subsidy of the investment, i.e. the part of c financed by a subsidy.

For a discount rate, α, and a discounted balance calculated from the dates –d to T, the net present value of the project may be expressed as follows:

$$\text{NVP} = \int_{-d}^{0} -\text{c.e}^{-\alpha t}.\text{dt} + \int_{0}^{T} (\text{a} + \text{b.t}).\text{e}^{-\alpha t}.\text{dt} \quad (1)$$

To simplify the calculations, we shall assume that the discounting extends to infinity, which does not affect the results we are interested in due to the low impact of the distant future and, above all, the convergence of the integral functions of equation (1). This equation therefore becomes[6]:

$$\text{NVP} = \frac{1}{\alpha}\left[\text{c}(1 - \text{e}^{\alpha d}) + \text{a} + \frac{\text{b}}{\alpha}\right] \quad (2)$$

The IRR of the project, α_0, is then expressed by:

$$\text{c}(1 - \text{e}^{-\alpha_0 d}) + \text{a} + \frac{\text{b}}{\alpha_0} = 0 \quad (3)$$

A subsidy rate, τ, lowers the annual construction cost, c, to c(1-τ) and increases the IRR α_0 to ($\alpha_0 + \delta$) so that (3) becomes:

$$(1 - \tau)\text{c}(1 - \text{e}^{(\alpha_0+\delta)d}) + \text{a} + \frac{\text{b}}{\alpha_0 + \delta} = 0 \quad (4)$$

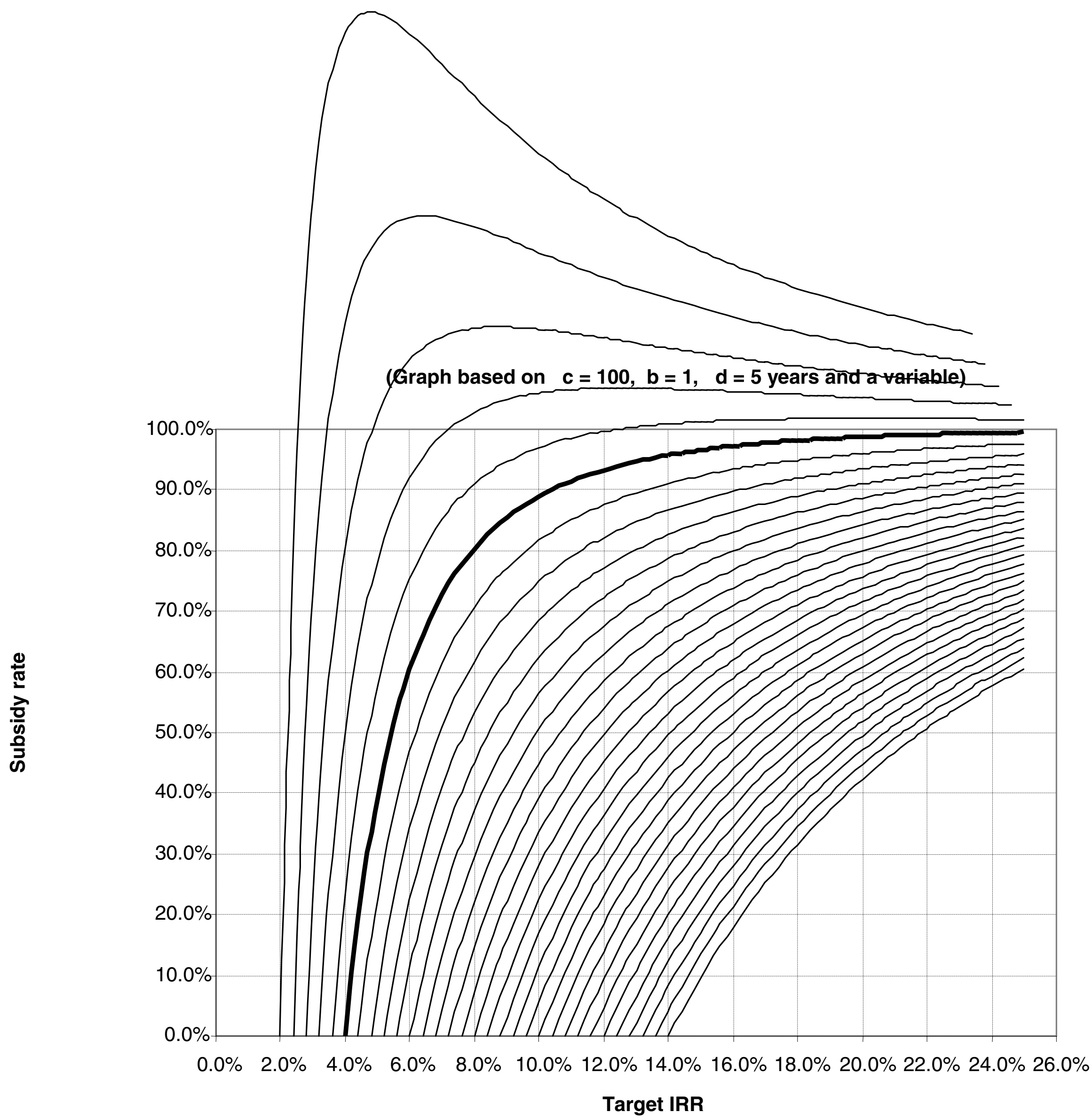
From which we can deduce the following expression of the subsidy rate:

$$\tau = 1 - \frac{\text{a}(\alpha_0 + \delta) + \text{b}}{\text{c}(\alpha_0 + \delta)(\text{e}^{(\alpha_0+\delta)d} - 1)} \quad (5)$$

The important aspect of this function with regard to the economic issues we are examining is the relationship between τ, the subsidy rate and δ, the increase in the IRR of the project to be accorded to the operator. This relationship obviously depends on the parameters c, d, a, b and, of course, α_0, characterising the economics of the project. Furthermore, these parameters are interlinked by equation (4) defining α_0, the IRR of the project. This means that if we wish to represent equation (5), some of these parameters must be fixed parameters, so that the only ones which will vary are those whose role we wish to display. To do this, we shall use a conventional graph-plotting technique.

We shall only present one of these graphs (Figure 2), as this will be sufficient for the purposes of our discussion. The annual construction cost, c, was set at a standard value of 100, and the length of the construction period was set at five years. The annual increase in net cost advantages, b, is taken as equal to 1. This is the same as varying the initial IRR of the project, α_0 (or even a, since α_0 depends solely on a, the net profit from the project at the time of entry into service). The graph below therefore represents function (5) for a series of values of α_0 between 2 per cent and 14 per cent plotted at 0.4 per cent intervals. For each of these values of α_0, read on the x-axis, each curve expresses the subsidy rate required to raise the IRR to the values indicated.

Figure 2: **Subsidy rate and improvement in IRR**



Although based on the characteristics of the cost-benefit time series of the project in question and on the specific values used for certain parameters, the shapes of these curves are of a general nature. In particular, their concavity is attributable to the properties, which can easily be demonstrated, of the second derivative of function (5). This concavity has major consequences with regard to the choice between public operator or private partnership, which we shall discuss in greater detail below. The first of these consequences, however, concerns the increasingly important role played by the rate of return as it decreases.

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3. THE TYRANNY OF THE FINANCIAL RATE OF RETURN

While it was to be expected that the subsidy requirement would increase in accordance with the internal rate of return to be offered to the operator, in addition the slope of the curve in Figure 2 is sharply decreasing. This concavity is a rather more unexpected outcome and means, in this instance, that the initial discrepancies between the initial IRR for the operation and the target IRR are extremely expensive, whereas intuitively an injection of subsidy into a project might be expected to secure a rapid increase in the rate of return for the operator. This graph therefore provides us with some highly intriguing orders of magnitude: at an initial IRR of 8 per cent, the project can be implemented by a public operator without subsidy; if the initial IRR is merely 6 per cent, a increase of 2 per cent to bring it up to the target IRR of 8 per cent would require public financing of 37 per cent of the cost of the project. This funding requirement is obviously even higher for projects whose intrinsic rate of return is even lower. If the rate of return is 4 per cent, for example, then making up the four missing percentage points would require a subsidy rate of 80 per cent!

This means that the leverage effect of public financing on the rate of investment is far greater than generally suspected due to the fact that priority may or may not be given to projects offering the best financial rate of return.

It is well known that the public financing requirement is inversely proportional to the initial rate of return. However, in addition, this public financing requirement increases very rapidly as soon as any attempt is made to increase the initial rate of return by a few percentage points. If public financing capacity is assumed to be low, financing resources may be depleted even faster if priority is given to projects with a low rate of return on the grounds that they offer a good economic rate of return.

Consequently, whereas the ERR is supposed to indicate projects with the highest social return, there is no guarantee that investing by (decreasing) order of the economic rate of return will provide a better overall social return than giving priority to projects with a high financial rate of return. In such a case, scarce public resources can be used to implement a greater number of projects and could in turn yield, on aggregate, a higher social and economic surplus than the order of magnitude suggested by the ERRs.

A number of simulations were made of investment programmes to lend some consistency to this thesis[7]. The exercise consisted in examining 17 toll motorway projects for which all the data required for the simulations were known and had been evaluated by means of standard methodology[8]. Subsidy rates were calculated by equations (4) and (5). It was initially assumed that the projects were subject to a budget constraint under which annual public financing was restricted to 150 million euros during the first year of the programme, after which the financing was assumed to increase by 2.5 per cent a year.

Four simulations are proposed which assume, respectively, that projects are implemented in order of decreasing IRR, in order of ERR, and then in two random orders (corresponding to alphabetical order and reverse alphabetical order). Each of these programmes, which were assumed to run for 15 years, clearly exhibited a social return which we chose to represent by the ratio between the socio-economic NVP (or collective surplus) generated by the programme per euro of subsidy. The results are given in the table below.

Table 1. **Social return of a programme of 17 toll motorway projects in the order in which projects were implemented**

Order in which projects are completed	**Decreasing order of IRR**	**Decreasing order of ERR**	**Alphabetical order**	**Reverse alphabetical order**
Collective surplus per euro invested	4.27	3.26	2.19	0.77
Length of network constructed	525	485	335	330

Source: Julien Brunel, LET research seminar.

It should first be noted that this table emphasizes the potentially adverse impacts, in terms of economic efficiency, of implementing programme projects in random order, in this case alphabetical and reverse alphabetical order, which is the type of order which could well result from the wielding of political influence by local dignitaries.

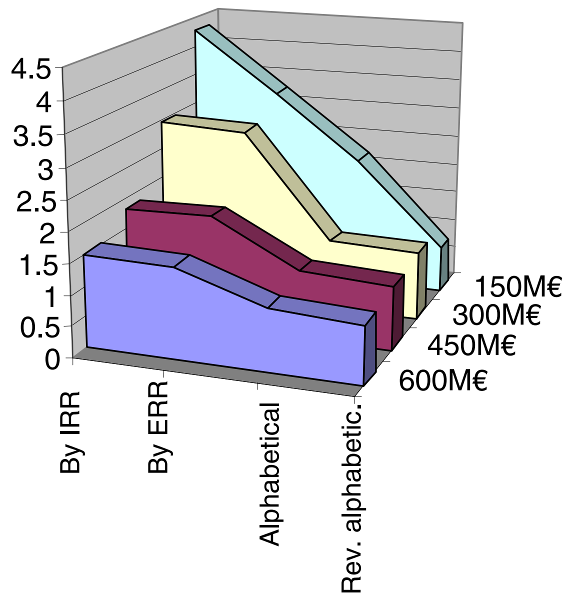
These results also hold an even more important and above all less well-known lesson, namely, that they challenge the widely accepted principle in public economics that the ERR of projects indicate those which should be undertaken first in order to generate the best social return. In this example, however, the collective surplus generated by the programme is greatest when projects are implemented in order of their IRR rather than their ERR. This is obviously attributable to a financial constraint, namely, that when public financing capacity is very low, an investment programme which takes little account of the financial profitability of the project will very quickly consume the public funds available, resulting in a slower rate of entry into service. The last line in Table 1 clearly demonstrates this "budget effect" and explains the paradox in terms of the length of network brought into service according to the order of programme implementation.

It would be fair to assume that the weaker the public financing capacity, the greater the likelihood of such a scenario arising. Taken to the extreme, it would suggest that an unlimited public funding capacity would permit all projects to be completed as soon as possible. To illustrate this trend in the budget effect, the programme simulations were diversified by relaxing the budgetary constraint (from 150 to 600 million euros). The results are given in Figure 3 below.

The data clearly show that the budget effect diminishes in direct proportion to the degree to which the public financing constraint is relaxed. Once the figure of 600 million euros has been reached, all the projects considered (i.e. 1 105 km of new motorways) can be completed within the lifetime of the programme. In this instance, the explanation of the paradox in terms of length of time before entry into service throughout the programme lifetime no longer holds, although the random orders in which projects are implemented will nonetheless generate less overall surplus, because projects with high rates of return and generating the greatest surpluses[9] were not the first to be implemented.

It is worth noting, in passing, that the light thus shed on the variable role played by the budget constraint suggests to us that, on the whole, it is perfectly logical that, historically, territorial development considerations only started to be taken into account once public finances had become sufficiently healthy. Not only is this a sign that the most urgently needed investments had been made, but in addition it is a situation in which our results show that the social loss is minimal if priority is given to investments with low rates of return.

Figure 3. **Collective surplus per euro of public expenditure**



It should be noted at this point that these simulations, suggesting that the rate of return criterion is imperative when public resources are limited, obviously depend upon the configuration of projects in alternative programmes. Each of these programmes may have intrinsic "network effects", whereby the order in which projects are implemented, for example, has an effect on the rate of return of individual projects. What we are advancing here is no more than a working hypothesis to the effect that: *an investment programme in which projects are implemented by decreasing order of their economic rate of return can have a lower overall social return than a programme which gives priority to high financial rates of return. The greater the constraint on public financing capacity, the greater the probability that such a relationship exists.*

4. THE PARADOX OF FINANCIAL PROFITABILITY AND USE OF PPPS

The concavity of the curves in Figure 2 determining the subsidy requirement also has implications with regard to the issue of PPPs. They suggest that when financial rates of return are close to the rate required by the public operator, the use of a private operator who would not be capable of significantly improving the profitability of the operation can prove costly: for an 8 per cent rate of return, a concession can be awarded to a public operator without any need for subsidy; but to increase the rate of return from 8 per cent to the 12 per cent likely to satisfy a private operator would require a public subsidy of 45 per cent of the investment cost. Within these IRR percentages, unless the public operator is vastly more efficient, it would not seem to be in the general interest to use a PPP.

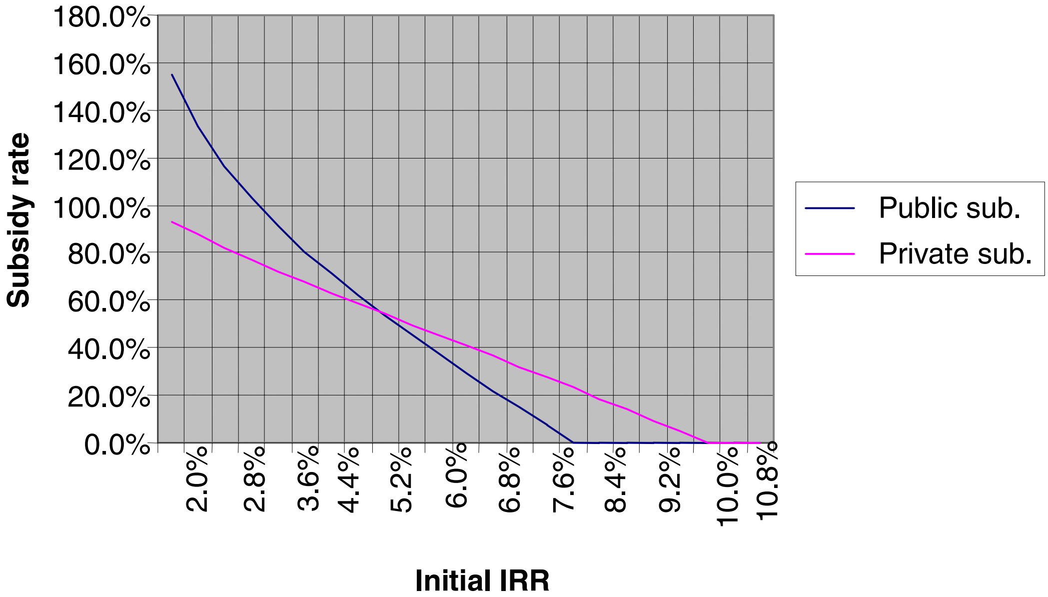
The concavity of the curves does have one major consequence, however, which is that, for projects with a low initial IRR, the switch from a public operator to a private one is of low marginal cost to public finances. In the case of an initial IRR of 4 per cent, represented by the curve highlighted in bold in our graph, the 80 per cent subsidy rate needed to achieve an 8 per cent rate of return only has to be increased to 93 per cent, i.e. a further 13 per cent, to bring the rate of return up to 12 per cent. These results illustrate what I have called the paradox of financial profitability[10], which may be stated as follows: *while the additional cost to government of making use of a private operator rather than a public operator assumed to be more efficient is higher when the profitability of a project is close to that required by the public operator, this additional cost will be lower if the initial IRR is itself low.*

This outcome bears out the equally paradoxical observation that private firms are returning to the development of major infrastructure at a time when the projects that still remain to be completed are significantly less profitable than those already completed and in service. The theoretical paradox is clearly not the sole explanation for the empirical paradox, but reveals that the process of privatisation should pose fewer financing problems for government than might be suggested by an overly cursory analysis.

It obviously remains for us to add to these considerations the dimension to the public-private partnership issue that we have until now avoided, namely, the respective efficiency of public and private enterprises. It would be fair to assume that private operators are capable of improving the internal rate of return of the operation, either though better control of operating costs [improvement of a and b in equation (4) which determines α_0], lower investment costs (lowering of c), short construction lead times (reduction of d) or a combination of these profitability factors. By way of a simple illustration, we shall assume that the initial IRR α_0 is thereby improved by 2 per cent.

Inputting variable values of this IRR α_0 in the target IRR scenario of 8 per cent for the public operator and 12 per cent for the private operator, we shall therefore obtain the subsidy values listed in Figure 4 below.

Figure 4. **Subsidy rate as a function of initial IRR α_0**
on the assumption that the private operator is the more efficient
(Target IRR of 8% for the public operator and 12% for the private operator,
Initial IRR with public operator = α_0, Initial IRR with private operator = α_0+2 %)



What is interesting about this chart is the way in which the particular configuration it represents suggests that a distinction can be made between three areas of IRR values. These three areas correspond to three relatively contrasting choice universes for the policymaker:

1) In the area to the right of the chart, for rates of return of the same order or higher than that targeted by the public operator, public finances can only lose as a result of making use of a private operator. If the loss is relatively limited, however, use of a private operator may be justified by the overall surplus in productivity from which the economy benefits as a whole, due to the difference in efficiency levels.
2. In the area to the left of the chart, for very low rates of return, the efficiency differential has a major role to play, but this then brings us closer to situations in which the social return of the project may be insufficient and may result in the project, or its consistency[11], being challenged. However, if the economic rate of return justifies undertaking the project, awarding the concession to a private operator will be less expensive for public finances.
3) Between these two areas lies a "switchover" point up to which, at a particular value[12] of α_0, the use of a private operator reduces public expenditure. In this case, the social return and public finance economics criteria are convergent and both indicate the private operator as the best collective choice.

It needs to be noted that the existence of *this switchover point is* not *a necessary outcome of the concavity of the subsidy requirement function*; there are clearly parameter values for which this function will at all points remain higher in the case of a private operator. The paradox of financial profitability therefore implies the existence of a switchover point solely for a subset of possible values for the parameters a, b, c and d, the IRR targeted by both types of operator and, of course, the efficiency differential whose level is clearly decisive.

5. CONCLUSION

We shall draw three conclusions from the above analysis, which, although equally paradoxical, are nonetheless the outcome of the inevitable consequences of the financial constraint.

1) When the public financial constraint is very high, the best social return on an investment programme is obtained by giving priority to financial profitability over social and economic profitability.
2) If private operators are no more efficient than public operators, it is always more expensive for the State to award a concession for public infrastructure to a private enterprise. However, this additional expense to public finances will be proportionately lower if the financial profitability of the project is itself low.
3) If private operators are more efficient, the additional expense entailed by their use may become a gain for public finances, and the lower the financial profitability of the project the higher the probability of such a gain being realised. It is therefore by no means inconsistent that private operators be awarded projects with very low rates of return in that such a course of action can both lower public expenditure and increase the social return of the project.

NOTES

1. World Bank PPI Project Database.

2. As is the case for the countries in the Economic and Monetary Union which, under the Maastricht Treaty, had to meet the criterion of debt convergence (no more than 60 per cent of GDP) and which remain subject to the same constraint under the Stability and Growth Pact. Independently of this particular case, any country with a high level of debt may wish to free itself of the "snowball effect" whereby public debt will increase the weight of the debt as a percentage of GDP if interest rates are higher than the nominal rate of growth..

3. The TGV Atlantique was subsidised but could just about have been able to finance itself without subsidies; the TGV Nord had a lower rate of return due to higher construction costs and links to London and Brussels that were not as efficient or that were put in place later than expected; the percentage of self-financing generated by the TGV Méditerranée was even lower, and in the case of the TGV Est will be no more than around 10 per cent

4. A shadow toll means that users are not charged for using the infrastructure and that the government pays the toll in their place. The operator is thereby encouraged to meet demand as fully as possible, provided that the shadow toll is higher than the marginal cost of usage.

5. In practice, the principles on which the calculation is based may propose demand forecasts cautiously considered to be linear or exponential forecasts to a given date after which they become linear. The net result (benefit minus cost) will then correspond to the same type of function. The following calculations can be readily transposed with an exponential function and the resultant analyses will not be radically affected.

6. Details of the calculations are given in Bonnafous (2002).

7. The following results are from simulations performed by Julien Brunel in the course of a research seminar at the LET.

8. These were competing projects for the French network proposed in the early 1990s. Most have since been completed with a low apparent subsidy from government in that the contracts were awarded to motorway construction companies able to underwrite and amortize their loans by means of net revenue from connecting roads which were generating profits. In accordance with an EU directive, the use of this instrument, known as linked financing, is no longer permitted.

9. While there is no reason why they should be proportional, the IRR and ERR are linked to the projected traffic levels in each project and are therefore correlated.

10. This paradox was first discussed in an earlier paper (Bonnafous, 1999), but was not based on the mathematical analysis subsequently presented (Bonnafous, 2001 and 2002); curves close to those in Figure 3 had been established on the basis of empirical simulations generated by the CALQUECO model (Faivre d'Arcier, Mignot, 1998).

11. In the case of motorways, for example, it might be wiser to abandon plans to build a toll motorway in favour of a dual carriageway link whose specification will be less demanding and less expensive, partly because of the fact that it is possible to use all or part of an existing road.

12. For the mathematically curious, this value for α_0 is 5.2 per cent in the simulation used.

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Competition (vs. Regulation) in Transport:
A Mixed Blessing or Utopia?

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SUMMARY

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INTRODUCTION

This paper is focused on testing the foundation and core of European transport policy for the past two decades, i.e. the issues of "liberalisation" and "free competition" in the provision and operation of transport infrastructure and services. It contends that this policy should be re-examined and re-evaluated in the light of its results and accomplishments so far, but also in the light of historical precedents which testify to the fact that the final shape of things to come is not the result of one "rigid" policy being followed over many decades, or even one specific "school" of policies, but the consequence of the application of different policies at different points in time, or perhaps the placing of different emphases on different parts of the same policy, which takes place periodically.

The basic premise is that structural changes occur in "cycles", following an almost "epochal" trend, and characterised by a prevailing "policy trend", which is defined by the political, cultural and economic environment in which transport operates and the current or foreseeable enabling technologies. The determining factor in trying to influence these "cycles" and therefore the final outcome is the ability to study and learn the lessons from past experience, i.e. the results of past policies.

As noted in an earlier ECMT paper (Giannopoulos, 2000), there are, first, *long–term cycles* which are due to major "jumps" in technology, or the political or social environment. Examples of such cycles are the coming of the railways, the emergence of private, motorised transport, the rise in commercial aviation and the recent dawn of the information age. These were primarily "technical" revolutions but there are also examples of "revolutions" in the political or socioeconomic fields, which started major long-term cycles of change. The creation of the European Economic Community and later the European Union is certainly one of them, as is the abolition of communism and the adjustment of the eastern European countries to market economies or (perhaps of a smaller magnitude) the recent wars in south-eastern Europe.

On top of these long-term cycles are superimposed identifiable, **short-term cycles**. By looking at the past thirty years, for example, one can identify:

- The 70s as the age of energy and environmental consciousness;
- The 80s as the age of regulatory reform;
- The 90s as the age of liberalisation and infrastructure issues.

The focus of the transport policies that have been applied at EU level over the last "short-term cycle", i.e. for the last 10–15 years, has been on the ***creation and proper functioning of the "internal market"***. This has been based on conditions of what can be called ***"(very) loosely controlled competition"***, in which the main preoccupation of the public sector is safety of operation and protection against unfair competition. A continuous push for privatisation in the transport sector and "protection" of the full and fair competition conditions have been the main preoccupations of the EU and national governments alike.

It is interesting to think of what the 2000s will hold, apart from being the age of the information society's technological applications. The real question, which this paper attempts to answer, is whether full and unrestricted competition and liberalisation are likely to remain at the front end of transport policy in the coming two decades, or indeed if they should... . Also whether certain actions and policies, such as those stipulated in the White Paper (EU, 2001), that aim to further enlarge the transport markets and "promote" competition, are indeed compatible with the equally recognised need to "manage" demand and increase "regulatory actions" to protect these markets and users from competition-induced oligopolies or monopolies… .

1. CHARACTERISTICS OF THE CURRENT "CYCLE"

The current policy cycle may be traced back to the first formulation of the common transport policy of the European Commission in the mid-80s. This cycle can be characterised by the general theme: **creation and proper functioning of the "internal" marke**t, but in a more detailed view contains a number of actions, primarily in the following areas:

- Strong *privatisation moves*. These moves were certainly not of uniform speed or depth in each country and this provides a measure of the difficulties and differences in appreciation of this policy. Application of the "privatisation principle" meant that for the past two decades a large number of state activities or industries, as well as ownership of public-owned enterprises and assets, were placed in the private sector -- at least in some countries …;

- *Full liberalisation* of transport service provision, which meant the lifting of most or all of the regulatory or intervening powers of the State in the functioning of the transport market. The airline industry has felt the weight of these policies the most so far, and this forms the subject of further study later on in this paper;

- Strong (and ever-increasing) *reliance on technology,* to solve or alleviate problems in all aspects of the operation of the system, from congestion reduction to operational efficiency and safety;

- *Interconnections of networks and interoperability* between transport systems within and between modes, as a "tool" to enlarge transport markets and further "protect" competition;

- *Placing the user "in the middle of it all",* as specifically pointed out in the new EU White Paper on Transport Policy (see Annex). The *user* is supposed to be the prevailing "element" of the new EU transport policy.

Overall, privatisation and liberalisation have been the two cornerstones of transport policy in the current cycle. Their application is at best characterised by mixed results so far. They have also been applied to a widely differing degree in the various countries, even among the EU Members, and there are increasing difficulties in their application. Briefly, the outlook in each sector is as follows.

In the **airline** sector, where this policy has advanced the most, the initial euphoria of airline privatisation in the UK and other central European countries has recently produced a backlash, caused by a number of spectacular failures of nationally important companies (e.g. Sabena, Swissair), as well as by the serious financial difficulties faced by almost all the other long-established carriers in the market.

For the **railways**, we are still far from seeing the policies of liberalisation-privatisation applied to a sufficiently large extent. So results are still sketchy and too early to judge, apart perhaps from the serious questions concerning safety of operation which are being asked in relation to rail operations in the only fully liberalised rail market, i.e. the UK.

In the **maritime** sector, fully liberalised markets have so far worked fairly well for the main lines and routes but serious questions and problems remain on the provision of services to small and "non-commercial" islands and/or destinations, as well as on the ports.

Finally, the **road sector,** after a very long liberalisation process, can now show results, which are at best mixed.

In the following chapter, we discuss in more detail some of the most noteworthy results of privatisation–liberalisation policies for two principal transport modes -- air and maritime.

2. REVIEW OF THE RESULTS OF PRIVATISATION AND LIBERALISATION: THE CASE OF THE AIRLINE AND MARITIME INDUSTRIES

2.1. The empirical evidence for privatisation of the transport sector

To test the hypothesis that ownership affects economic performance, Parker (1994) selected twelve relevant ownership-status groups to analyse. After testing twelve organisations in the field of transport by using several performance indicators, Parker concluded that[1]:

> *"… the results do not contradict the view that privatisation improves performance and they provide some support for the argument that political intervention in an organisation's operations damages efficiency."*

Hutchinson (1991), by applying regression analysis to the labour productivity and profitability of the aerospace and electronics and electrical industries, revealed that the empirical evidence gives mixed results as to the effects of ownership on the performance of firms in the UK. That is, public ownership was found to correspond with higher levels of growth in labour productivity, while private ownership gave rise to higher levels of profits. This result suggests that the privatisation of public enterprises is likely to have a positive effect on the profitability performance of the affected firm and a negative impact on the firm's labour productivity.

Table 1 provides a summary of the empirical evidence on the relative performance of different ownership types in several economic sectors (Song *et al.,* 2001). This table suggests an "edge" for the private sector, but the results vary considerably across the sectors and for the two transport-related sectors show clearly that no difference was observed or that the results were ambiguous at best.

Overall, the evidence does not establish the clear-cut superiority of private ownership over its public counterpart. A large number of studies, e.g. Yarrow (1986), Vickers and Yarrow (1991), Bishop and Kay (1988, 1989), Bishop and Thompson (1992), Rowthorn and Chang (1993), Parker (1994) and Jackson and

Price (1994), conclude that competitive environment, regulatory policy and organisational reforms can be more important determinants of economic performance than ownership *per se*.

Table 1. **Relative efficiency of public and private enterprises: Results of survey**

Sector	Public company more efficient	No difference or ambiguous results	Private company more efficient
Electric utilities	3	5	6
Refuse collection	1	3	5
Water supply	2	1	4
Health-related services[3]	-	1	11
Airlines	-	3	2
Railroads	-	2	-
Financial institutions	-	1	1
Fire services	-	-	1
Non-rail transit	-	-	3
Total number	6	16	33

Note: Figures in cells indicate the number of empirical results in each industry sector.
Source: Derived from Song *et al.,* 2001, originally from Bourdman and Vining (1989, p. 6).

With regard to this matter, it might be worth quoting the following two comments:

"Competition, which is conceptually distinct from ownership, can greatly improve monitoring possibilities, and hence incentives for productive efficiency… But product market competition, or even the threat of it, does not always exist… ***Regulation for competition may then be a desirable complement to privatisation*** *(Vickers and Yarrow, 1991)."*

"Economists are now generally agreed that simply changing the ownership of assets is not sufficient, and indeed is not even necessary, to improve efficiency. What is important is the threat of competition and, therefore, market condition and perhaps the regulator regime (Bishop and Thompson, 1992)."

As pointed out in Song *et al.* (2001), privatisation has proved in practice to be a controversial policy. Its supporters and critics base their cases on a mixture of ideological, political and economic arguments. The highly political nature of privatisation makes it difficult to assess the truth of many claims made for and against it. To some extent, political bargaining in the process of privatisation seems to work against the results we expect to achieve.

2.2. The empirical evidence for liberalisation–competition

A widespread view in economics is that competition forces economic entities to work harder. The inexorability of the link between competition and efficiency was found in several works. For example, Horn *et al.* (1994), Graziano and Parigi (1998), found that more competition[2] increases economic efficiency. However, as pointed out in Goss (1995):

"If they [governments] are to rely increasingly on the private sector then they will need to remember that it is competition which may make the private sector efficient; most of us have seen

too many examples of private sector inefficiency caused by a lack of competition, as well as by obsolete rules and excessive bureaucracy."

The results of the privatisation-liberalisation policies can best be considered in the air and maritime transport sectors, where most of the changes occurred in the last two decades.

In the field of **maritime transport,** the 80s and 90s saw a move towards port privatisation and liberalisation (massive in some countries like the UK, very slow in others like Greece) as well as the full liberalisation of the internal maritime sector of the EU countries. Looking at the results of several studies on both issues, we find that the "benefits" of these policies so far are difficult to identify and even more to quantify, particularly in the case of ports.

Thomas (1994a) noted in 1994 that, although it was too early to measure the commercial and operating benefits of (port) privatisation in the UK, there was considerable evidence to suggest that the programme was proving successful. He asserted that the overall evidence pointed to a significant improvement in the performance of the UK ports and to a turnaround in the industry's fortunes.

However, other studies proved the opposite. John (1995) asserted that port productivity in the UK, pre- and post-privatisation and liberalisation, had not changed significantly and that most of the changes in the UK were due to the abolition of the NDLS[3] (which took place in 1989). In terms of the turnover of major British ports from 1980 to 1990, Bassett (1993) highlights substantial growth in the ports mainly located on the east and south coasts, thanks to increasing trade with continental Europe. Liu (1995a, 1995b) argues that, after measuring the productive efficiency of major UK ports during 1985-1990, port efficiency can be explained by location differences rather than diversity in the forms of port ownership. Going further than the previous researchers, Saundry and Turnbull (1997) proclaim that the financial and economic performance of UK private ports has failed to achieve what was expected, i.e. higher efficiency relative to public ports.

Based on the UK results for port privatisation-liberalisation and taking into consideration the special characteristics of ports in general, Goss (1998) points to the need for a specifically tailored port privatisation-liberalisation policy which would include the proper elements of regulation, rather than merely directly employing policies that have been applied in other industries.

As regards the liberalisation of national maritime transport services, a number of observations can be made. According to the results from the application of the fully liberalised regimes in EU countries (EC, 1999-2001), the opening up of the "inland" maritime systems has not resulted in dramatic changes as regards the number and nationality of the operators (i.e. shipping companies) that enter the "national" markets, nor does it change dramatically the levels of service offered. Initially, there was a (rather modest) increase in the number of carriers (in Spain, for example, only about 20–30 per cent of the total number of carriers were initially from other nationalities), but this number was quite quickly reduced as several of the newcomers were soon "forced" to withdraw.

Maritime "competition" is normally focused on the main (commercial) lines, leaving aside the not-so-commercial ones, where levels of service normally drop. For example, in Greece (HIT, 2001), after the recent liberalisation of maritime transport (Law 2932 for the "freedom of offer of inland maritime transport services in Greece, and other issues"), it was found that after the first year of application of liberalisation, the number of "non-commercial" lines, i.e. those which need public service obligations subsidies, *had doubled.*

Maritime competition has so far been largely focussed on quality and other non-price "offers" to the customer (e.g. travel times and speed) rather than on tariffs, and this only for the *main lines*. The evidence from an earlier analysis of levels of service in other European maritime systems (Goulielmos, 1996) indicates that, in terms of the quality of service offered by the liberalised system (e.g. in terms of frequencies, travel times and comfort), the main "trunk" lines are likely to experience considerable improvements in quality as compared to the old system, but some island or non-commercial clusters (routes) will be served less satisfactorily. Some of these islands will have to cope with decreased levels of service compared to the "regulated" system.

In the **air transport sector,** we have the most experience of liberalisation-privatisation policy. This policy started in the US in the mid-80s and continued in Europe all through the 90s. The overall results can be summarised in the following four points:

- Fares dropped (spectacularly in some cases);
- Service provision and service levels improved on the so-called commercial routes but were reduced or cut down altogether on the non-commercial ones (and even on the not-so-commercial routes);
- Many air transport operators (in some cases, large and long-established ones) disappeared from the market or merged with others;
- Many thousands of jobs in the air transport industry were lost.

These results cannot always clearly be attributable to the privatisation-liberalisation of the market since there are other exogenous factors that may also affect the very sensitive air transport market. However, the relatively large number of mergers and of spectacular failures in this sector since the full application of the two policies should be cause for a detailed study and re-examination of all the features of these policies and the way they are applied in practice.

There are two "extreme" recent examples which show the mixed results achieved by the application of these policies so far. The first is the recent failure and disappearance of Sabena (the worst business failure in Belgian history) and Swissair, two of the largest and most well-known airlines in Europe. Their failures may be attributed to a large extent to mistakes of management (for Sabena, this is now being investigated[4] and has not yet been resolved), but the fact that these companies were already fully privatised meant that no government intervention was possible to influence at least some of the decisions nor to apply even a minimum of "public interest" intervention. On the other end of the scale, we find failed attempts to privatise and/or severe cuts in services by companies which need to stay financially viable or attractive. For example, in spite of successive attempts to privatise Olympic Airways, which date back to 1995, the Greek Government has not yet succeeded in restructuring and privatising the company. As a result, OA is permanently under the threat of default and its future is uncertain, with no credible private investors being found so far to privatise it.

The issue, therefore, of whether privatisation-liberalisation improves efficiency and service levels or not can only be answered (for the maritime and air transport sectors according to the evidence above, but for all other sectors according to evidence not mentioned in this paper) in the sense that it provides only a partial "cure" and cannot provide the "panacea" that has been expected of it. In other words, it is a "**mixed blessing**". As the results are (at best) varied, we can only hope that, in the emerging new cycle of transport policy, a "recalibration" -- a turning point -- can be reached which will allow for the continued success of past policies while preventing the excesses and failures which are being continuously revealed by current research and results evaluations.

3. THE UNSOLVABLE "HORIZONTAL" ISSUES

Transport policies in the current cycle have also been marked by a failure to solve and act on a number of well-known "horizontal" issues which have become "buzz-words" through continuous repetition and inaction. To recall some of these issues, we may mention:

3.1. The continuous push for integration

The (obvious) need to push for truly integrated transport services and systems which will take advantage of the tremendous possibilities offered by technology but also economies of scale, has been paid "lip-service" in policy statements ever since the beginning of the nineties. However, "integration" at the geographical, technological and modal levels is still far from being attained and the continuous push for more integrated systems and services which will benefit the end-user is likely to continue as a very important policy objective until the market itself makes the provision of such systems self-supporting and evident.

3.2. The continuous push for common standards

Many of the developments in telecommunications and information technology and their applications in transport have emerged in different ways, at different times and at different speeds. Thus, policies in the current cycle have aimed at helping to achieve horizontal and vertical co-operation among the various systems and technologies, with partial success so far.

3.3. Solving the institutional and legal issues

From the beginning, it became clear that the new technology-driven systems and infrastructure could not simply develop from the modernisation of existing physical infrastructure, through repair, replacement and optimisation of existing technical infrastructure systems. They also require "institutional and social" modernisation and acceptance of these systems.

Examples of such institutional and legal aspects are: questions of liability and authentication in electronic transfer of data; questions of securing privacy and accuracy in electronic booking and payment systems; protecting the commercial interests of companies dealing through the Internet as regards access to confidential information; various fair competition issues; the issues related to the internalisation of external costs, etc. These issues have been dealt with fairly vigorously all through the 90s and are likely to preoccupy policymakers until the end of this cycle.

3.4. Considering the user, and the social and behavioural issues

Transport has now been accepted as the main element of society's overall "mobility package". As such, the issues relating to social justice, equity and public acceptance have now been recognised as important and needing urgent attention. The recent EU White Paper on Transport Policy also brings to the surface, as the controlling element "of it all", the user. This I see as an important turn in the focus and orientation of transport policy, which is inevitably also going to influence and impact on the next cycle.

3.5. Consideration of the externalities

This is an item that has been "present" in transport policy considerations since the beginning of this cycle. However, as we all know, very little progress (if any) has been made and it is evident that the issue will continue to preoccupy policies and policymakers in the future.

4. THE EMERGING NEW CYCLE OF TRANSPORT POLICIES

As indicated in the previous chapters, we are now at another turn in the evolving "cycles" of transport policy in Europe, and it is of interest to see (in view of the results and experiences of the previous "cycle") what will be the priority items and issues for the future.

Let us first of all assert the obvious, i.e. that no "cataclysmic" changes or revolutionary new concepts are likely to emerge in the (at least near) future. All the "elements" of a sound and comprehensive transport policy for the coming decade are already in place. What is needed is to be able to see which are the necessary new priorities or subtle changes that will create the **prime elements** of the coming cycle of transport policy(ies) in Europe.

First, it would appear that the continuous and "extreme" application of privatisation and liberalisation policies in the transport sector will create a backlash and a reaction towards more regulation, and will meet with more and more resistance and resentment, not only from the labour force in the transport sector (which will see their jobs cut or scrapped entirely), but also from society as a whole. The latter will want to see more pronounced levels of service guarantees, i.e. that basic levels of transport service will be maintained and protected from the economic risks of full privatisation-liberalisation.

This means that, over the course of this decade, policymakers will have to sort out the degree and extent to which they wish to push the privatisation and liberalisation policies of the previous cycle. The view of this paper is that a new emphasis will have to be placed on some important issues with a view to setting some distinct limits and safeguards as to how far we can go. These issues may be identified in the following ways:

1. **Securing transport services to underprivileged and less accessible regions and sectors of the population**. This already exists in the form of "public service obligations", but these provisions will have to be given far more emphasis than today, and be further extended and strengthened in the future.

2. **Formulating and setting rules and agreed practices** in the provision of important transport services, in order to act in cases where the private sector is not interested, or fails to adequately provide such services. This is the case, for example, of services in areas where

strong seasonal variations in demand or other factors create a “grey” area of profitability-viability.

3. **Implementing extensive and continuous monitoring mechanisms** in order not only to monitor currents trends and practices but also to *foresee and prevent* situations in which the market may need adjustment.

4. **Ensuring efficient but above all *fair* implementation of the “user pays” and, where appropriate, the “user subsidises” principle.** This is also related to the need to establish and secure legislatively the correct calculation of the “true” costs of transport provision.

These are issues that will most probably dominate transport policies in the coming “new cycle” and will characterise the application of the privatisation and liberalisation principle in the field of transport in the future.

Secondly, the current cycle has established the principle that provision of more infrastructure alone does not by itself solve the problems. What is needed is to be able to influence the “user” to use the system in a way that minimises the total social cost of transport. “Placing the User in the middle of it all” as the EU’ s new White Paper on Transport Policy emphatically says, *is not enough.* What we need is a more comprehensive policy of “managing” the demand and inducing users to act in a way which is more “socially” acceptable, i.e. which helps the system collectively towards a more optimal equilibrium.

What I would therefore suggest should be done is to put more emphasis on policies and actions which:

- Make users aware of the costs and impacts of their choices. This calls for awareness campaigns in which detailed and carefully collated data are published in support of specific policies;
- Make users “**part of”** the solutions envisaged. This stems from the realisation that it is the users who can contribute considerably to the success of a new policy. A “user-acceptable” policy is also a successful policy… ;
- Provide users with all the necessary real-time information in order to enable them to make the appropriate choices.

Thirdly, the question of externalities (an overlooked issue for many years), will now have to be faced and solved. The same technological breakthroughs that are currently shaping the face of transport, and which will influence the next cycle, will soon make it possible to measure and account for these external effects. The issue will therefore be primarily a political one and policymakers must be ready to face it.

Finally, the spectacular advances in technological applications will inevitably and inextricably influence the next cycle and future transport policies. Technology will be the factor enabling almost all policies to be formulated and followed in the future. The capabilities that will emerge from convergence, i.e. the union of telecommunications, information technology, the Internet and consumer electronics, will give limitless new possibilities for applications on the European transport scene.

What should be of interest and concern for policymakers, as regards new technology applications, is:

- the possible timing and market implementation of these applications;

- the investigation and promotion of new business models which, when they emerge, will provide the necessary market conditions for success. They will however, have to be test-bedded by industry and entrepreneurs operating in the areas that provide the most fertile conditions for experimentation.

It is reasonable to assert that the remainder of this decade will see most of the initial technological applications in the transport field, which started their first stages of evolution in the 1990s, mature and achieve wider market acceptance and integration. The technological challenge for the new cycle will thus be to make sure that the so-called "intelligent" development of transport infrastructure which will be built using the "Ambient Intelligence" (AmI)[5] environment -- expected to characterise the years 2010 and beyond -- is in line with the real needs of users and society as a whole.

In a special report prepared for the IST programme of the EU (IPTS, 2001), on the prospects and potential timing for the materialisation of the AmI, it was noted that:

"… the vision of Ambient Intelligence is a strong starting point for giving direction to research and policy formulation over the coming years …. Next to technological and economic feasibility, the implications for issues such as energy, environment, social sustainability, privacy, social robustness and fault tolerance may in the longer run determine the success or failure of AmI."

The above passage from the IPTS report on AmI also indicates the particular "social" and "human" dimension that is always present in European technology development.

CONCLUSIONS AND RECOMMENDATIONS

This paper has tried to answer the basic question "Competition and Regulation: substitutes or complements?" in a way that clearly supports the second option, i.e. that the two policies should be complementary rather than either one or the other. The basic premise is that structural changes in the policies that are applied take place in "cycles", characterised by a prevailing "policy trend", the political, cultural and economic environment in which transport operates and the present or foreseeable enabling technologies.

As we are currently entering a new era in transport policy formulation (marked, *inter alia*, by the publication of the new EU White Paper on Transport Policy in 2000), considerable emphasis has been given to testing the foundation and core of European transport policy for the past two decades, i.e. the issues of "liberalisation" and "free competition". The findings point to the fact that these policies should be re-examined and redirected, in the light of their mixed results and accomplishments so far.

In view of the above, a number of recommendations can be given, based on experience so far and empirical evidence of the successes and failures of transport policies. These recommendations are intended to denote the areas where emphasis should be given in realigning the current policies:

- Formulating and establishing more distinct limits and rules to market liberalisation and privatisation in the transport sector, so as to avoid the malfunctions of the past and ensure that "public interest" is always present and duly taken into account. In this sense, public interest would at the very least mean:

- ensuring a minimum of service provision;
- monitoring and maintaining safety of operation; and
- ensuring the proper functioning of the market.

The next cycle is thus expected to re-establish the need for some sort of regulation in the transport sector.

- Putting more emphasis on and pushing for integrated and interrelated transport services. Now that the technological "enablers" are present, or expected to be in the near future, this push must regain its momentum for final and concrete results. This point also means that new emphasis must be placed on setting common technological and interoperability standards as well as other actions to ensure co-ordination and co-operation between the modes (see, for example, the next point).

- Creating pan-European institutions and organisations which will reflect the new face of multinational, intermodal, technology-driven and borderless European transport, "pan-European" covering non-EU as well as EU Members. The ECMT is particularly well placed to advise on type, structure and mandates for these new institutions and pan-European organisations.

- Establishing and implementing a commonly agreed framework for financing transport infrastructure. The balance between public and private funding and the application of the "user pays" principle is something which needs to be established once and for all. The decisions to be taken on this issue will inextricably determine the rate and extent of developing transport infrastructure for the 2010s, especially in the developing areas of eastern Europe. Of particular importance in this respect is the regulatory capacity that will be acknowledged to governments to set the right balance, and therefore clear and objective rules should be established on ways to arrive at this balance.

- Making the "user" part of the "solution" and providing him with all the necessary information to enable him to make the right decisions and choices. Policies and actions aimed at changing travel behaviour should be given priority in the coming cycle of transport policy. These should aim at making trip-makers more aware and thus complying with the existing capacities and capabilities of the system of transportation in both urban and interurban areas.

- Creating the necessary organisational and business structures which will take full advantage of the capabilities offered by the Information Society Technologies (IST) and their application in the field of transport.

It is suggested that the above points should be included in the agenda of the Ministers and administrators who formulate transport policy, as the main areas of "change" which will characterise the new cycle of European transport policy for the 2010s.

NOTES

1. Although he stated that it was dangerous to draw firm conclusions from what was clearly a small sample.

2. The definition of "more competition", can be given as: more firms and markets closer to perfect competition, i.e. (i) an increase in the number of rivals, (ii) the greater freedom of rivals, such as the freedom to enter an industry following the removal of legal monopoly rights or barriers to business, and (iii) a move away from collusion towards more independent behaviour between rivals. All three perceptions are closely interlinked.

3. The National Dock Labour Scheme (NDLS) in the UK dated back to 1947, when it was instituted in order to end the use of casual labour in the docks. It was considered by many as the main impediment to port liberalisation and competition.

4. In the case of Sabena, by a parliamentary commission of inquiry, led by Raymond Langendries.

5. Ambient Intelligence (AmI) stems from the convergence of three key technologies: Ubiquitous Computing, Ubiquitous Communication and Intelligent, User-Friendly Interfaces.

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The Benefits of Deregulation

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SUMMARY

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1. NEGLECTING THE MARKET

It is indeed appropriate that our Symposium on the Theory and Practice of Transport Economics has as its topic the issue of competition and regulation. The emphasis in recent years has shifted, in both theory and practice in transport economics, towards the market. That recent shift happened as a move away from neglect of the market in both theory and practice in transport since about 1930.

The neglect of market forces in transport, for some fifty years from 1930, might be explained by factors such as the following:-

a) The Keynesian revolution changed the emphasis to macroeconomic management and away from microeconomic issues. The State came to be seen as the key factor in resource allocation rather than the market.
b) The belief that market forces were inherently unstable and caused the 1929 crash and the 1930s slump.
c) The success of incumbent producers in the transport sector in achieving regulatory capture over governments at the expense of consumers and new market entrants. Incumbents thus acquired a property right of exemption from normal market forces.
d) The concentration of economic expertise in the public service in departments of finance and a neglect of economics in spending departments such as transport.

2. THE RETURN TO THE MARKET

As economics has evolved in the last two decades from the anti-market emphasis of the 1930s to deregulation policies, we may chart this evolution under the same headings used in the above review of neglecting the market.

The return to the market factors may be charted as follows in response to the points (a) to (d) in Chapter 1 above;

a) The Chicago revolution (as early as 1945, Milton Freedman and Simon Kuznets pointed out the cost implications for the health sector of restrictions on entry to the medical profession in the USA); the work of Alfred Kahn, an airline regulator who believed strongly in deregulation; the work of trades theorists who argued with success against tariffs and quotas and who promoted large free trade areas in Europe and North America and the successive rounds of trade liberalisation in GATT and WTO rounds; and the elegant theory of contestable markets in William Baumol's presidential address to the American Economics Association in 1980. This brought a strong emphasis that regulators should not ban new entrants or ban market exits. New entrants both discipline the incumbents and bring innovations to a sector.

b) The gains from deregulation in terms of lower prices and better services forged a link between market economists and consumer interests.

c) The property rights of incumbents to protection from new entrants were balanced by, or subordinated to, the rights of new market entrants and the rights of consumers to improved services and products.

d) Economists in the public service were more widely dispersed and came to understand the costs to the economy as a whole of lack of competition in sectors such as transport. Competition authorities became counterweights to departments which represented the incumbents in their sectors at the expense of the overall national interest.

The emphasis on potential market entry to ensure the efficiency of incumbents provokes a range of response, from invalid to important. The invalid argument is that potential new entrants have little impact compared to actual new entrants. The important argument is that contestability theory implements the welfare gains of perfect competition. The world of many buyers and many sellers, each one a price taker -- production only in response to consumer preferences and carried on by the most efficient firms -- is no longer regarded as irrelevant to the real world. Potential new entrants ensure that price tends to long-run marginal cost, that supernormal profits are not earned, that costs are minimised and that the industry always comprises the optimum number of firms. While it became more difficult to make the policy case against new entrants as the emphasis in economics shifted back to markets for many non-economists, the successes of deregulation, in gains to consumers and the wider economy, were the decisive validation of contestability theory and the policy of deregulation which it promoted.

3. THE GAINS FROM DEREGULATION

Winston (1998) estimates the improvements in consumer welfare arising from deregulation in four transport sectors in the USA, as shown in Table 1. In this section his template is applied to five Irish and European transport deregulations.

Table 1. **Consumer gains from deregulation in USA transport sector**

Industry	**Improvements**
Airlines	Average fares 33% lower in real terms since deregulation, service frequency improved significantly.
Truckload trucking	Average rates per vehicle mile have declined 75% in real terms since deregulation and, because of the emergence of "Advanced Truckload" carriers, service times have improved significantly.
Less than truckload trucking	Average rates per vehicle-mile have declined at least 35% in trucking terms since deregulation and service times have improved significantly.
Railroads	Average rates per tonne-mile have declined by more than 50% in real terms since deregulation, average transit time has fallen at least 20% and the standard deviation has fallen even more than 20%.

Source: Winston (1998).

4. AIRLINE DEREGULATION

In aviation, the Irish case study is one of the earliest in Europe and the most dramatic in terms of fare reductions and passenger volume increases. On the first day of deregulation, 23rd May 1986, the Dublin-London air fare was reduced from £208 to £94.99, a fall of 54 per cent. The present average fare per journey on Ryanair, the Irish startup airline under deregulation, is 41 euros and the airline claims reductions of as much as 85 per cent off the fares charged by traditional European national airlines.

Passenger numbers between Dublin and London in August 1987, the first full year of deregulation, were 92 per cent above those in August 1985, the last full year of prederegulation policies. Although the population of the Republic of Ireland is under 4 million, more people fly between Ireland and the United Kingdom than between the United Kingdom and France, Germany and Italy. Ryanair was the first startup airline in Europe to carry more passengers than its national airline, and its 24 million passengers in the current year place it as likely to become the largest international passenger airline in the EU in 2004, exceeding 30 million passengers and passing BA and Lufthansa, currently with 29 million passengers in Europe.

The Ryanair product is low-cost, point-to-point travel without in-flight service or seat reservation. Travel is ticketless and secondary airports are frequently used. The role of airport competition in the deregulated European aviation market is examined below. The Ryanair turnaround time is 25 minutes. It is both the market leader on Dublin-London, the busiest scheduled air route in Europe and has the best punctuality record on the route.

Staff productivity is far above the European industry average. With 24 million passengers and 2 200 staff, Ryanair has 10 900 passengers per staff member per year in contrast with 800 in member airlines of the Association of European Airlines.

The gains from European airline deregulation have been more dramatic than in the USA. European air fares before deregulation were the highest in the world, according to the annual ICAO surveys. The national airlines concentrated on hub airports, collusively decided market size in advance, charged the same fares and interchanged one another's tickets while successfully persuading governments to ban new entrants. These airlines were further weakened by strong public service trade unions and politically-appointed boards (Doganis, p. 193).

5. TRUCK DEREGULATION

Truck deregulation in the United Kingdom in 1968 caused a sharp fall in the Republic of Ireland's share of cross-border haulage. The Republic commenced deregulation of the haulage sector in 1978 and completed the process in 1988. Restrictions imposed on the sector in 1933 were designed to assist the railways but their main effect was to increase transport costs, increase own-account transport to a market share of 83 per cent in 1964 and to generate a scarcity value for haulage licences. The 1999 Road Freight Transport Survey (2002) found that the own-account share under deregulation had fallen to 27.6 per cent. The increase in hired haulage from 17 per cent to 72.4 per cent market share indicated the superior ability, by a factor of 4.3, of the deregulated over the regulated road hauliers to attract market share.

Deregulation has brought a dramatic increase in hired haulage and a decline in own-account haulage. Haulage licences no longer command a premium price. The rail freight share has declined from 16 per cent before road freight deregulation to 4 per cent in 2001 (Booz Allan Hamilton, 2003, p. 173). Rail revenues per tonne-kilometre, the only published freight rates in Ireland, have fallen by 40 per cent in the years 1980 to 2001, based on data in the railway annual reports and the analysis of Booz Allen Hamilton (p. 180).

The OECD warned in 2001 that "*while the road haulage sector has been deregulated, the report by the Department of Public Enterprise published in 1999 on the sector concentrated on the road haulage sector itself and not on the interests of consumers and the wider economy*." This raises the prospect of regulatory capture by a sector previously deregulated.

6. TAXI DEREGULATION

Taxi deregulation in 2000 was ordered by a High Court decision. Because of pressure from incumbent taxi licence-holders, new market entry was restricted from 1977. The High Court deregulated the sector because "*a quantitative restriction not alone affects the rights of citizens to work in an industry for which they may be qualified but it also manifestly affects the rights of the public to the services of taxis and, indeed, restricts the development of the taxi industry itself.*" The High Court criticised policies as "*a blanket restriction which renders nugatory applications from parties other than current taxi licence-holders*." The judgement also invoked EU law because the great majority of existing licence-holders are Irish nationals and, by confining the grant of new licences to current licence-holders, "*the Minister is effectively precluding nationals of other EU Member States from becoming the owners of new taxi licences in Ireland*."

The results of taxi deregulation have been dramatic. The number of taxis increased from 3 913 on the eve of deregulation, to 11 630 two years later, an index of 297, taking the base year as 100.

Deregulation resulted in a fall in market entry costs from £90 000 for a licence before deregulation, bought from an incumbent licence-holder, to a £5 000 fee paid to the local authority after deregulation. The Oscar Faber Report estimated that under regulation the annual capital cost to a driver of a taxi vehicle and a licence was £14 400, compared with £1 716 capital cost for the taxi vehicle only.

Deregulation also brought a sharp reduction in passenger waiting times for taxis. Research by Goodbody Economic Consultants found that, after deregulation, 48 per cent of persons had to queue for less than five minutes compared to 25 per cent before deregulation.

After midnight, waiting times in excess of thirty minutes fell from 43 per cent to 6.2 per cent. Approval for deregulation is also indicated by the finding that just under half of users stated that the service had improved since deregulation and only 5 per cent indicated that the service had deteriorated since deregulation (2002, p. i/ii).

7. AIRPORT DEREGULATION

Airport competition has been an unprecedented result of airline deregulation in Europe. The traditional European hub airport was a high-cost, non-competing facility, controlled by the host national airline through a scheduling committee which allocated slots to airlines in order of seniority, through the grandfather rights system. Without airport competition, the single European market in aviation would have afforded few market opportunities for new market entrants who would have had freedom to enter the market but would not have had access to hub airports in a sufficient number of slots to make a significant market impact.

Taking the Dublin-London route case study, it was vital for Ryanair, as the new market entrant, to have access to Luton Airport in 1986 and Stansted in 1991. Today, over half the passengers on the route use Stansted, Gatwick, Luton and London City, compared to a virtual Heathrow monopoly at the London end of the route before deregulation. Currently, Ryanair accounts for 70 per cent of all passengers at Stansted and is the market leader on the Dublin-London route, Europe's busiest. Given capacity constraints at Heathrow and the control of that capacity by incumbent airlines, the success of airline deregulation on the route could not have happened without airport competition.

New entrant airlines are price-sensitive, both in selling their products and in buying inputs. At airports they seek low costs, such as single-storey buildings, no airbridges or business lounges and fewer check-in desks, because their product is a simple point-to-point journey. They seek discounts because standard airport charges would be a much higher proportion of their low fares than of the traditional airline fares. They also seek much faster turnaround times than offered by traditional airports. They offer to airport managers a proven ability to deliver large numbers of passengers to airports which may have been neglected by traditional national airlines.

The passenger response to new airports has been overwhelmingly positive. Typically, between 25 per cent and 50 per cent of passengers travelling between main airport city pairs have been willing to transfer to low-cost airlines using minor airports, generally more distant from the city centres. Those transferring to the newer airports receive benefits such as lower fares, less walking around, less waiting time and confusion, and perhaps a more human scale of operation than at the busy hub airports. The key examples of new airport market entrants under deregulation include Stansted, Prestwick, Charleroi, Beauvais, Hahn, Torp, Skavsta, Treviso, Lubeck, Orio al Serio and Ciampino.

The new airports have also improved aircraft utilisation by reducing turnaround times to 25 minutes, enabling two extra rotations per day to be achieved compared to airports with conventional turnaround times of one hour or more. The new airports also reduce journey times by providing direct service from regional airports to major cities, rather than routing these services through hubs such as Paris, Milan and Rome.

Airports in Europe are thus becoming contestable markets with low-cost airlines providing services not supplied by the old cartel airlines in the past and passengers quite willing to transfer to new airports.

Airport competition appears sustainable because of the large number of underused airports in Europe. Fewings (1999), in a study of ten EU countries, found that there were 131 airports within a one-hour surface journey of another airport and 369 within two hours.

A further Cranfield study covered 431 airports in thirteen European countries. Many regional cities have underused airports. Many regions have airports intended to promote regional development. Demilitarisation in Europe has released for civilian use airports previously reserved for military purposes.

8. BUS DEREGULATION

Bus competition in Ireland was severely curtailed by legislation in 1932, at the behest of the railways. Seventy independent bus services were acquired in the Dublin area, 52 by compulsory and 18 by voluntary acquisition, between 1934 and 1936. In the country as a whole, there were 1 098 acquisitions, of which two-thirds were compulsory.

The parliamentary debates at the time indicated strong pressure from railway companies and their shareholders to restrict their competitors. The ban on competition was therefore a classic example of regulatory capture. There subsequently developed, however, a quasi-public interest view of restricting competition in bus transport. It was claimed that bus competition was unsafe because competing bus companies would reduce their maintenance budgets in order to compete on price, would race to bus stops to pick up more passengers and would bypass a queue of only one passenger in order to pick up more passengers at a bigger queue later. The author's checking of national newspapers, police records, health department records and the records of the Central Statistics Office show no indication of the above negative consequences of bus competition. They do not feature in the parliamentary discussions. In the absence of documentation supporting these retrospective arguments against bus competition in the years before 1932, the evidence points to regulatory capture by incumbent producers wishing to achieve a monopoly as the motivation for preventing competition in the Irish bus sector.

The ISOTOPE Report, prepared for the EU Lisbon Summit in 2000, contrasted bus costs in monopoly, competitive tendering and deregulated markets in 1996. The results, strongly supportive of deregulated markets, are shown in Table 2.

Table 2. **Comparative bus costs per vehicle-km, 1996 (euros)**

	Cost per vehicle-km	**Index**
Closed markets	3.02	100
Controlled markets	2.26	75
Deregulated markets	1.44	47

Source: ISOTOPE Report, 1997, Commission of the European Communities, COM (2000/0212).

Estimates of the possible gains from bus deregulation in Ireland include the following:

a) In 1980, Barrett compared the Dublin-Drogheda fare of 6.83 p per mile with four small, independent operators in rural areas with fares per mile of 63 per cent, 55 per cent, 57 per cent and 77 per cent of the CIE fare. The CIE fare was 69 per cent more than the average of the four private bus operators.

b) In the Nestor Bus case at the High Court in 2001, legal discovery documents indicated that the actual fare charged on the Dublin-Galway deregulated route with four competitors, 15 euros, was 69 per cent of the fare permitted by the Department of Public Enterprise for that journey length.

c) The Dublin-Cork route fare of 24 euros is 60 per cent higher than the Dublin-Galway fare but the journey length is only 19 per cent greater, leaving the fare per mile 34 per cent greater.

d) The Dublin-Limerick fare of 16.5 euros is 10 per cent more than the Dublin-Galway fare for a journey which is 9 per cent shorter. The fare per mile is thus 22 per cent greater on the Dublin-Limerick route than on Dublin-Galway.

e) The deregulation of the Dublin-Galway route increased the service frequency from one per day as a monopoly in 1980 to 26 a day in the summer of 2001, and gave direct access to Dublin Airport for the first time for passengers on the route.

Despite the fare reductions and service improvements and zero cost to the exchequer from the Dublin-Galway deregulation, the Irish Government remains opposed to bus deregulation. Table 3 lists the Irish Government's objections to bus deregulation over the period 1985-2002.

Table 3. **Irish Government's objections to bus deregulation, 1985-2002**

- Adverse quality impacts with safety implications;
- Gaps in an integrated network;
- Concentration on high demand routes;
- Benefits of CIE cross-subsidisation would be lost;
- Adverse impacts on CIE;
- Free sale of tickets would be abandoned at peak times;
- Fares might increase.

Source: Department of Communications (1985), Department of Transport (2002).

In reply, it might be stated that the accident rates in the British bus sector fell after deregulation. In a market dominated by point-to-point travel, integration is irrelevant to the majority of passengers. Integration is expensive and, in the deregulated European aviation market, passengers are increasingly deciding against it when the product is unbundled.

The assumption that deregulation leads to new entrants on trunk routes only rests on a strange view of the entrepreneur. The new entrant is assumed to be able to compete with incumbents on busy routes but to lack the entrepreneurial skills to develop other routes. The assumption contrasts with market reality in the air sector, in which Ireland has the longest experience of deregulation. There, new entrant Ryanair both dominates the busiest route, Dublin-London, and has established 124 other routes.

Cross-subsidisation is ended by deregulation because the supernormal profits will be eliminated by new entrants. The presumption that supernormal profits were used to cross-subsidise thin routes has to be tested against hypotheses that the benefits of cross-subsidisation may accrue to producers rather than consumers and may be socially regressive rather than progressive. When subsidised transport costs more than unsubsidised transport, as in Ireland, the subsidy is a producer rather than a consumer subsidy. Since the CIE subsidy is a global payment, not tied to specific social benefits but geared to meet the company's deficits, there is no measure of income distribution impacts.

These may be regressive. For example, bus services in cities are likely to absorb more subsidies in areas with high car ownership and low population density than in areas of low car ownership and high population density.

Since Ireland is now a full employment economy, with unemployment as low as 3.4 per cent in 2001, there is no case for condoning overmanning in public companies such as public transport. In countries with high unemployment, the correct policy response is to lower the shadow price of labour to reflect differences between its market price and opportunity cost. It is not a solution to overman public enterprises through protectionist policies.

The final two government arguments against bus competition in Table 3 date from 2002. The government case that output is lower in a free market than under monopoly is at odds with the normal economic model, which predicates that monopolists restrict output compared to a competitive market and, by doing so, earn supernormal profits.

The Government's case that prices would increase in a competitive market contradicts both economic theory and the Irish market experience on the deregulated Dublin-Galway bus route and the airline deregulation achievements in reducing fares.

In the Nestor Bus case, the Department of Public Enterprise is seen to place its role as the sole shareholder in CIE above its role as market regulator. The theme of regulatory capture was strengthened by the court hearings. The list of objections to bus competition in Table 3 reflects a determination to defend the present policy rather than to evaluate the benefits of bus deregulation.

9. US AND EUROPEAN DEREGULATIONS CONTRASTED

Table 1 presented the summary results by Winston of his studies of deregulation in the US. In Table 4, these savings are contrasted with the savings in European aviation and surface transport. The results of deregulation in Europe are expected to be in the following ranges.

9.1. Airlines

The US savings of 33 per cent are expected to be exceeded in Europe because:

a) European air fares had further to fall. Annual ICAO survey data showed that prior to deregulation European air fares were the highest in the world.

b) Productivity at Ryanair, the longest established and most successful European deregulated airline is higher than at Southwest, its model in the US.

c) European aviation deregulation has included airport competition. This allows new entrants to bypass congested hub airports controlled by incumbent airlines. Europe has a large enough number of airports to facilitate airport competition.

d) Passengers have responded to airport competition with over 50 per cent transferring to new airports since the Dublin-London deregulation in 1986. In more recent cases of airport competition in Sweden, Norway, Belgium, Italy, France and Germany, between a fifth and a third of market share is attained by the new airports.

e) The fare reductions from European deregulation range from 55 per cent off the Dublin-London fare to 85 per cent off the fares to Scandinavia.

9.2. Airports

The data from two surveys of airport charges in Europe in Annex 1 indicate an average aeronautical revenue of 6.78 euros at twelve main airports. While the lowest in the comparison made by Warburg Dillon Read, the Aer Rianta Dublin charge is in fact more than twice the average paid by Ryanair, as the annex also indicates. There are eight airports in the Ryanair data with charges of about a third of the average that Ryanair pays at airports, that is, a sixth of the Dublin charge of 3.4 euros, some 57 cents. This is a reduction of 92 per cent on the average charge of 6.78 euros found by Warburg Dillon Read.

There are obvious large gains to the economy when a little-used airport begins to generate large passenger numbers in conjunction with a low-cost airline. The opportunity cost of otherwise little-used runways and terminals may be close to zero. There may also be operational efficiencies in low-cost airports which compete on price rather than service and for point-to-point travel which requires fewer check-in desks and simple, single-storey buildings, in contrast to the traditional, more expensive international airport catering for full service interlining passengers.

Traditional airlines concentrated on hub airports where they interlined their services. This left large numbers of airports in Europe with little or no service and no prospect until airline deregulation. They then offered incentives to the new airlines and a whole range of new services commenced. The EU Commission is currently examining the benefits accorded by the Walloon Region to Ryanair in relation to its use of Brussels South Charleroi Airport. Following complaints from at least one other Belgian airport, the Commission wishes to establish whether EU competition policy has been infringed.

Charleroi Airport, founded in 1919, was virtually empty until 1997, with a terminal capacity of 1.8 million passengers and a runway capacity of 5 to 6 million passengers based on day use only, and 10 to 15 million passengers with twenty-four hour working. In 2002, the number of passengers at the airport was 1.5 million. All other airlines using the airport in 2001 carried only 45 000 passengers. Stansted, built to high design standards to cater for airlines experiencing overcrowding at Heathrow, failed to attract support from the latter airlines, with the result that Ryanair now accounts for 70 per cent of its passengers. Similarly, Prestwick, built to cater for Scotland's transatlantic passengers, lost that role and declined to 10 000 passengers in 1993. It is now busier than ever in its heyday and is dominated by Ryanair.

Airport and airline competition has also brought downward pressure on airport charges at the hub airports. For example, at Dublin, Aer Lingus has joined with Ryanair in its criticisms of airport charges.

The range of savings from airport deregulation appears in the range of 50 per cent to as high as 92 per cent in the Ryanair example. In some examples, airports may so badly require extra passengers that they will offer zero landing charges or subsidised landing charges.

The availability of lower airport charges depends on factors such as reducing airport costs to the level required by low-cost airlines; the number of underused airports in Europe and their attractiveness to new airlines and their passengers; and the response of the EU Commission to complaints about alleged unfair competition by these airports.

Compared to the US market, the gains from airport deregulation in Europe are expected to be greater because of the higher number of underused airports in Europe in a smaller geographical area and the proven willingness of airlines and passengers to transfer to these airports.

9.3. Taxis

The £90 000 requirement to buy a licence from an existing licence-holder was replaced by a £5 000 fee to the local authority for a taxi licence. The net saving in licence costs was therefore £85 000. The annual value of this reduction in the capital outlay required for a taxi licence depends on the interest rate used. At 5 per cent, the annual value of the saving is £4 250 and at 10 per cent, the annual value of this saving is £8 500. The estimate by Kenny and McNutt that monopoly profits of

£30 million were earned by 2 374 taxis equates to £12 636 of monopoly profit per taxi (1998, p. 5). The Oscar Faber Report, at Box 1, estimated an average income of £28 751. The economic rent element was therefore 44 per cent of receipts per taxi.

Table 4. **Estimated savings from deregulation in Irish transport sectors with US comparisons (%)**

Sector	**Irish savings**	**US savings**
Airlines	55-85%	33%
Freight	40%	75% truckload 35% sub-truckload 50% rail
Buses	53%	
Airports	Up to 92%	
Taxis	Up to 44%	

Sources: Table 1 above for US savings. Text above for Irish savings.

10. THEORY AND PRACTICE OF DEREGULATION

This paper has presented the broadly favourable practice of deregulation in the Irish experience. The airline deregulation made a huge impact on an island economy and has been successfully exported to both Britain and mainland Europe. The airline deregulation, according to the OECD, "*provided a clear demonstration of the potential benefits of competition to all consumers in Ireland, having a significant effect on public opinion*."

The prederegulation Dublin-London air fare of £208 IR is the equivalent of 501 euros in 2003. This fare, determined by the combined regulatory decisions of the Irish and UK regulatory authorities, is 6.1 times the market-determined fare of 41 euros per Ryanair passenger journey. The lesson from this experience is that airlines, especially airlines owned by governments, achieve regulatory capture over regulators at the expense of consumers and the wider public interest. Regulation also runs the risk that it can be expensive, especially if detailed appraisals and legal procedures are required.

From the perspective of economic theory, the results of the Irish deregulations come as no surprise. The works of William Baumol and Alfred Kahn in recent times have given us a sure-footed set of policy prescriptions. The intuition of Adam Smith from 1776 has stood the test of time.

"*The monopolists, by keeping the market constantly understocked, by never fully supplying the effectual demand, sell their commodities much above their natural price, and raise their emoluments, whether they consist in wages or profit, greatly above their natural rate* (The Wealth of Nations, Book 1, Chapter VII)."

ANNEX 1

Airport charges in Europe, 1998 (US$ per WLU)

Airport	Revenue
MAN	11.1
VIE	9.0
HAM	8.6
FRA	8.1
BAA	7.1
ADP	5.7
BRU	5.6
AMS	5.5
CPH	5.0
SEA	4.5
AENA	4.0
ADR	3.8
Aer Rianta	3.4

Source: Warburg Dillon Read (1999).

Ryanair charges at Dublin and UK airports (January-June 2000) (Ryanair network average = 100)

Dublin	204
Gatwick	179
Birmingham	155
Manchester	122
Luton	119
Stansted	102
Leeds/Bradford	36
Cardiff	31
Bournemouth	<30
Liverpool	<30
Bristol	<30
Prestwick	<30
Teesside	<30
Derry	<30

Source: University of Westminster (2000), Study of Ryanair Airport Charges.

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Competition and Regulation in the Public Choice Perspective

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SUMMARY

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COMPETITION AND REGULATION IN THE PUBLIC CHOICE PERSPECTIVE

It is not from the benevolence of the butcher, the brewer or the baker that we expect our dinner, but from their regard to their own interests.

People of the same trade seldom meet together, even from merriment or diversion, but the conversation ends in a conspiracy against the public, or in some contrivance to raise prices.

Adam Smith

1. A FEW THEORETICAL ASSUMPTIONS

The traditional social choice approach states that public intervention is needed to achieve social goals and to remedy market failures. Historically, this intervention has taken the form of "command and control" via direct production or, more frequently, public agencies. These agencies have, in general, performed poorly, generating "capture", "rent-seeking" and "information rents1" and have in fact given rise to both the concept and the practical policy of public regulation. Command and control regulation and market competition in turn can be seen within a subsidiarity2 context; the former is to be employed whenever the latter fails to deliver.

A possible definition of "regulation" is the following: *State intervention designed to achieve welfare goals by setting rules to motivate efficiency-oriented actors*. This definition implicitly affirms that the State has particular difficulty in reconciling welfare and efficiency objectives. Furthermore, while "efficiency-oriented actors" may well be public enterprises, this orientation is much more sharply focussed in private (profit-motivated) firms. The fact that the State faces problems in achieving efficiency seems inherently quite natural: the minimisation of labour costs is an all-important factor in efficiency, while welfare objectives are in general oriented towards enhancing employment and labour conditions. But, in addition, managerial skills are rewarded and motivated by profit rather than by the goal of mere good governance, which is the best possible outcome for public management.

But, as we have seen, state intervention is needed not only to achieve autonomous welfare goals but also when the market fails to deliver efficiency in production or allocation.

The first task, therefore, is to define the proper scope of state intervention. Within the transport sector, there exists a wide range of situations where such intervention is needed to deal with natural monopolies, externalities (both standard externalities like those related to the environment, and club externalities such as congestion), information asymmetries (related mainly to safety issues) and other "special" transport failures, like the Mohring effect or the existence of incomplete or inherently unstable markets. Income distribution may also be included within the scope of state intervention, and even if it cannot be defined as a market failure, it can be a legitimate public objective.

The decision as to which services have to be regulated (i.e. are in need of public intervention) and which can be left open to competition is theoretically straightforward: it depends on the political objectives and the technical evaluation of the efficiency of the market.

The second issue is related to the choice between command and control public policies and regulatory intervention within the definition proposed above.

As we have seen, in a classical social choice model, the public principal is assumed to be both benevolent and all-knowing. Therefore, he will be perfectly able to obtain efficient outcomes from his agents (public companies). Furthermore, his objectives will remain strictly and unwaveringly aimed at welfare maximisation. But it seems much more realistic to assume that public principals are humans and not angels.

It should be noted that this does not only apply within the radical context of a public choice setting, where the public principal is presented as a standard *Homo economicus*, maximising egoistic objectives. Even within a more relaxed setting, where the mix of egoistic and altruistic objectives may be varied and *ex-ante* basically unknown, the pure "benevolent, all-knowing prince" hypothesis deserves to be treated with some scepticism.

Nevertheless, even if regulation (as opposed to command and control) is assumed to be the dominant strategy, it has to be kept in mind that its role is limited to a well-defined subset of public objectives. *Productive* efficiency is the main objective, given that in this area the public principal faces, as we have seen, severe conflicts of interests. A second set of objectives relates to natural monopolies and other market failures of the same order (problems of efficient tariffs and access rules, etc.) which mainly generate problems of *allocation*.

But it can be argued that other public objectives cannot be kept at a strictly technical level (i.e. measured in terms of surplus losses or gains) since their nature remains mainly political -- distributive and environmental issues, for example. In these cases also, a regulatory attitude appears to be more effective than direct state intervention.

For example, if a country or region decides that transport has to be provided free of charge (while other services are deemed less socially relevant), this is a perfectly acceptable choice (but less so if these services are produced via command-and-control mechanisms instead of by competitive tendering).

In the case of an opposing political choice, if free-market provision of collective transport generates unstable results or dominant firms which are not justified by economies of scale, proper regulation is again necessary, without any foreseeable need to return to command-and-control practices.

Environmental issues, in theory, result from failures in allocation (social surplus is not maximised due to excessive consumption). Nevertheless, the same concept of externality implies a relevant distributive content (certain actors damage other actors without due compensation). Furthermore, the uncertainty involved in measuring the related economic costs leaves wide scope for political judgement.

But also in this case, the tools needed to achieve environmental improvements have to be efficient, i.e. able to minimize the social costs involved in every environmental policy. A regulatory approach appears by definition more efficient: "vouchers" and tariff techniques look far more promising than the traditional approach of imposing constraints and prohibitions.

In conclusion, while the scope for public decisionmaking remains very large within the transport sector, the scope for command-and-control practices (as an alternative to public regulation) seems to be shrinking, at least in theory.

2. THE SCOPE OF "TRADITIONAL" PLANNING IN THE TRANSPORT SECTOR

Planning instruments will remain important for dealing with transport policy issues, even accepting the increasing role of regulation. The interfaces between land use, infrastructure planning and landscape control are the main areas where a more direct public role has to remain dominant. Low-density land use has been generated by mass motorisation, via the increased accessibility of low-cost residential and commercial areas[3]. Low-density land use nevertheless makes public transport provision very costly; public transport is generally subsidized, the more so when its full cost becomes unaffordable to many users. Two external costs therefore seem to be rooted in low-density land use: public transport subsidies and the environmental costs of a more transport-intensive pattern of settlement (where individual transport becomes dominant). In theory, getting rid of subsidies to public transport, while at the same time "internalising" all the private transport externalities, will solve the problem without any explicit planning activity. But this scenario is totally unrealistic since it ignores landscape values which cannot be reasonably "priced".

Think of the worth of a Tuscany "renaissance" landscape, menaced by a dozen high-rise condominiums. Infrastructure planning has similar problems: on top of the all-important landscape issues here, natural and legal monopolies are also present, as are regional development objectives. Traditional cost-benefit analysis can play an important role in setting priorities and helping planners to take efficiency objectives into account.

Regulation has a major role to play here in optimising the construction and management process (public financing, concessionaire regimes, etc.), i.e. it is called on to play a role in a later stage of the process.

3. THE SCOPE OF MARKET COMPETITION

Market competition has to be promoted, where evidence of its failings emerges, within the "subsidiarity" approach suggested at the beginning of this report. Let us leave aside infrastructure operations, where only regulated or "Demsetz"[4] competition is possible. In the case of transport services, the different modes offer quite a mixed picture. Within the dominant land transport mode, road haulage is basically open to competition and no major problem exists, on account of the very limited economies of scale and entry barriers which characterise this mode. The same pressure of competition and the social weakness of the operators (often small self-employers) generate problems of law enforcement -- which has to be improved -- and even stricter environmental and safety standards are possible, but re-regulation of this market is out of the question.

Staying with the road mode, long- to medium-distance bus services are urgently in need of real liberalisation, at least in continental Europe. Long- to medium-distance buses compete with rail services for low-income demand; in addition, these services do not have any real impact on the environment or require any subsidies (in contrast with rail and local services). Both users and taxpayers are penalised by this "defence" of (public) rail services. This is a striking example of "non-benevolent princes", given the social characteristics of the patrons of these services. The situation, nevertheless, is now slowly improving.

Local public transport is quite a different matter. Here, the UK experience[5] is illuminating. Full liberalisation has generated problems of unstable markets, followed by spatial monopolies (which are "contestable" in theory rather than in practice). Users have been penalised as the quality of service has deteriorated. Theory supports these practical outcomes: Mohring effects[6], network effects and other types of market failures apparently are working together with some characteristics of demand (related to information, the long-term effects of decisions on residential location and car ownership, etc.), in generating severe problems.

In contrast, regulated (Demsetz) competition has delivered good results across the board (see the well-known London case). Moreover, since regulated competition via competitive tendering can fully guarantee *any* social objective (even free transport, if so decided), the widespread European resistance to opening up this type of market is another example of "non-benevolent princes" "captured" by the interests of the suppliers of the service. In due time, even some form of full liberalisation may well be introduced, subsidising users[7] instead of suppliers (this approach has not been tried in the UK) and carefully monitoring the possible undesirable consequences.

A far more uncertain picture emerges from the rail sector. Here, even within services, both economies of scale and sunk costs are present, together with the other above-mentioned problems (Mohring effects, etc.). Furthermore, rail services are closely interlinked with infrastructure operations, generating high transaction and severance costs.

The main problem here is that there is very little experience of liberalisation of rail services. The British case has taken a very peculiar form, and anyway has not been very successful, mainly due to serious mistakes made in regulating infrastructure (see point 4.2.1). On top of this, there is little overall experience of "free access" for rail services over a given network (other than a partial case in the USA).

Up to now, the European liberalisation process has been confined to limited entries in the freight sector over a time-span of more than ten years. Nevertheless, the reason for this slow pace of progress is far from technical in nature: liberalisation has been opposed with entire success by the incumbent public companies, while governments (their owners) have helped them to oppose it.

There are two main problems here: the threshold at which the separation of services from infrastructure generates excessive transaction costs and, as we have seen, the possible economies of scale, i.e. where "natural monopoly" effects can arise, even in rail services.

The existence of the first problem is evident: for a subway line, such separation does not make sense. The rolling stock is an essential asset, barely divisible from the infrastructure and lacking any secondary market. So, where does the threshold lie? Possibly in the presence of complex networks, where long-distance services are operated together with freight and local services, separation is advisable. In the case of isolated lines with limited demand, separation seems a dubious choice, and effective public regulation of monopolies can well substitute for open-access strategies.

Economies of scale differ in nature: clearly, they are present in rail services (rolling stock procurement in large quantities, maintenance, etc., are examples). But here any real experience of a free market is lacking. In this case, a well-defined "dynamic" policy can be advocated.

Whether economies of scale play a dominant role is up to the market to decide. So public regulation has to be focused on removing all possible entry barriers (technical, financial, information, etc.), even assisting the implementation of a secondary market for rolling stock (see the British "Roscoes"). If a dominant company emerges thanks to its long-term lower costs, so much the better for the users; the regulator needs only to avoid "abuses of dominant position" (e.g. a "Microsoft-on-wheels" setup). Given the current role of the dominant, inefficient public companies, there is a long way to go before a dominant rail company, based purely on its competitive merits, will emerge.

The situation in the air sector is similar. Notwithstanding widespread declarations of "liberalised markets", the sector is highly protected (and self-protecting). The slot allocation regime is based on grandfather rights, so that the most lucrative routes are plied only by incumbent companies, and intercontinental services are in general not open to external competition. In such a situation cross-subsidies become part of operators' normal practice, and so other markets are affected too[8].

The argument that large companies are suffering (even before September 11th), while new, low-cost entrants are prospering, and that therefore competition is at work, does not seem convincing. Large national companies have been suffering for many years from high costs, low productivity and unsound fares policies; the states involved are now less ready to subsidise them, and in Europe there are growing constraints on doing so. The low-cost companies are operating from minor airports and cannot attain the high-yield routes: i.e. these companies are growing *notwithstanding* the present barriers and, thanks to their low fares, are attracting lower-income travellers.

A completely reshaped air transport sector will probably emerge from a genuine liberalisation of the market. Little can be said about something for which there is no precedent, however.

Even in this sector, economies of scale, or network economies, do play a relevant role. There are also some doubts about another type of market failure which may emerge, in the form of incomplete and therefore unstable markets[9], with the consequent need for some form of public regulation. But, first of all, a genuinely competitive market has to be implemented, doing away with the "national champion" concept which has nothing to do with efficiency and the protection of users.

Sea shipping may be a case of an unstable liberalised market which has already been operating for many years. The wide fluctuations in demand, supply and prices may have generated some inefficient outcomes but, on balance, the overall benefits of this competitive setting seem to make public intervention inadvisable, except to protect the environment and perhaps the labour component (as we have seen for the road haulage sector).

Table 1. **The "subsidiarity chain" in transport policy action**

MAIN AREAS		*EXAMPLES/CURRENT ISSUES*
LIBERALISATION	***Transport services in general***	• ***Long-distance rail and bus services*** • ***Intercontinental air services***
REGULATION	• ***Infrastructure operation/building*** • ***Unstable/inexistent markets in services*** • ***Efficient charging and access rules***	• ***Public – private partnership in infrastructure*** • ***"Demsetz competition" for local transport*** • ***Competitive tendering for concessions*** • ***Slot allocation***
PLANNING ***(direct public intervention)***	• ***Infrastructure design and location*** • ***Environmental and social values*** • ***Land use/transport policies***	• ***European "Common Transport Policy", TEN, etc.*** • ***Kyoto standards*** • ***Urban sprawl containment***

4. THE SCOPE OF PUBLIC REGULATION

4.1. The issues

As we have seen, public regulation has to simulate the market pressures towards efficiency, where market competition cannot work properly. This is the case with natural monopolies, i.e. transport infrastructure. "Club" or co-operative solutions to this problem can work only in theory: transport infrastructure in fact has not only a natural monopoly but also a legal monopoly, in the sense that land use, of which it is a relevant "building brick", is planned (under a command-and-control type of public intervention, as we have seen). But its operation and physical construction can be efficiently regulated, i.e. left to efficiency-oriented (basically private) actors.

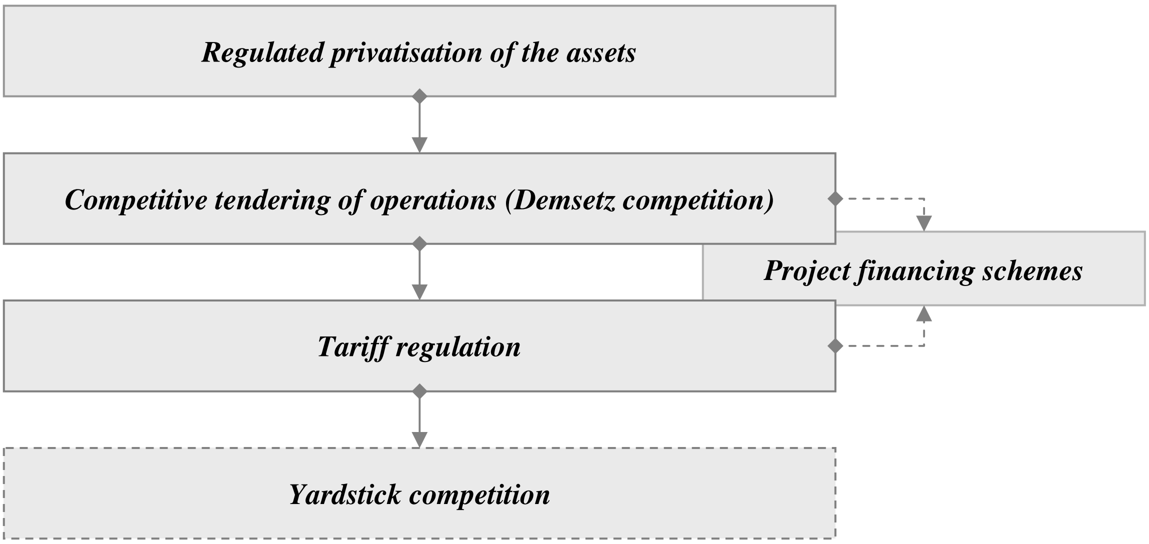
This already happens for pure construction activities, which are regulated by competitive tendering. Construction combined with operation, i.e. "project financing" practices, deserves a more in-depth analysis, as we will see later.

Establishing a proper regulatory regime for infrastructure is a highly complex task, with many aspects still to be tested and even fully understood. Furthermore, there seems to be a marked reluctance on the part of political actors[10] to move from a command-and-control regime to regulation (more proof, if still required, of the existence of the capture mechanisms highlighted in the public choice approach).

4.2. The main regulatory policies for infrastructure

There exists a wide range of regulatory policies; the main ones are summarised below in order of their degree of innovative content, i.e. of their "distance" from the *status quo*. This can also be seen as a kind of "subsidiarity chain".

Figure 1. **The "subsidiarity chain" in the regulation of transport infrastructure**



4.2.1. Privatisation of the assets

This is the British "model" for every public utility sector. The implicit risk for the public interest seems very high, given the "option value" rooted in this choice, which is basically irreversible. Capture risks remain paramount, given both the length of the public-private relationship involved (practically unlimited) and the power held by a (generally) large, private monopolist.

For railways, the UK experience has revealed severe problems, both with the control of information during the privatisation phase[11] (apparently, the real future costs of maintenance were deliberately underestimated) and with subsequent regulatory policy. The core issue is that a *private* natural monopoly is contestable as property (others may buy it), but that it keeps too much power *vis-à-vis* its public regulator, i.e. it is a policy which again assumes a "benevolent, all-knowing prince" attitude. Periodic tenders for concessions seem a far less demanding strategy, since the market pressure itself and the transparency involved in the tendering process allows a more multi-faceted control of the results.

For airports (again mainly a British experience), the problems seem less severe, even if more difficult problems of, for example, varying land-use choices, may arise in the longer term.

4.2.2. Competitive tendering for concessions ("Demsetz competition")

We have already seen the advantages of this tool for transport services. For infrastructure operations, experience is still quite limited, but in theory it looks like a "balanced" policy, since it limits the risks of "capture" involved in very long public-private relationships. For some types of infrastructure, nevertheless, the length of the concession has to be fine-tuned to the technical content of the assets involved and the consequent need to allow a sufficient "learning" time to the new-entrant company: for example, rail and air infrastructure may well need longer concessions than toll highways (which have a mainly maintenance and toll-collection content).

For infrastructure, it is quite obvious that keeping the same operator for a long time raises the risk of information asymmetries and capture phenomena.

Furthermore, long concessions for infrastructure are generally explained by the need for amortization of long-term investments. But this is a highly questionable argument for transport infrastructure: these assets (essentially civil works) have a practically infinite life and therefore there is no physical amortization at play, only financial amortization (if applicable), and sound contractual constraints on maintenance duties seem to be a sufficient controlling instrument. Therefore, the length of concessions can be shortened, setting proper rules for the incumbents and for new entrants in the case of a change of concessionaire.

4.2.3. Building and operating concessions ("project financing")

When a new investment is the main object of a concession, generally the process covers a very lengthy concession period, it being assumed that the capital invested has to be recovered completely. This has the well-known advantage of combining responsibility for construction, operating and maintenance with the consequent overall optimisation of the entire "system". But we have already seen the risks of long concessions[12], and the weak rationale for linking the assumed physical to the financial amortization. Therefore, this approach has to be considered with prudence, taking into account its capacity for disguising public expenditure as private, via over-generous risk guarantees in favour of private investors, which transform those investments into risk-free loans. This was the case for the Italian high-speed rail lines, but many other projects have similar characteristics, not immediately identifiable, and the possibility of reopening negotiations in the long run, far from a competitive context is ever present.

4.2.4. Tariff regulation

Tariff regulation is required basically in two cases: a) in the case of transport services, when there are distributive, congestion or environmental issues involved; b) in the case of infrastructure, when productive efficiency has to be achieved without competitive tendering (i.e. when the provider of the service cannot be changed) and in the extreme case of privatisation of the main assets. "Price-capping" is the main technical tool used in these cases. Of course, there are possible "mixed" or overlapping situations.

We will examine in more detail the uncertainty involved in transport tariff regulation, both within transport services (see point 4.3) and for infrastructure (4.3.2).

4.2.5. Yardstick competition

This strategy (known also as a "tournament") is a form of "simulated market" but seems by far the most conservative policy, and remains quite close to "command and control". The regulator confines itself to comparing the results of different public companies in the same field (for example, airports or railways), setting "prizes" and "punishments" according to their performance. So far, so good. The problem is that this approach is basically akin to a sound "command and control" policy, where many operators are at play.

The drawbacks related to insufficient incentives, the mixture of efficiency and welfare objectives, "capture", etc., which gave rise to regulatory evolution, remain intact. Regulators and regulated parties are not sufficiently separated and juxtaposed. Even in the case of the Japanese railway reform (perhaps the largest example of a form of yardstick competition in the transportation sector), the model was adjusted in order to guarantee a high level of autonomy of the different local companies from the central regulator, with the explicit aim of minimising the risks of "capture" mechanisms[13].

In fact, the "regionalisation" process itself can be seen as a form of yardstick competition, where even within a "command-and-control" structure, each region becomes a "residual claimant" on the resources involved and may well compare its performance with that of other regions. This is what happened in Germany with the decentralisation of local rail services, where the DB national rail company had to cope with the pressure of budget-minded regions, and had to provide more efficient services; this decentralisation eventually set in motion real competition with the arrival of "new entrants", both public and private.

4.3. A few examples of regulatory problems within the transport sector

4.3.1. Congestion charges and access rationing

Congestion implies a mismatching of transport infrastructure demand and supply (access rationing is basically the same issue). Two main problems can be underlined here. The first one is related to "project financing".

The rationale for charging the construction costs of a natural monopoly to users has to be related to congestion charges, otherwise such charges generate a well-known welfare "dead-weight loss". Congestion charges are, by definition, efficient and therefore the related revenues can be used efficiently (and equitably -- see the "club externality" problem[14]) for financing infrastructure costs. But infrastructure "suffers" from indivisibilities, so in general it is underutilised at the beginning of its technical life and congested toward the end. But financial outgoings evolve in the opposite direction: they are maximal at the beginning and thereafter tend to decline.

This is another reason for adopting a prudent attitude towards "project financing" strategies: "old-fashioned" competitive tendering for construction contracts, followed by a judicious periodic tendering of concessions for operations and maintenance, may often be a more prudent choice, where even user charges can be kept under better control.

A second issue related to congestion is the (highly questionable) difference between the road mode and "controlled access" modes, i.e. railways, airports and ports.

Road congestion has to be regulated via "social surplus-maximising" charges which exclude less willing-to-pay traffic. It is assumed that, since congestion is non-existent (or minimal) in "controlled access" modes, they do not need congestion charging . This would be true if, and only if, the "excess demand" in these modes were also excluded by a traffic controller with a surplus-maximising rationale. But this is not the case: railway, airport and ATC capacity is controlled basically by grandfather rights or similar, inefficient criteria.

Auctioning capacity, or setting a rationing access tariff, are the only two possible surplus-maximising practices (which are exactly in line with a "road pricing" approach). These two alternatives differ only from a distributive point of view (the first one "creams off" all the social surplus from users, to the benefit of the infrastructure operator, while the second one leaves part of it to users).

4.3.2. The "minimal efficient dimension" issue

The regulation of "network infrastructure" (in transport, toll highways and rail tracks) poses the problem of the minimum efficient dimension. This arises because there is no market pressure to determine the efficient dimensions of such networks. Furthermore, the issue is important because the "efficient dimension" also has to be "minimal" in order to avoid excessive power of the regulated against the regulator (again, due to "capture" risks). It is a problem of balancing the possible economies of scale against "excessive power". (This "excessive power" in turn may well have a negative impact on the proper working of a "Demsetz market" in concessions, and not only on the regulator.)

Toll highway networks probably have very limited economies of scale, which are related only to the dimension of maintenance centres. Therefore, it is reasonable to split up the concessions into subsets of a few hundred kilometres. (Toll collection is becoming highly computerized, and several concessionaires already have automated toll collection systems which operate smoothly).

For rail networks, the picture is more complicated. Nevertheless, it is extremely unlikely that economies of scale coincide exactly with national borders (therefore confirming the "efficiency" of the present dimensions[15]). The Japanese experience tends to show that minimal efficient dimensions are probably closer to a "regional" scale (for large counties at least), depending on the number of long-distance lines which have to be "cut" in separating networks (generally few, compared to the local lines which remain within the region).

In this case, too, there is a long way to go -- at least in Europe, where national considerations continue to prevail over economic good sense.

4.3.3. Financial issues

The established rule of setting a proper rate of return for regulated companies is based on the calculation of the WACC (Weighted Average Cost of Capital) index. This index is needed only when investments are explicitly financed through tariffs, and not left within the price-cap mechanism.

But the WACC definition needs to be used carefully: it is necessary to take into account the specific level of risk of every regulated sector; for transport infrastructure, if the commercial risk is removed from the concessionaire by the public regulator, the WACC has to be lowered in consequence. Furthermore, it is advisable to define a target leverage level in order to avoid "opportunistic" composition of capital by the concessionaires. Finally, concessionaires which are floated (i.e. whose value is left to the "judgement" of the stock market) need to be overseen closely by the regulator, which must be extremely transparent and prudent in all its regulatory actions, especially as far as the "X" parameter of the price-cap formula is concerned.

Also, the inflation index in the price cap formula has to be handled with care: there is a tendency to curb its level by referring to “projected” inflation instead of adjusting it to the real rate of inflation. It is the wrong tool: inflation is an exogenous factor for the regulated company, and efficiency goals have to be addressed adjusting the “X” parameter.

4.3.4. The price-cap problem: patterns and levels of efficient costs

The price-cap mechanism, although by far the best-known tool for regulating tariffs for infrastructure concessions[16], poses several problems, a few of which are summarised here: the first one is related to the type of risk which is left to the regulated companies. In the case of transport infrastructure, it seems reasonable to leave them only (or almost only) industrial risks and not commercial ones (i.e. those related to the level of demand).

The basic rationale for leaving them the "sectoral" risks is linked to the exogenous nature of variations in transport demand, which basically depend on the overall growth of a country’s economy and national and regional transport policies (competing infrastructures and their tariffs, gasoline prices, liberalisation of services, etc.). In fact, if a company faces a risk which is outside its control, it has to behave “on the safe side”, maximising the relevant prices, etc. It is the same rationale which allows the regulated company to offset inflation in full (under the price-cap formula).

A second problem is related to the “efficiency” parameter in the price-cap formula. Its definition requires accurate benchmarking (even if efficient costs can be known only via a “learning by doing” process). In the case of transport infrastructure concessions, this is far from easy, given the absolute dominance of monopolistic, inefficient “examples” from which the relevant data have to be derived. Even the speed of efficiency (implicit in the X value) has to be estimated taking into account the specific constraints faced by each sector (labour contracts, etc.). Obviously, the “starting base” set every five years (the “regulatory lag”) when the price-cap is recalculated, comprises the costs incurred by the concessionaire and not its revenues [the objective of the mechanism is to make users pay for efficient costs and for them only, allowing for an incentive factor, linked to any extra profits earned during each five-year period (the “regulatory lag”) by the concessionaire, thanks to its efficiency.]

Strange as it may seem, this obvious statement does not hold in important cases; for example, in Italy, large and undue extra profits are made by highway concessionaires, who prove able to “capture” the regulator (also thanks to the “far from minimal” dimensions of the concessionaires).

4.3.5. The regulation of investments

Price-caps or competitive tendering, in theory, “automatically” guarantee the efficiency of the investments: only investments capable of generating net profits will be implemented by the regulated company.

As we have already seen, the problem here is that the bulk of transport investment is *not* profitable in financial terms, and is decided by the public authorities on social grounds. As far as this decision remains outside the remit of the concessionaire, it is perfectly correct to finance it with “public” funds, either in the form of direct transfers or a tariff increase on the whole network. The former solution is generally adopted for railways (and ports) and the latter for highways and airports.

But investment guarantees for profit-oriented projects generate the well-known Averch-Johnson phenomenon[17], i.e. pressure to maximise the level of “guaranteed” investments. In fact, given a "normal" level of risk and a corresponding "normal" level of profits, the *total amount* of profits of the regulated company is also maximised. Therefore, special care has to be paid to evaluating the social benefits of the proposed investments, and to their design and costs, even if competitive tendering is made mandatory (which is not always the case, and is anyway subject to "information asymmetries" on the part of the regulator).

4.3.6. Safety and quality regulation

It is well known that a monopolist has to be regulated not only with regard to the tariffs it charges (and access rules), but also with regard to the quality of services it provides, since there are no specific incentives to improve quality (and sometimes safety) such as those provided by market pressures.

The problem here is technically quite complex, in contrast with price regulation which, at least in conceptual terms, is rather simple. Efficient, safe transport services require not only specific experience and benchmarking but also a direct and active role by the users who are the main stakeholders and generally those who pay for the services (the "residual claimants"). Though up to now there has been little experience of such involvement by users, it needs to be developed urgently. Setting "abstract" quality standards is useful but not sufficient; furthermore, it leaves open the question of how to measure safety and quality "objectively" in case of disagreement between the regulator (and the stakeholders) and the regulated companies, with a view to minimising litigation costs. Finally, the need to ensure a proper balance between mandatory standards and incentives is another problem that deserves special consideration, while safety standards are obviously paramount.

4.3.7. The problem of the number of "tills"

This problem is well known in airport regulation but also exists with railways and highway infrastructure (the main difference being that there is hardly any proper regulatory experience in the latter cases). The nub of the problem can be summarised as follows: how complex should regulatory action be? There are, in fact, trade-offs: fine-tuned regulation may be more efficient in theory but it is less transparent and leaves less scope to the regulated companies to develop general optimisation strategies. Let us start with toll highway concessions. A double-till is already present when investments are decided and financed on top of the regulation of tariffs.

If tariff regulation also takes into account congestion and environmental impacts, we can speak of a "triple till", i.e. three different "tools" of public intervention.

For airports, the dominant theoretical approach is known as "double till": tariffs are price-capped on the *air* side (landing fees, etc.), while on the *land* side (commercial activities, parking charges, etc.), since it is technically almost impossible to regulate every single price, any monopolistic rents are "skimmed" via specific royalties. (Alternatively, periodic tendering with pre-set air tariffs achieves the same "skimming" effects). The single-till approach used for London airports limits price-capping on the air side but it generates a distorted price signal; since the price-cap periodically eliminates the rents from overall revenues, the tariffs on the air side tend to decline sharply as the rents on the land side rise. Therefore, the more traffic (i.e. congestion) an airport generates, the lower its air tariffs.

Within the rail sector, the alternative is between a double or a triple-till approach[18]: the double-till approach limits state intervention to services (with subsidies for social or environmental goals) and investments (again with subsidies). This approach implies that infrastructure is not subsidised, i.e. the full costs are charged to users (via track-use tariffs). Since infrastructure is a natural monopoly with sharply increasing returns to scale, full-cost charging (in contrast with the marginal cost suggested by the economic theory), generates welfare losses. (In turn, track-use tariffs have to be capped, or the concessions have to be tendered periodically in order to obtain incentive effects on efficiency). Obviously, the triple-till approach requires specific subsidies for infrastructure operations as well. Furthermore, subsidies to infrastructure operations have to be capped (with a specific "subsidy cap") if the concession is not periodically tendered out.

The trade-offs involved here are quite evident. Given the complexity of the sector, a triple-till approach is liable to render "opaque" the public objectives embedded in the sector. What is the final cost to the public purse of the entire system? Furthermore, in the "double till" approach, the subsidies given to rail services may well include those that in the "triple till" case are earmarked for infrastructure operations. The only remaining advantage of the "triple till" is its effect on competition in rail services: given the high entry barriers which exist in the sector, low track-use tariffs (i.e. priced at marginal cost) are definitely more pro-competition (without the need for explicit subsidies to service operators, which are not easy to muster in a competitive environment).

These examples can be extended to other infrastructure as well (ports, etc.) since the issues involved are basically the same.

5. CONCLUDING REMARKS

Public regulation of transport services and infrastructure is a highly complex task, and basically still in its infancy. "Command and control" practices predominate even when they are no longer needed. The liberalisation process in turn is slowed down by extensive "capture" phenomena.

A first point needs to be stressed: regulated ("Demsetz") competition does not conflict with social objectives. Even free transport can (and must) be provided within a competitive context.

The gist of the problem is as follows: direct intervention ("command and control"), regulation and market competition have to be considered within a "subsidiarity" perspective. Why is this explicit "hierarchy" of strategies needed? Because the traditional assumption, known as "social choice", of a "benevolent, all-knowing prince" is no longer acceptable, even if the "perfectly egoistic prince" of the "public choice" assumption is also too extreme. A balanced attitude is to remain on the safe side, i.e. try not to assume that the prince is necessarily benevolent.

Nevertheless, public regulation and market competition are not so far apart as is commonly assumed. The market is not the absence of rules and constraints, quite the contrary: it has been built up via a complex set of rules and laws which have taken a couple of centuries to be put in place, and which are continuously evolving along with social values (and technology). A good example comes from the former Soviet Union: the "destruction" of the State has generated a highly distorted economic structure (organised crime, etc.) and the task of reconstructing proper market rules poses a much bigger challenge than does the "destructive" phase.

There is an ideological difference between liberal values and pure *laissez-faire*. Furthermore, public regulation *itself* is not a purely technical issue: in reality, the choices contained within regulation represent different visions of economic democracy and social priorities.

The transport sector is quite singular in the sense that it abounds with "market failures" and touches on very sensitive issues and social objectives (freedom of movement, the environment, safety and security, etc.). The stronger the drive to liberalisation, the more (necessary) public intervention has to be attentive and up-to-date; in other words, the more "market" we want, the better the "state" we need. Nothing is really spontaneous in market competition: it is a political construction, and much work remains to be done within the transport sector.

NOTES

1. See Buchanan, 1969.
2. The term usually used in European Commission policy papers.
3. See Litman, 2002 and Maffii Ponti, 2002.
4. See Demsetz, 1968.
5. See Banister, 1997 and Fawkner, 1999.
6. See Ponti, 1997.
7. See Ponti, 2002 (a) and (b).
8. See Doganis, 2001.
9. See Tucci, 2002.
10. See Ponti, 2001.
11. See Nuti, 1997 and CESIT, 1998.
12. See Ponti, Federtrasporto, 1996.
13. See *Japan Railway and Transport Review*, 1994.
14. A "club externality" occurs when the damaged parties belong to the same social group as those doing the damage.
15. See Preston and Root, 1999.
16. See Marzi, Prosperetti and Putzu, 2001.

17. See Averch-Johnson, 1962.

18. See ECMT *Round Table 120, What role for the railways in Eastern Europe?* -- Thompson, 2001.

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Competition and Regulation in the Transport Sector:
A Recurrent Game and Some Pending Issues

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SUMMARY

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1. OBJECTIVES, CONSTRAINTS AND INSTRUMENTS

For virtually any type of economic activity today, there are technical regulations connected to safety and environmental preservation goals, and economic regulations which specify the conditions that interested parties must satisfy to be recognised as suppliers (both in general and to specific markets when that is applicable), and possibly also the limits to their economic behaviour in the market. The first type of economic regulation is called structure regulation and the second conduct regulation (Turnbull, 1999).

In extreme cases of regulation, authorities allocate markets to suppliers, and this has in many cases in the recent past been replaced by regulation of market access conditions (Wauthy, 1999). Thus, regulation is also necessary to define the field and the rules of the game for competition between economic agents, and only in the extreme cases can one speak of competition versus regulation, the general rule being competition under (some kind of) regulation. Regulation of activities provided by the private sector is important because not every transport activity is naturally competitive in durable conditions, as oligopolies or even monopolies may arise in rather common circumstances.

But competition is not a goal in itself, rather one of various types of instruments; and because there are a multiplicity of policy goals, in each case accompanied by different sets of constraints and resources, so the precise nature and intensity of application of each of those instruments should vary.

It is very frequently implicitly assumed that the dominant goal of transport policy should be to maximise economic efficiency of transport operations, but this is only true if other important attributes of those operations are taken for granted. Transportation has become an essential component of personal daily activity patterns, as well as of the proper functioning of companies, in such a way that it is now required by its consumers to be not only available and safe, but predictable and reliable.

In the domain of the European Union, transportation is recognised as part of the "services of general interest" (European Commission, 1996), which means it should be accessible to all members of society, thus contributing to solidarity and equal treatment.

This may mean that economic efficiency of transport activities will sometimes come second in the concerns of governments in this area, after those attributes of universal, guaranteed, stable supply. Such concerns naturally create inertia against change, as the process of change may be perceived as having the risk of introducing instability or even rupture of transport supply. Naturally, the argument is frequently (ab)used by those who gain from the status quo to capture the political decisionmakers. This is especially visible in scheduled transport activities, but in chartered transport also, such arguments come to the surface. So, a balanced and careful use of regulation must be made to ensure not only pressure towards efficiency gains, but also the required availability, stability and predictability of transport supply. As will be discussed below in this paper, the most adequate type and level of competition in a certain market will depend on various factors, so that no general recommendations should be given.

But the importance of competition for promotion of efficiency is not easy to measure, as it stimulates innovation, both on the technological and organisational fronts. This innovation will sometimes be of a discontinuous nature, and that is why it is impossible to quantify its benefits. This can be called the dynamic benefits of competition, i.e. benefits originating in better incentives to expend effort, learn and innovate (Klein, 1996).

Currently in affluent societies, the dominant form of competition in the transport sector is quite often not between suppliers of similar services in the same mode but rather between different transport networks. Depending on the geographical scope, these networks may correspond to different modes, to different intermodal combinations of various modes, or even to various alliances within the same mode. This creates complex problems of regulation, as this governmental function has traditionally been organised by transport mode and by geographical market. But a few examples clearly show the challenge and how difficult it has been for regulation to keep step with the market forces:

- In urban areas, competition is mainly between the private car and public transport, but all the recent effort of the European Commission has been on the provision of competition within the public transport industry. Some local authorities have already understood that they must simultaneously embrace all mobility vectors in their area of jurisdiction, so that one key element of access to the market (road space) can be managed as an instrument to pursue the desired market shares, but they are still a very small minority;

- Combined services, like park-and-ride or occasional upgrades from public transport onto taxi services can be properly designed and implemented;

- In long-distance markets, national rail monopolies giving preferential treatment to customers of only one or a handful of airlines create a cross-modal market distortion, which is probably out of reach of aviation regulatory authorities;

- Still in long-distance markets, yield management schemes by the airline alliances have created such price differences for the same service (the same flight leg between A and B in the same company X), depending on what other companies the client is using to get to A or follow on from B, that in fact the competition on the route between A and B is not the relevant issue for the choice of the consumer.

Competition between networks normally poses fewer risks of immediate disruption of service in any of the networks competing, and so opening of market access has fewer risks. But the two last examples show that, as regulation of access to the markets has been made more open, powerful operators are transferring the defence of their positions to anti-competitive practices in the market. Such practices are increasingly complex and cross-modal, possibly going beyond the legitimate field of (geographical or modal) intervention of existing regulators.

So, governments must periodically check whether there is scope for a redefinition of their regulatory agencies or for international action on the creation or extension of scope of regulatory agencies, in order to ensure that suppressed barriers to entry are not being effectively replaced by anti-competitive behaviour in higher dimensions of complexity.

As already mentioned, regulations are only one family of instrument applicable to pursue policy goals, and we must not forget that two more families are available: supply-side instruments (construction of infrastructure, introduction of new technologies) and demand management instruments (mainly pricing and taxation). Frequently, combined and coherent application of more than one of these families can be much more effective than the optimised use of just one of them.

In the remainder of this paper, an effort is made to show how the interaction between various forms of competition and regulation has evolved, depending not only on the other objectives present and on the economic attributes of the markets involved, but also on the maturity of the players and on the skills of the authorities, thus creating a recurrent game in which the playing field is not only not necessarily level in each round, but successively changes its borders, barriers and slopes.

This leads us to acknowledge that there is no correct, definitive answer to the question of the best way to organise competition in the transport sector. Moreover, in several of the sections below, examples are given of some pending issues, indicating regulatory solutions that are being applied or even just considered, and discussing their positive and negative points.

2. INCREASING SOPHISTICATION IN COMPETITION AND IN REGULATION

In general, the risk of disruptive competition has been reduced, both by increases in market size and by new technologies that reduce the minimum scale for efficient operation and also allow better market segmentation. But for more sophisticated forms of competition, more sophisticated forms of regulation and more sophisticated regulators are necessary. This should happen under the recognition that, for both State and (some) private parties, there will be the need to go through a steep learning curve of working together.

In this process of increasing sophistication of regulation in favour of fair competition, five main challenges can be identified for the public sector in transportation (Oster and Strong, 2000):

- *Restructuring to promote competition* (especially to what degree infrastructure investment and ownership should be passed to operators);
- *Keeping competitors' behaviour in check* (control anti-competitive behaviour by large cartels, ensure level playing field for new entrants);
- *Maintaining small market services and access* (sharper competition in the market makes cross-subsidisation of services within each operator virtually impossible, so the State must ensure competitive provision of less profitable services);
- *Managing concessions* (discourage/disqualify overoptimistic bids);
- *Defend safety and environmental preservation* (avoid corner-cutting on safety and environmental defence by private concessionaires).

There are two main risks of capture of the regulator: by operators and by users. In the first case, operators will try to extract advantage from political circumstances to their conditions of operation or of reward and, in the second, users may create pressure to imposing demands not covered in contracts (Estache, 2001). In some cases, operators may even be capable of stimulating users' movements that play into their own hands, thus capturing the regulator on both sides. Only very clear definition of the limits of action by the regulator, and of the financial engagement of public administration at its various levels, may be effective against these pressures.

If there is an effective competition or anti-trust agency in the country, it could in principle take care of legal barriers to entry inherited from the past, of monopoly abuse by dominant players and of predatory practices, although some of these practices may be of such geographical scope that they fall outside the current statute of the regulator. But only a sector-specific agency will have the competence to avoid safety cutbacks or to adequately treat claims from users or their pressure towards provision of services beyond existing contracts. In both cases, decisions of the regulator must be based on evidence, not only on opinion, which may require relatively costly data-gathering exercises and analytical sophistication to process that data.

The independence of the regulator is an important feature, inasmuch as in transportation contracts there is frequently an obligation for government to deliver something on its side, for instance, legislation or adequate infrastructure. This should be translated at two levels: financial autonomy and accountability for its decisions before a body other than that which nominated it (e.g. nomination by executive and auditing by judiciary). Although auditing the performance of such a regulator can be quite costly, the costs of not doing so may be higher, if we consider the consequences in terms of non-delivery by government or abuse by strong operators.

3. POLICY WAVES

As with social expectations with regard to transport, the economic capacity of consumers to access the various transport vectors and the external effects of transport activities have changed, so policy goals must evolve in response to these changes. But the forms of organisation and level of sophistication of public and private parties engaged in the various forms of transport supply have also evolved, thus requiring the State to regularly adapt not only the goals, but also the instruments used to pursue them.

Recognising this, the need to regularly monitor the development of supply and demand emerges, not only to detect as early as possible the symptoms that could lead to a change of policy or of the required instruments, but also for enforcement of contract clauses (when there is a contract).

In many areas of transport there are significant economies of scale, due to high fixed costs. In those cases, market size is critical in respect to economies of scale because it determines how many stable competitors are viable (Oster and Strong, 2000). But technological progress is a factor promoting increased competition (except when it is kept exclusively in the hands of one supplier), for three possible reasons:

- It may lower the economies of scale in general and the optimal size of supply in particular, thus allowing an efficient split of the market among a higher number of suppliers;
- It may also reduce production costs and/or increase occupation rates, which will stimulate lower prices and thus increase market size;
- It may be an instrument of differentiation among suppliers, placing the terms of the competition not only in the field of price to the consumer but also on product attributes.

But when there is a relatively long period of stable technology and regulation, the stronger players frequently are capable of developing sophisticated strategies for reinforcing market domination, sometimes to the point where the regulator feels the need to intervene to prevent abuse of market power. In the real world, we can witness successive waves of more regulation followed by more competition, driven by market size and technology progress, that reduces the minimum supplier dimension for market access and improves possibilities of product differentiation and corresponding market segmentation.

So, it should be clear that there is no permanent ideal level or nature of regulation, which must be adapted to extract the best results from the forces present in the field. Trying to present it in a systematic manner, we can say that the preferable nature and level of regulation, at a certain point in time, depend on, among other factors:

- the dimension of the market and potential number of suppliers;
- the existence of alternative (and acceptably similar) forms of transport;
- the sophistication of the services being offered (higher sophistication constitutes an instrument of differentiation and thus a barrier to destructive competition);
- the level of technical competence and sophistication of the regulatory agency, which should be in correspondence with the complexity of the supply requirements.

4. COMPETITION IN THE MARKET

The most natural form of economic competition is that which occurs directly in the market, giving consumers the possibility of choice for each act of consumption. So, suppliers are constantly put in question and have a permanent feed-back on how the demand side likes or dislikes whatever changes or perturbations there may have been in the product or service supplied. This is supposed to constitute a permanent stimulus to efficiency and product improvement, as well as to low margins, thus giving the best deal to the consumers.

But there are multiple examples in which the intensity of such competition has led to instability or even rupture of supply, at least for limited periods of time, during which consumers are left with very poor and uncertain supply. This is particularly serious for scheduled passenger services in urban areas, but has also happened in chartered service markets, for instance in road haulage. The main risks of over-competition are associated with the tactics of the various players to dislodge others in the contested market:

- Instability in general, as operators frequently have to change tactics to respond to others;
- Duplication of services by different operators, with the corresponding waste of resources and economic losses;

– Over-capacity as a result of optimistic visions by too many operators leading to parallel investments, often left underutilised;

– Cherry-picking of services with the highest density of demand, where better loading factors and results are easier to obtain, with the counterpart of leaving unserved other areas and times where demand is not judged dense enough.

These situations have indeed occurred in several sectors, leading governments in general to define markets with strong allocations of capacity or of specific shares, in many cases even without explicit competition for those parts. So, there have been cases of strict allocation of capacity in the road haulage sector, to provide increased stability in this sub-sector, and to defend the heavy investments made in the railway sector (McKinnon, 1996); similarly, in the urban passenger transport sector, as well as in the airline business, routes or even entire networks were allocated to designated operators, very often in the public sector but not necessarily so. In some other cases, as with US railways, governments had very strictly regulated prices to prevent risks of abuse of captive clients by the only possible supplier.

However, the last decades of the 20th century have staged a trend towards higher market liberalisation, i.e. much easier access of operators to the markets, followed by direct competition there, and much lower interference of governments on prices. As mentioned in the preceding chapter, this has been justified by previous increases of market size, by technological progress, as well as by the availability of alternative forms of transport in most markets where it has occurred.

The outcome of these options is relatively clear, but it is difficult to establish a clearcut balance, as there have been gains and losses, incident upon different dimensions of market performance, and upon different market segments.

In the case of the US railways, deregulation of prices has led to very significant increases in productivity and overall price reductions, with no visible evidence of abuse towards captive clients (Donald and Cavalluzzo, 1996).

It is now relatively clear that it is possible to reach stability of supply in scheduled transport markets, such stability being very strongly linked with the possibility of product differentiation (van Reeven, 2003) or to affirmation of market power by dominant players (oligopoly). Product differentiation seems to be decisive in air transport (more attributes of importance to consumers besides time convenience and price), but not in urban transport by bus (in which time and price are almost the unique important attributes for consumers), where the power of oligopoly has been the key stabilizing factor in the urban areas of Great Britain outside London.

But in the case of air transport, it has become clear that the full power of liberalised market access can only be released when constraints on airport access are relaxed and the strategic behaviour of incumbents (alliances and slot dominance) are curtailed (Gonenc and Nicoletti, 2000; Meyer and Menzies, 2000). These constraints on airport access are difficult to release, or even to regulate adequately, because landing slots have to be acquired in pairs, or even in sequences for the whole day of operation, to allow efficient use of the aeroplanes, and this would require co-ordinated decisions by the various authorities/airport operators allocating those slots in the different regions and countries. Since this would correspond to another source of instability being enacted, the current solution, based on "grandfather" rights of the incumbent users of the slots, has prevailed.

Several low-cost airlines are circumventing these barriers by using smaller airports, with much lower charges and quicker turn-around times, although at a longer distance and access time to the main cities served. Although access time is an important factor for choice of air transport solution (Pels *et al.*, 2003), this affects business travellers much more than leisure travellers. But choice of smaller airports is not enough to survive among the competition if the full low-cost approach is not adopted, as the case of French regional airlines shows (Thomson, 2002).

The high price surcharges (or lack of discounts), introduced by airline alliances when a passenger is using several non-aligned companies in the same trip (Brueckner and Whalen, 2000), constitute a practice that can be viewed both as market segmentation (the benevolent view) or as consumer discrimination and an economic obstacle to interoperability (the malevolent view). The intensity of competition and the lack of an independent international regulator have allowed this practice to survive and indeed be intensified, but defence of consumers' interests would probably go in the direction of limiting the extension of such tariff differences.

In free-access networks of scheduled transport, both on land and in the air, a recurring issue has been that of universal service, i.e. service to areas of lower density. How should it be defined, and how can it be financed, if profits tend to be much lower due to the intense competition on the denser markets (Wauthy, 1999)? Clients located in these areas certainly are the main losers of the deregulation wave of the last decades, as they are now facing less frequent services, often provided only as feeders to the next hub, where a transfer is necessary. Even when there is the direct intervention of authorities, the direct and explicit cost of the necessary subsidy often forces a reduction in previously available levels of supply. Although it is not obvious that cross-subsidisation by denser services would be more fair, the fact is that many persons and companies have located in those areas under a presumption of stability of the previous patterns of (regulated) supply, and now feel poorly treated.

One area of systematic difficulty, where there are many operators competing in the market and the safety risks are not immediate or obvious yet very serious, is enforcement of technical regulations. This is especially vital in the road freight sector, where there are regular reports of excessive working hours, overloading, excessive speed, etc. Although the regulations are there, the risk of penalty is sufficiently low in many European regions to regard these practices as normal. There is, of course, an aggravation of safety risks through such practices, but also a distortion of the terms of competition.

5. COMPETITION FOR THE MARKET

In the case of competition for the market, public authorities define what kind of transport infrastructure or services they want to be available (and under what terms), and firms compete to be the selected supplier. As we are comparing this with direct competition in the market, only cases where investment is carried out by the private supplier (not by the authority) are considered in this paper. We are also not covering the situation in which the State is simply privatising (through tender) a monopolistic supplier of transport services, and jointly opening the market to direct competition.

Given the high initial costs and their irreversibility, this is the natural form of introducing competitive pressure when infrastructure has to be built, operated and maintained. But for the provision of transport services also, this is often a solution preferred by public authorities, as they see it carrying lower risks of instability or rupture of service (which could be occurring in the case of competition in the market).

Under this general designation, two relatively different situations exist, in both the markets for transport infrastructure and for transport services:

– The selected firm only has to deliver a product according to specifications and is subject only to industrial risk, its revenues being paid by the authority according to the production plan, possibly with corrections related to quality of delivery;

– The selected firm has to deliver the product or service and market it, making it subject to industrial and commercial risk, with revenues being partly or totally obtained by the sale of the respective access or services.

In either case, it frequently happens that, in order to attract private entry into any transport sector, it may be necessary to restructure it, by unbundling some activities which can be privatised from others that would not be suitable for it.

In the case of competition for infrastructure with commercial risk, fair pricing of access to that infrastructure by third parties is critical to ensure competition in the operations market, and should be clarified before privatisation. This is especially applicable to railway lines, stations and terminals, but identically so for port terminals and airports.

When there is commercial risk, irrespective of whether it is the case of competition for the supply of infrastructure or of transport services, the winner gets a contract for that supply, with some restrictions of market access for competitors. In some cases, there may even be a period of monopolistic supply, although this does not necessarily mean operation under full protection from competition, as there may be competition with other modes.

In these cases, barriers to entry of direct competitors are generally sought for two reasons:

– To facilitate the practice of cross-subsidies between different parts (sections or services) of the contracted object;

– To lower the cost of capital needed by the private agent for investment, as this reduces his exposure to commercial risks. However, it should be recognised that this is just a transfer of the risk from him to the public (Klein, 1996), by preventing the emergence of possibly better suppliers.

As such, offers of these barriers under the terms of the competition must be made with some prudence, although it is quite common that governments are keen to offer these kinds of support to increase their expected rent.

Although, in the case of transport services, the option of competition for the market may seem to carry very low risks for the authority and for the public, this is not necessarily true. Considerable risks exist here, but they are of a very different nature from those in the case of competition in the market. The main risks associated with this option are:

– The services specified by the authority are not necessarily those that the public would prefer, or those that in a most efficient way meet the public's demand for accessibility;

- Even if those services are the preferred ones at the beginning of the contract life, the evolution of demand during that life may introduce significant misalignments between the services provided and the desirable services, as the effectiveness of the feedback from the market is weaker. This is especially important when the contract duration is long, in connection with significant investments made by the operator;

- The selected operator may have presented an unrealistic bid and be unable to sustain an economically healthy operation under the terms proposed, thus falling into an unstable situation for the company and the services it supplies, and forcing the authority to urgently intervene.

Similarly, in the case of competition for the infrastructure market (BOT), the extension of contracts required for full amortization of private investment and the strict nature of most of the clauses normally found in these contracts, create severe difficulties for adaptation of public policy regarding infrastructure use, namely, concerning charging regimes and levels. As these constitute the main source of revenue for the private parties and thus a critical part of their engagement, they tend to be very tightly defined upfront.

There is a trend towards *functional* specification of the object of the contract in the cases of hardware (infrastructure or vehicle systems), by which the client authority defines what it wants to be achieved, instead of the traditional *technical* specification, by which the client defines how it should be achieved. Competitors may, in such cases, make the best use of their technical knowledge and ingenuity, developing and presenting innovative ideas to meet those targets by different approaches and hopefully coming up with more efficient solutions. This is a positive trend although it may make the initial job of the client more difficult, as it imposes a higher degree of abstraction in the specifications.

In the case of scheduled transport services, this is still a very rare practice, as most tendering is done for the operations on the basis of a fully specified timetable. However, if the tender comprises both the tactical and the operational levels, i.e. the specification of the routes and timetable, as well as running the corresponding services, very significant efficiency gains could be expected, as our own evaluation on the urban bus networks of Lisbon and Oporto has shown. The fact that this is seldom done may be due to the additional difficulties of specification of what the authorities want (higher abstraction) and of the evaluation of the bids.

For large transport systems, there may be advantages in dividing the market into several slices for separate tendering (see below), but the conception and planning of the route network and timetable must be done as a whole, to ensure proper integration. Contrary to the statement of Klein (1996), however, the author does not think this should be considered as a natural monopoly, as it can be tendered based on a functional specification of requirements.

In general, as the object of the tender becomes more complex and risky, the set of potential competitors will be reduced, with only large economic groups presenting themselves in the final round. This has two particular dangers for the defence of the public interest: there is an increased probability of cartel among those large groups, and there is a greater risk that the supplier will outsmart the authority during the life of the contract. For these reasons, the complexity of the job and the level of risk of the contract for the supplier must be carefully evaluated, considering the desirable level of real competition and the level of skills of the authority who will be launching the tender and managing the contract.

5.1. Tenders

Tendering is a form of competitive procurement with open and definitive specification of the requirements by the procuring agency. The success of tendering operations is initially measured by the number of competitors presenting their bids, and successively by the quality of the bids presented, by the length of the negotiation period and by the similarity of conditions and prices between the ensuing contract and the specifications of the call for tender.

All of this requires that the procuring agency knows quite well in advance what it wants to be delivered and under what conditions the competing firms have to work to deliver it, thus being better able to distinguish between solid and unrealistic bids.

This poses quite tough requirements on the competence of the agency, and is frequently forgotten when the decisions to tender are taken. This kind of competence is easily found in agencies which had an earlier life as public monopoly providers, as they have had the direct experience, which, however, can be lost quite rapidly if nothing is done to ensure the regular recruitment of the same type of operational skills.

Another tough constraint for the success of tendering as an instrument to introduce competition in (parts of) service markets previously under monopoly, is to ensure that all significant barriers to effective competition have been removed. This is especially applicable when the incumbent is still present as a strong and powerful operator.

An interesting example is given by competition for regional passenger services in the German railway sector, where relatively low levels of competition have occurred, albeit with a significant number of operators now present in the markets, given their fragmentation. The main reasons are, according to Schnell (2002): many regional authorities were not prepared to launch and manage a competitive process; the incumbent Deutsche Bahn (DB) had blocked all supplies of rolling stock in the manufacturing industry, and no companies for leasing of rolling stock existed in Germany; DB Netz, the infrastructure manager, delayed completion of renovation works, thus delaying the process of market opening and consuming large parts of the energy of the regional agencies; finally, there are different platform heights in the different regions, thus making rotation of rolling stock across franchises very difficult.

Experiences pointing in the same direction have been observed in other transport markets as well as, for instance, in telecommunications. This does not mean that such opening should stop, only that we must recognise that the set of conditions for fair competition is larger than anticipated, and that there is a learning curve to go through. This makes it an area where sharing of good and bad experiences is critical to learn quickly and thus avoid consolidation of the opinion that we either leave incumbents untouched (and lose internal efficiency) or have to break them in small pieces before privatisation (and lose integration efficiency).

Whenever a tendering process is launched with less than adequate clarity about what is required and what kind of proposals could be expected, the evaluation of the bids becomes very difficult, longer and more arbitrary, and complex negotiations become necessary to approach the suppliers to the intentions of the procuring agency. Depending on the time pressure because of publicly-made promises, this may severely bias the balance of negotiating power between acquirer and supplier, as it is quite simple for the latter to step out of negotiations (or threaten to do so) when conditions are not as expected, which is not the case for the public agency.

In recent times, the crises of emerging financial markets have brought greater awareness of risk factors to private equity suppliers, and to the bidding consortia they support. As a consequence of this increased risk perception, it often happens that only two types of bidders will show up: the large and experienced consortia, who expect to dominate the regulators in the negotiations or during the contract life, and new or relatively small suppliers, willing to promise anything to get the contracts, but bringing with them a large risk of underestimation of difficulties or the willingness to "cut corners" in the execution of the contract to achieve the cost levels that fit the presented bid (Estache, 2001).

In tenders for contracts with commercial risk, a critical aspect is the estimation of demand and revenue, which should be made independently both by the State agency and by the bidders. Very often it has been found that estimates made by both sides at the tendering phase run well above future reality. In some cases, there may be situations of modification of surrounding circumstances or of technical incompetence on either side, but the fact is that there are also joint perverse incentives: the State wants to sell at the best price, and the private party wants to get the business, both knowing that there is a good chance that a renegotiation will be necessary (Estache, 2001), but also knowing that their key objective of transferring/acquiring the operation will not then be under question.

This is an area of very difficult improvement, because of this alignment of objectives. Perhaps competition authorities (a different agency from the acquirer) should be required to intervene as an arbitrator in the re-negotiation phases, but not during the initial negotiations, as that would create additional delays which may be unjustified on a general basis. However, this rule could constitute a powerful deterrent for the continuation of such practices.

Another interesting and difficult problem is that of the second and later tenders for operations with commercial risk, under protected monopoly during the contract life. In these cases, the winner of the first tender acquires very rich information about the market during execution of the corresponding contract, which makes it very difficult to avoid his advantage in successive tenders. With relatively stable technology and strictly regulated labour regulations, any bid more favourable than that of the incumbent could be seen as unrealistic, and thus as carrying the risk of instability of supply. This effectively constitutes capture of the authority by the supplier.

Two types of answer seem to be possible:

- In the first case, the authority follows the market closely, and requires the operator in place to supply regular information on a set of important items;

- In the second, applicable only in larger markets, the authority splits the market into several "slices" and prohibits accumulation of operations by the same economic group.

Both answers can be combined, as adoption of the second answer does not reduce the usefulness of the first.

5.2. Contracts

Depending on the fact that the winner of the tendering process has to sustain only industrial risks and/or commercial risks, two main types of contract are found:

- Gross cost contracts, in which the provider is remunerated based on his bid for production costs. Depending on the terms of the tender, the specification of the items to be produced can be pre-fixed or variable, but the overall or unit costs will have been set;

- Net cost contracts, in which the provider may have a relatively large leeway for designing his network and range of services, though frequently with some general service specifications and price limitations set by the authority. In this case, remuneration is based on the revenues obtained in the market, plus or minus a fixed rent paid to/by the authority managing the contract.

Various difficulties exist in relation with these pure types of contract, especially when applied to transport services. In the case of gross cost contracts, suppliers under contract may tend to simply produce according to specification, concentrating on cost reduction rather than service quality or customer satisfaction. A correction is frequently introduced through a bonus/malus payment, linked to the level of achievement in a range of quality factors (as produced or as felt by the public) and/or to the overall changes in the patronage volumes. However, many producers see this type of contract as a limitation on their entrepreneurial and managerial skills, reducing them to simple "traction providers".

In the case of net cost contracts, although they are generally stimulating greater efficiency and commercial initiative by the operators (Gagnepain and Ivaldi, 2002), there are also difficulties related to changes introduced during the life of the contract, somewhere in the transport or land-use scene, supposedly affecting the willingness of the public to use the services under that contract. Such cases may be used by experienced companies as a recurrent instrument to obtain additional revenue (compensation) from the authority, which then starts feeling captured by the operator. So, in large and complex transport systems, requiring high levels of integration between parts of networks of the same mode as well as across modes, net cost contracts are very difficult in application, except if the contract applies to the whole set of transport networks and the contracted operator is also involved in the more general aspect of mobility management.

But even in smaller systems, the main difficulty with net cost contracts is related to the tendering phase, as smaller companies do not feel capable of adequately measuring the risks and abstain from submitting a bid. This fact strongly reduces the level of competition and raises the fear of cartel-controlled bids.

Here too, the learning process is still going on, with most authorities opting for gross cost contracts with varying incentive schemes (Dalborg and Kinane, 2003).

But it is possible and it would be interesting to develop hybrid contracts, in which, besides delivering services according to the specification by the authority (on a gross cost basis), concessionaires would be allowed to develop markets through innovation of product or value-added services. Contracts should stimulate this process, for example, by partial retention of marginal revenues and by contract extensions in case some targets are reached.

In the case of infrastructure construction and operation, contracts are mostly on a net cost basis, with suppliers being paid directly through the tolls or charges they impose on their users. In some cases, there will be an initial contribution from the State, as the expected revenues are not enough to meet the costs plus the required margins. This had been applied in roads, ports, airports and railways in many parts of the world, with very high overall rates of success but with some well-publicised failures.

In the last decade, some schemes have been developed under a shadow-toll concept, in which it is not the user but the State who pays the required toll or charge (Viegas and Fernandes, 1999). By itself, this does not make the contract more difficult to manage, but there will be distortions and possibly equity problems if other facilities of the same kind in the same country are charging real tolls to their users.

Because of the high investment volumes required from the private parties, these infrastructure contracts generally have a long duration and a relatively high level of uncertainty as to the evolution of demand, especially when the privatisation is accompanied by changes in the pricing of access to that kind of transport infrastructure. In order to limit both the downside and the upside risks, governments will often accept to ensure a minimum return on investment (or equivalent measures), and require some form of limitation of "excessive" profits, either by a cap on that rate of return, or by an imposition of reduction of prices, thus sharing the benefits of high demand with those very consumers. A combination of the two approaches on the upside is also found in some cases.

However, these two approaches to limit excessive profits have very different impacts on the concession: a cap on the rate of return may reduce pressure to control construction and operating costs, and thus it should be applied to the costs declared at the time of the bidding, not to the costs stated later. On the other hand, a reduction of access prices will induce higher demand, which may be undesirable in itself because of congestion imposed by that traffic in other parts of the network, or simply by the environmental externalities it will generate.

The long duration of these contracts also tends to have implications on the level of their specification, with both parties often trying to "define the future". A more detailed contract will bind the parties in the future, even beyond their will, whereas a less detailed contract will leave matters more open and give more discretion to the regulator. Although it may seem that more detailed contracts defend public interest, this is probably not so:

- Transport policy may change during the several decades that contracts normally last, in particular with respect to pricing of access to infrastructure. This will mean that some parts of the network will have a set of pricing rules, in line with the adopted policy, while others may have very different pricing rules, based on existing concession contracts;

- Not only policy but also the circumstances surrounding the contract may change in ways that were not foreseen at the time of signing the contract;

- In both cases, even if it is true that governments may renegotiate concession contracts during their mandates, the upper hand in those cases is always with the private side, not only because it is the public side that is declaring the wish to change, but also because the private side (very large and powerful consortia in all such contracts) is normally equipped with much better teams of lawyers and other consultants.

So, there seems to be a good case for rule-based contracts, selecting rules that are recognised as fair by both sides and requiring minimum information to be properly applied (Estache, 2001). Trust in the regulator for regular checking of the material conditions of the contract and their consistency with the agreed rules is essential, as well as the initial agreement on an arbitration instance and procedure for the cases when the performance of the regulator is not seen as fair.

But another option could be to shorten the lives of these contracts to a horizon where we can still have some idea of the challenges ahead (possibly somewhere around fifteen years), recognising that this is insufficient for full amortization, and thus including in the contract an exit payment of the residual physical value of the infrastructure. This should pose no financial difficulty for the State, as it could easily launch another competitive tender for the next cycle (15 years) of operation of the same infrastructure, and thus have the second concessionaire pay an amount of rent that would, in many cases, far exceed that residual value, as the object of the concession would by then be an established business instead of a risky venture starting from zero (Viegas and Colaço, 1998).

6. CONCLUSIONS

6.1. The baseline: Objectives of transport system and the roles of competition and regulation

Transport systems exist not only in themselves but as critical suppliers to personal lives and economic activities, so the availability, stability and predictability of their performance are at least as important as their efficiency.

In the search for these attributes of the transport system, competition and regulation are important instruments, which are not antagonistic. The dominant practice today is competition under some kind of regulation.

In the complex mobility systems of the developed world, institutional design constitutes a limitation to the effectiveness of regulation, because competition may be as strong across modal frontiers as within one mode, where each regulator normally has his powers defined. In the most obvious cases for intermodal competition -- large urban agglomerations -- the regulator should also be intermodal.

6.2. The dynamics of supply and their impacts on the conditions for competition

Technological innovation is lowering the barriers to entry of efficient competitors into the markets, but at the same time incumbents are developing ways to raise other barriers to those entries, namely, by blocking access to critical resources (infrastructure or rolling stock), to combined services, etc.

Even under regulated competition, with temporary allocation of markets to specific companies, innovation should be promoted, not only in the application of technologies, but also at the organisational level. The best way to do this is not with long contracts (which may induce cosy relationships between authorities and operators), but with shorter contracts and possibility for their extension after reaching certain pre-established targets.

In general, cheaper technology for remote observation and measurement, as well as instant mobile communication, are moving towards more efficient allocation of capacity and pricing systems, to more demand-responsive systems and thus to greater feasibility of increased integration and efficiency in competition for shorter-term markets. But this has to be balanced with the aforementioned needs for availability and stability in the supply of transport.

Cheaper technology will also facilitate product differentiation, and with it the possibility of direct competition in the market with much lower risks of disruptive competition.

6.3. The need for authorities to become learning institutions

This is a dynamic game, not only because mobility requirements change, and new technologies become available, but also because private parties are constantly trying to penetrate the markets or to improve their chances in the market in which they already operate. So, authorities must also keep a dynamic attitude, trying not only to follow those behaviours and redefine regulations which limit their negative effects, but to anticipate them and prevent abusive behaviour from some competitors.

But, even more deeply, those changes in demand and supply conditions will imply an evolution in policy directions and in the palette of instruments required to apply them in efficient and effective ways.

One clear message is that rigid contracts of long duration constitute barriers to innovation and to good fitting of policies to the issues of the day, at least as much as they are instruments to facilitate the mobilisation of private investment, which could still be adequately protected in contracts of shorter duration. So, contracts must evolve in the direction of adoption of general rules instead of tight specifications, and of shorter durations.

The systematic need for redesigning policies and their instruments calls for authorities which are as dynamic and skilful as the private suppliers they are meant to regulate, which means they too must reinvent themselves, in the sense of becoming learning institutions.

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Competition and Regulation: The Role of Ownership

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SUMMARY

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1. REVIEW OF THEORETICAL PRINCIPLES GOVERNING COMPETITION AND REGULATION

1.1. Overview

Over the past 20 to 30 years competition has been introduced into transport markets in ECMT member states and observer states as well as further afield. Change has happened faster in some states than others. Not only that but the competition has assumed different forms. The variety of experience reflects two factors. Within the European Union (EU) for instance, the European Commission has not yet established *clear guidelines* as to the way state-run systems should cede control to the market. In addition, the approach adopted by individual governments has been influenced by the extent to which they have embraced anglo-saxon capitalism as compared to its European continental counterpart.

Nevertheless, a wealth of experience has been built up which gives some pointers to the way further change should be directed. Broadly speaking, full deregulation of local transport systems lowers costs but at a price of lower ridership. Continuation of fully state-controlled operations sacrifices efficiencies for the sake of social benefits. Limited competition, being a compromise between the first two, does seem to offer the best option at least for urban and local transport. Whatever the nature of the system, however, there will generally if not always be a need for regulation. What shape it takes will be influenced by the priorities and policies of government. The ensuing interplay between competition and regulation then determines the character of the overall public transport service.

1.2. Competition, regulation and efficiency: Contradictions or complementarity

The very notion of regulation, implying interference in the workings of the market, appears to conflict with the norms of economic theory. According to this line of thought, the State can best achieve allocative efficiency by minimising its role and allowing markets to become perfectly contestable.

This view has inspired governments across the world to privatise a range of institutions and activities, from prisons to power plants to public transport. The United Kingdom, under the leadership of the former Conservative Prime Minister, Margaret Thatcher, was among the first countries to pursue this policy of reducing Big Government. It therefore provides a wealth of evidence on which to measure the success or otherwise of the free market strategy. Overall, the consensus appears to be that the *laissez-faire* approach has yielded greater efficiencies. Nevertheless, in some areas, especially public transport, the results have been, to say the least, mixed. When bus services were opened up to free competition in many parts of England, the outcome can be considered, in a very narrow sense, consistent with Pareto optimality, on the assumption that oligopolistic behaviour does not become a feature of the market. But more importantly, the result is only acceptable if one ignores externalities such as increased road congestion, greater emissions of greenhouse gases and further isolation of rural communities. If a complete free-for-all in public transport is a step too far, then what solution combines greater efficiency as well as addressing externalities?

Markets exhibit four main types of competition: perfect competition, monopolistic competition, oligopoly and monopoly. In perfect competition there is complete freedom of entry to the market, implying negligible or non-existent barriers to any firm wishing to participate. There are many participants and they are all price-takers. If the scenario produces supernormal profits, more firms will be attracted to the market.

A monopoly is a price-maker. Its real power depends on the extent to which there are no substitutes for its product. A natural monopoly occurs where the industry's long-run average cost is always greater than the demand curves for two or more market participants. If barriers to entry are not total, a firm making supernormal profits may limit its prices to deter entrants. Monopolies will tend, however, to maximise profits by constraining output to the point where marginal revenue equals marginal costs. Such an outcome is considered to be allocatively inefficient because it denies society Pareto optimality. More recently, it has been argued that a market can be competitive more by reference to its contestability. If there is a real threat of competition, even if the competition is not actualised, then supernormal profits should not, in theory, be generated.

Oligopoly occurs where only a small number of firms contest the market. Their size and share of the market means they are interdependent. If one lowers its prices, it will take share from the others. This dependence encourages collusion, either explicitly in the form of a price-setting cartel or tacitly where unwritten rules exist about not stealing market share. Monopolistic competition exists where many firms compete but offer differentiated products. To an extent, the participants can act independently of each other. Supernormal profits are only possible in the short run. Where does transport fit within such a spectrum and how does society address the implications in the real world marketplace for the former's services? The answers to these interrelated questions provide the *raisons d'etre* for this paper. Their complexity reflects the variety of the conditions within which transport and its various subsectors operate as well as the evolution of society's wider goals, and particularly the almost inevitable tradeoffs it is required to make between economic interests, equity considerations and the needs of the environment.

1.3. Competition: a powerful force in transport

Competition can be a powerful force in transport. However, it will only bring benefits beyond those afforded by the concept of Pareto optimisation if suitably regulated. The twin phenomena of competition and regulation are therefore best considered together. Understanding competition requires an understanding of regulatory regimes, both in theory and in practice.

Competition can only work perfectly if the prices to which the various actors are exposed reflect the true social costs of their operations. In urban transport, for instance, the distortions created by irrational pricing regimes are probably felt most strongly between the different modes -- especially in the undercharging of private vehicles for the use of congested road space.

1.4. Market and intervention failures

While, as long ago as the work of Pigou in 1920, there has been a tendency to treat any externality as a failure in the market process the absence of a price means that there is a propensity to over-consume such things as clean water, unpolluted air or even road space. Such failures may compound external costs. The solution to market failures has traditionally been for governments to intervene in (or, in the extreme case of a control economy, to abandon) the market economy. Equally, if the failures are internal to the market then actions may be taken to limit such things as excessive competition so as to ensure that prices are charged, making consumers aware of their own private costs.

While all regulation in public transport displays a very clear concern for externalities, in only some cases is there an attempt to internalise the externalities. Road pricing is such an example. It aims to place a cost on road congestion and levy that on users of the public highways. This year, road pricing has been introduced into the centre of London where the experiment is being closely watched by metropolitan authorities in other countries. It is already being tried in Singapore, where vehicle density per kilometre is seven times that experienced in the United States.

1.5. Competition and regulation

Even deregulated markets are usually subject to some type of regulation. However, the objectives and form of regulation generally vary markedly even within one country, for instance, between urban areas and other locations, the public transport sector or even one mode. Public intervention and regulation include a wide range of mechanisms used for reducing or counteracting market failure. The main policy instruments are:

– *Competition policy:* across all sectors of the economy to prevent the abuse of monopoly power and uncompetitive practices;
– *Standards:* minimum standards for safety and the environment or access to the sector;
– *Entry controls:* entry to the market can be regulated through the issue of contracts, operator licensing or franchising;
– *Price controls:* maximum fare levels can be set nationally by a regulator or locally by transport authorities in contracts, concessions or licences;
– *Rate of return regulation:* maximum returns on investment or capital can also be used to control market power;
– *Tax concessions/rebates:* intended to reduce operators' costs;
– *Subsidies:* to help provide/enhance service levels beyond those that would be provided commercially, to keep fares below their commercial levels.

There is an important distinction to be made between procurement and regulation. A procurement agency is sometimes, incorrectly, described as the regulator. Whilst in such situations the public authority lays down a number of constraints and requirements, these typically form part of the contract between the two parties, and are not acts of regulation imposed by a third party with no direct interest in the contract.

1.6. Micro- and macro-regulation

In the transport sector, there can be two different types of economic regulation: micro and macro. The purpose of macro-regulation is to prevent one commercial grouping securing so large a share of the market that it can exploit consumers by charging excessive prices or restricting choice and innovation. Micro-regulation relates to individual transport operations. This is the most common form of regulation in urban public transport. At the macro level, regulation may be needed to prevent or limit the abuse of market power. Micro-regulation deals with the conditions under which an operator can take part in a particular market. The sorts of matters that can be subject to regulation include fares and ticketing, provision of information, vehicle types, appearance and standards, routes and areas to be served, minimum/maximum service frequencies and relations with other operators.

1.7. Non-economic regulation

Economic regulation is only one of the forms to which transport operators may be subject. Others may include vehicle safety, professional competence, environmental performance and labour quality and monitoring. Regulation of these can be through the agency which deals with economic regulation or through one or more separate agencies.

Effective competition and regulation also embraces the legal system, policymaking processes and institutional competence. Sufficient technical and financial resources must be available to put policy into action. Regulatory bodies must demonstrate:

- Well-defined objectives;
- Integrity;
- Independence from the public body with ultimate responsibility for determining and resourcing the system;
- Understanding of the market;
- Effective control mechanisms;
- Sufficient resources.

Deficiencies in any of these areas will compromise the ability of the public sector to exercise effective control of competition.

Finally, it should be emphasized that the ultimate regulatory instrument is, of course, public ownership or state control. Typically, publicly-owned public transport has been the norm, until the 1980s, throughout Europe. This has a direct bearing on the manifestations of competition and regulation we can observe in the industry today.

2. THE RELATIONSHIP BETWEEN PUBLIC SECTOR CONTROL, PRIVATE SECTOR OWNERSHIP AND THE NEED FOR REGULATION

2.1. Transport as a regulated sector

Transport is one of the most regulated sectors in any economy, according to Button and Gillingwater (1986). It is generally accepted that, if left to market mechanisms, in many safety and other situations the necessary procedures would prove too cumbersome and the transaction costs would be too high for efficient market solutions to emerge. In contrast, the merits of economic regulation are subject to much more vigorous debate.

Direct ownership of transport facilities has often been justified in terms of their importance to the national or local economy. In continental Europe, this argument manifests itself as a goal to achieve wider social, economic and strategic objectives. In other countries, such as the UK and USA, the role of transport is viewed as being concerned with the simple efficiency of transport provision for its own sake. Direct ownership is still common, however, but justified on the basis that it is the most effective means of achieving internal efficiency.

The focus of intervention in transport in the UK has changed with time. Historically, many of the regulatory controls in the UK were aimed specifically at containing the potential power of railway monopolies, while the inter-war period witnessed controls over highly competitive road-based modes such as buses and road haulage. One of the aims of inter-war legislation was to protect railways against "unfair" competition from road transport. A further goal was the protection of existing bus operators and road hauliers, together with concern over the possibly undesirable consequences of instability in the supply of services. The cross-subsidisation generated by this bus licensing system was in part intended to ensure comprehensive public transport services across the country. This philosophy remains in vogue in Northern Ireland up to the present day.

2.2. The rise and fall of state ownership: a UK perspective

In the UK, post-Second World War policy saw nationalisation of the main transport supply industries, on the grounds that it would improve internal efficiency by facilitating greater co-ordination within and between modes, and afford transport a more central place in developing the country's economy. However, less than two decades later, a further change in direction saw public ownership no longer regarded as necessarily the optimum solution and emphasis was placed on market forces. In this new situation, economic regulation was intended to replicate efficient market outcomes rather than being seen as a straightforward replacement for market processes. More recently, UK governments have tended to withdraw from direct control of transport with the introduction of wide-ranging privatisation. Changes in licensing laws have made market access easier for transport operators (bus, taxi and airline). In terms of infrastructure provision, there has also been greater encouragement for private-sector participation. Nevertheless, comprehensive regulation of rail, including fares, has remained the order of the day, even after privatisation. Moreover, fiscal policies regarding road transport have remained almost unaltered since the 1920s.

When utilities were privatised in the UK in the 1980s, they were often, if not always, sold off at large discounts to their book values. Investors were almost guaranteed to make good returns as the government tried to ensure the success of its privatisation policy (Channells, 1997). But nowadays, for a variety of reasons, new investment in utilities is not seen as anywhere near as attractive. Regulatory price cuts have made the returns slimmer. There is a perception, in the case of rail networks and electricity generation in the UK, that the market has become a lot more risky. In these circumstances, there is now increasing enthusiasm for competition for the market rather than competition within the market.

2.3. Perspectives on regulatory mechanisms

Where one function of regulation is to set prices, a fundamental task facing a new regulatory regime is to decide the form of price control it wishes to adopt. In the United States until relatively recently, the practice was to set a price which would allow the regulated industry to cover its costs and earn a rate of return on its assets sufficient to encourage shareholders to approve new investment. Rate of return or cost-plus pricing regimes suffer from several problems. They do not encourage companies to look for efficiencies since the regulator will confiscate the resultant savings. Indeed, by rewarding investment, the rate of return regime encourages a company to gold-plate its system, i.e. to make unnecessary investments to earn a greater return.

The UK system offers a way round these difficulties through the RPI-X price-capping mechanism. Prices in nominal terms are allowed to increase each year by the rate of inflation less an X percentage figure reflecting expected efficiency gains. Clearly, this implies a real cut in prices on a year-by-year basis. If companies can achieve savings in excess of the X estimate, they can keep them. Every four or five years, prices are reset at a lower figure to capture the efficiency gains for customers -- the so-called P_0 adjustment. Through the RPI-X mechanism, regulated firms are given incentives to find savings but they do not get to keep them beyond the start of the new price-control period.

If it is felt that privatised companies have earned excessive returns, which are due to lax price controls, then governments have the option of imposing windfall taxes. However, the acceptability of such levies depends on their being used sparingly. The alternative to windfall taxes, namely, profit sharing, has some attractions. It reassures consumers that they are not being exploited and it still leaves firms with an admittedly reduced motivation to seek savings.

It should not be forgotten that governments retain an influence in markets served by utilities, not simply to insure against forms of market failure but because responsibility for such services cannot ever be fully outsourced to private companies. A public transport system such as water and electricity is essential to the functioning of society. State-owned bus and train systems can be sold off but governments still “carry the can” if things go badly wrong on a large scale. Furthermore, in a completely free bus market there is a tendency towards oligopolies. Smaller operators may be deterred from entering the market for a number of reasons. They may fear predatory pricing from a bigger rival. The outcome could be a few large companies dominating local markets, raising prices and reducing choice.

Regulation was imposed on the GB railway industry and on the major airports but not on the bus industry. However, it is already clear the regulation is not itself a guarantee of success. The performance of the railways has been a grave disappointment (Wolmar, 1996). But, wherever the blame lies, the resultant market failure has forced government in effect to renationalise and refinance the erstwhile private sector monopoly provider of infrastructure, *Railtrack*. Nevertheless, if regulation cannot prevent economic disaster, the view increasingly gaining currency around the world is that it is an essential tool to oversee those public transport systems which are no longer under the full control of governments.

2.4. Licensing as a regulation tool

Even where direct ownership is not practised, therefore, governments frequently intervene directly to influence both the level of supply and the form of transport service which can be offered. The most common method is through licensing systems. These may be quantitative, placing absolute numbers on the availability of licences; or qualitative, under which there are no limits on the number of licences but acquisition is restricted to those which meet certain defined criteria. Even today, examples of quantitative controls abound in international transport -- for instance, bilateral arrangements limiting aircraft capacity on routes and the number of road hauliers permitted to engage in cross-border activities.

Quality controls are, in fact, far more common than quantity constraints. For instance, design, safety and maintenance standards for vehicles are increasingly applied on an international basis. Bodies such as the EC, the OECD and the UN Economic Commission for Europe are responsible for introducing minimum standards across a range of countries.

Quantitative and qualitative regulation are not mutually exclusive. Severe qualitative entry requirements in both the USA and the UK in the 1930s, limiting market entry to prevent excessive competition, also allowed incumbents to earn sufficient profits to maintain safe vehicles and pursue safe operating practices. Direct control is often employed to influence the way transport operates, for instance, the designation of traffic lanes for the exclusive use of buses, taxis and bicycles. Intervention of the sort just mentioned emphasizes the supply side. However, government intervention may also influence demand through advertising or both supply and demand via fiscal measures.

Government intervention via cross-subsidies, both between modes and across services by individual modes, is also common and generally enforced through combinations of price controls and licence allocation systems. Under such arrangements, typically, operating licences are granted to operate profitable services only if the supplier agrees to provide financially unattractive ones. While most examples of this have been withdrawn in the UK, Northern Ireland's state-owned bus services continue to be regulated in this manner.

2.5. Packages and the State as Final Arbiter

Measures intended to limit potential or actual abuses among monopoly suppliers are typically most effective in those transport sectors/modes exhibiting economies of scale, scope and density. Laws governing wage levels or working practices can inhibit the deployment of labour-intensive transport or promote capital-intensive forms. It should be noted, however, that most intervention takes the form of policy packages, which embrace a variety of the instruments outlined above.

As we noted above, the most intensive regulatory instrument is, of course, public ownership or state control. This is illustrated most graphically in the *de facto* re-nationalisation of Britain's former privately-owned rail infrastructure provider, in the guise of the not-for-profit body, *Network Rail*.

3. OVERVIEW OF PATTERNS OF CONTROL AND REGULATION IN ECMT MEMBER AND OBSERVER COUNTRIES

3.1. Overview

The last fifty years have witnessed much change in both the patterns of control in and regulation of the transport sector. However, the nature of those changes together with their pace has not been uniform across the member countries of the ECMT, let alone the observer countries. The OECD's own International Regulation Database offers a comprehensive and internationally comparable set of information about the state of regulatory and market environments generally, in OECD countries for the late 1990s, as well as sector-specific regulations, regulatory settings and industry or market structures governing, for instance, the transport sector -- including road freight, air passenger travel and rail. This lack of uniformity is true even for individual states where, for instance in the case of the UK, radically different forms of control and regulation of public transport exist within what had been until the late 1990s a very centralised, unitary state.

Despite this apparent trend toward market liberalisation, direct ownership of transport facilities by government continues to be exercised at various levels of government in almost every ECMT member state and many of the observer countries. For instance, while there are some privately-owned roads, most national road systems are publicly owned. Most railway companies are also publicly owned, while airports and ports are generally publicly owned either at the national or local level. The continued dominance of the State and the maintenance of largely monopoly conditions in that industry are well demonstrated by the characteristics of individual countries given in Tables 1-3. The UK is an exception to this. Operational/mobile assets are typically owned by the private sector. Table 4 provides a summary of the range of regulatory instruments employed in the rail industry in ECMT member states and observer countries. Table 5 illustrates the variety of conditions of entry into the rail sector in various countries.

Table 1. **Rail Transport: Control held by national, state or provincial government**

Country	RAILWAYS	
	National, state or provincial government equity stakes in business company	**National, state or provincial laws/ other regulatory restrictions on number of competitors allowed to operate a business**
EC	-	-
USA	Y	Y
Japan	Y	Y
Germany	Y	N
France	Y	Y
Italy	Y	Y
UK	N	Y
Canada	Y	-
Australia	Y	Y
Austria	Y	Y
Belgium	Y	Y
Denmark	Y	Y
Finland	Y	Y
Greece	Y	Y
Iceland	-	-
Ireland	Y	Y
Luxembourg	-	-
Mexico	Y	N
Netherlands	Y	Y
N. Zealand	N	N
Norway	Y	Y
Portugal	Y	Y
Spain	Y	Y
Sweden	Y	Y
Switzerland	Y	Y
Turkey	Y	Y
Czech Rep.	Y	N
Hungary	Y	Y
Korea	N	N
Poland	Y	Y
OECD-e	24/27 Y	21/26 Y
g7-e	6/7 Y	5/6 Y
ue-e	12/14 Y	10/14 Y

Source: OECD.

Table 2. **Rail Passenger Transport: Operators**

Country	PASSENGER TRANSPORT		
	Total number of operators	**Market share (pax/km) of largest operator**	**Max. no. of operators competing in same area**
EC	-	-	-
USA	1	100	1
Japan	121	32.1 (1995)	10
Germany	1	100 (59066 Mio pax/km)	1
France	1	100	1
Italy	1 national/27 local	97	1
UK	25	-	-
Canada	5	1,4 $ billion (revenues)	1
Australia	-	-	-
Austria	-	-	-
Belgium	1 (1990 = 1)	100	1 (1990 = 1)
Denmark	1	100	1
Finland	1 (1990 = 1)	100	1 (1990 = 1)
Greece	1	100	-
Iceland	-	-	-
Ireland	1 (1990 = 1)	100	1 (1990 = 1)
Luxembourg	-	-	-
Mexico	5	90	1
Netherlands	2	99.9	-
N. Zealand	2	-	-
Norway	2	90	2
Portugal	1 (1990 = 1)	100	(1990 = 1)
Spain	6 (1990 = 6)	93 (1997)	2 (1990 = 2)
Sweden	3	97	1
Switzerland	54 (inc. f't) (1990 = 57 inc. f't)	12485 Mio pax/km	No comp. In 98 (comp. In 99) (1990 = 1)
Turkey	1 (1990 = 1)	100	None (1990 = None)
Czech Rep.	4 (1990 = 1)	99.5	1 (1990 = 1)
Hungary	2 (1990 = 2)	95	1 (1990 = 1)
Korea	1	100	1
Poland	1 (1990 = 1)	100	1 (1990 = 1)
OECD-e	-	-	-
g7-e	-	-	-
ue-e	-	-	-

Source: OECD.

Table 3. **Rail Freight Transport: Operators**

Country	FREIGHT TRANSPORT		
	Total number of operators	**Market share (tonne/km) of largest operator**	**Max. number of operators competing in same area**
EC	-	-	-
USA	570	-	-
Japan	1	98.4 (1995)	1
Germany	1	100 (72388 Mio pax/km)	1
France	1	100	1
Italy	1 national/27 local	97	1
UK	4	-	-
Canada	54	156$ billion (revenues)	3
Australia	-	-	-
Austria	-	-	-
Belgium	1 (1990 = 1)	100	1 (1990 = 1)
Denmark	2	100	-
Finland	1 (1990 = 1)	100	1 (1990 = 1)
Greece	1	100	-
Iceland	-	-	-
Ireland	1 (1990 = 1)	100	1 (1990 = 1)
Luxembourg	-	-	-
Mexico	10	45	2
Netherlands	5-10 (5-10)	-	-
N. Zealand	-	-	-
Norway	2	85	0
Portugal	1 (1990 = 1)	100	(1990 = 1)
Spain	4 (1990 = 4)	96 (1997)	2 (1990 = 2)
Sweden	8	79	5
Switzerland	3	8738 Mio tonnes/km	No comp. in 98 (comp. in 99) (1990 = 1)
Turkey	1 (1990 = 1)	100	None (1990 = None)
Czech Rep.	6 (1990 = 1)	99	2 or 3 (1990 = 1)
Hungary	2 (1990 = 2)	90	1 (1990 = 1)
Korea	1	100	1
Poland	18 (1990 = 1)	-	18 (1990 = 1)
OECD-e	-	-	-
g7-e	-	-	-
ue-e	-	-	-

Source: OECD.

Table 4. **Rail Transport: Mode of Regulation**

Country	**MODE OF REGULATION**		
	Infrastructure	**Passenger**	**Freight**
EC	-	-	-
USA	-	-	-
Japan	1	1	2
Germany	8	10	10
France	5	11	10
Italy	3	3	3
UK	5	5	5
Canada	8	8	-
Australia	-	-	-
Austria	-	-	-
Belgium	-	-	-
Denmark	9	-	10
Finland	10	10	10
Greece	-	-	-
Iceland	-	-	-
Ireland	6	4	6
Luxembourg	-	-	-
Mexico	10	2	2
Netherlands	7	7	7
New Zealand	-	-	-
Norway	-	-	-
Portugal	3	4	-
Spain	8	8	8
Sweden	-	9	9
Switzerland	5	5	11
Turkey	-	12	12
Czech Republic	5	2	10
Hungary	-	13	-
Korea	-	2	2
Poland	8	8	8

1. Prices set by operator but need to be approved by regulator (regulation applies to the incumbent PTO).
2. Prices set by operator but need to be approved by regulator (regulation applies to all operators).
3. Prices set by operator but need to be approved by regulator.
4. Prices set by operator but subject to restrictions.
5. Prices/tariffs set by regulator (regulation applies to all operators).
6. Government exercises control over standard-fare increases.
7. Regulation of some prices (regulation applies to all operators.
8. Other (regulation applies to all operators).
9. Other.
10. No regulation.
11. Prices set by regulator.
12. Other (regulation applies to the incumbent PTO).
13. Prices set by regulator (regulation applies to the incumbent PTO).

Source: OECD.

Table 5. **Rail: Legal Conditions of Entry**

Country	LEGAL CONDITIONS OF ENTRY		
	Infrastructure	**Passenger**	**Freight**
EC	-	-	-
USA	1	1	1
Japan	-	2	2
Germany	-	2	2
France	3	3	3
Italy	3	3	3
UK	-	4	-
Canada	-	-	-
Australia	-	-	-
Austria	-	-	-
Belgium	6	6	6
Denmark	-	4	2
Finland	-	3	3
Greece	-	2	2
Iceland	-	-	-
Ireland	6	6	6
Luxembourg	-	-	-
Mexico	2	2	2
Netherlands	2	2	2
New Zealand	-	-	-
Norway	-	-	-
Portugal	7	8	7
Spain	-	5	5
Sweden	-	-	-
Switzerland	9	9	9
Turkey	7	7	7
Czech Republic	2	2	2
Hungary	3	2	2
Korea	3	3	3
Poland	2	2	2
OECD-e	-	-	-
g7-e	-	-	-
ue-e	-	-	-

1.Not available.
2.Free entry upon paying access fees.
3.Franchised to single firms.
4.Franchised to single firms with open tendering.
5.Franchised to single/several firms.
6.Directive CEE (91/440/CEE).
7.State monopoly.
8.Open tendering.
*9.*Concession.

Source: OECD.

Air transport in general is increasingly in the hands of the private sector. At the local level, public transport is often provided directly by urban authorities. Cars and the lorry, are, however, almost always privately owned. While this overview of OECD members gives some indication of the variety of matters relating to transport regulation and control, it is pertinent to consider a number of subsectors of transport in more depth. A significant and complex area is that of urban and local transport. We will return to consider this subsector below.

The relationships between national states and supra-national bodies might also be expected to play a role in the emergence of patterns of control and regulatory frameworks. The current situation, certainly within the European Union, owes its origins to the tensions exhibited between the European Union and individual member states in the development of a Common Transport Policy.

3.2. Transport policy developments in Western Europe, from the Treaty of Rome to today

A Common Transport Policy has been a fundamental element in the integration of Europe ever since the formation of the European Economic Community (EEC), the precursor of the European Community (EC) and today's European Union (EU). At that time, almost all transport of goods and passengers within the six Member States was protected from international competition.

Road freight across frontiers was subject to strict quotas. International trains carried both passengers and freight, but there was no competition between the various national operators, each of which enjoyed a monopoly on its own tracks. Cross-frontier freight trains were operated under the Bern Convention of 1890, with the revenues shared out among the railway companies in proportion to usage. A parallel convention for passenger travel was signed in 1924. For air transport, duopolies pervaded under bilateral treaties which allowed the business to be shared equally between the national airlines at either end of each international route. Ironically, the only significant transport market open to international competition was river traffic on the Rhine, where a regime dating back to the Congress of Vienna (1815) provided for freedom of navigation under the authority of a Commission.

The Spaak Report (1956) identified the elements of transport policy which would need to be covered in the 1957 Treaty of Rome:

– The charging of all passengers or freight at the same price for the same journey within the common market;
– The development and financing of infrastructure investment;
– The formulation of a common transport policy.

Agreement was quickly reached on the principle of non-discriminatory pricing (Article 79). For infrastructure investment, it was decided to rely on the general provisions of the Treaty, modified only in 1994 by the Treaty of Maastricht. However, agreement was not reached on the principles which "should underlie a common transport policy within the EEC (Abbati, 1987: 29-33)." Of the six original EC members, the Dutch, with support from Belgium and Luxembourg, favoured liberal, market-driven policies. Conversely, France, Germany and Italy opted for a Common Transport Policy, which would allow wide-ranging state intervention.

The transport articles of the Treaty of Rome reflected a compromise. They required the Member States to pursue the objectives of the Treaty within the framework of a common transport policy. However, there was plenty of scope for differing interpretations of what constituted appropriate implementation measures. There was reluctance among many EEC states to address the implications of competition in the transport market, probably because transport is held to be a public service, or that unrestrained competition is regarded as leading inevitably to an uneconomic use of resources. The uneasy balance between liberal and interventionist policies is reflected in the basic arguments against subsidy and the various exceptions to this principle which were deemed acceptable.

Most Member States appeared to view the transport articles as a defence against the general provisions of the Treaty, governing such matters as competition, state aids and the freedom to provide services. An effective veto was provided by the requirement for unanimous voting under Article 75(3) *"where the application of provisions concerning the principles of the regulatory system for transport would be liable to have a serious effect on the standard of living and on employment in certain areas and on the operation of transport facilities."* The application of the Treaty to sea and air transport in particular was even more problematic.

After some 25 years of ineffective action towards establishment of a Common Transport Policy, the European Court of Justice (ECJ) ruled that, in the absence of a common transport policy duly laid down by the Council, the general provisions of the Treaty, which include the freedom to provide services, should be held to apply to transport (European Court of Justice, Case 13/83). The implication of this was that largely unregulated competition should apply to transport. In the wake of this judgement, the Council of Ministers finally got round to formulating an embryonic Common Transport Policy.

Over the last two decades and more, road infrastructure, while typically remaining a public monopoly, has tended in some countries to be restructured from a government department to a public sector company/agency. However, in many EU states, including Spain, France and Italy, the private sector has played a substantial role for many years.

The European Court of Justice (ECJ) ruling had also been preceded by Directive 91/440, which introduced a limited form of open access for international rail services and required the separation of accounts for rail operations and rail infrastructure. Directives 95/18 on rail operator licensing, and 95/19 on rail infrastructure access and pricing, followed this. Expansion of open access was envisaged by the Railways White Paper (European Commission, 1996). Also over the last two decades, while generally remaining a public monopoly, rail infrastructure has tended to be restructured from government department to public sector company. With respect to rail operations, a similar change can be observed as for infrastructure. Operations remained monopolised except in Great Britain and, to a lesser extent, Sweden, the Netherlands and Germany (Link, 2000).

In the interurban road passenger transport sector, there are a large number of providers of regular and irregular services exhibiting features of monopolistic competition. Mixed ownership is important in that the coaching subsidiaries of state-owned rail and municipally-owned bus companies are important players. Regular express coach services are most important in Great Britain and Sweden. Regulation 12/98 introduced cabotage for regular coach services by June 1999. This followed earlier measures covering tourist services.

With reference to urban and local public transport, the industry has tended to remain serviced by local monopolies but with a change from government department to public sector company. The "classic" model of regulated, publicly-owned monopolies remains the dominant organisational form in most Member States but with a number, including the Netherlands and Germany, preparing for substantial change, particularly for bus services. Regulation 1893/91 sets out procedures for public service contracts. This represents a refinement of Regulation 1191/69 on public service obligations. These developments were reinforced by the Citizens' Network Green Paper, which provided for application of standard European procurement legislation (European Commission, 1995). Proposed revisions to 1893/91 seek to extend contracting-out and sub-contracting to the bus market and, to a lesser extent, the urban rail market (European Commission, 2000).

3.3. Beyond the European Union

In virtually all countries, government directly controls the provision and access to major parts of the infrastructure. While there are some privately-owned roads, the majority of most national road systems are centrally owned. This even extends to countries such as the USA, where public ownership in other sectors is very limited. Many railway concerns are also nationalised -- the major exceptions being the USA and Japan -- while airports and ports are generally publicly owned either at the national or local level.

While the American tradition is to follow the market for the transportation sector, government strongly influences virtually every aspect of transportation. Federal, state, local and special purpose governmental agencies all play major roles in the provision of transportation infrastructure. For these facilities, government is often responsible for planning, design, financing and construction, along with operations and maintenance. In other cases (e.g. many air and water port terminals), private-sector interests play partnership roles.

Federal, state and local governments are also involved in the provision of transportation services, both indirectly -- as organisers, financiers and subsidisers -- and directly, as operators. The US Federal Government has been involved in such ventures as the St. Lawrence Seaway Development Corporation and Amtrak, the Federal Government-established rail passenger service corporation. States sometimes participate with Amtrak in the operation of intercity rail.

In addition to providing transport services and infrastructure, various levels of government also regulate the sector in a variety of ways. The trend since the Second World War, at all levels of government, has been towards an increase in both the economic/social and environmental regulation of transportation. Regulation of transportation's social and environmental impacts at both federal and state levels grew rapidly in the 1960s and 70s. This form of regulation has been called into question in recent years.

Economic regulation, however, is where most liberalisation has taken place in recent decades, arising in part from concerns about inefficiencies and cross-subsidies resulting from economic regulatory practices. Partial federal deregulation activities have occurred in the air, rail, lorry and intercity bus industries. In several cases, federal deregulation was accompanied by restrictions on state regulation, while some states reduced regulation on their own initiative during the same period.

3.4. Urban and local transport: A case study on patterns of regulation and competition

3.4.1. The competition spectrum

Urban and local transport provides some of the greatest challenges to policymakers in both developed and developing countries. It is recognised that distortions in the marketplace for transport in cities do create a requirement for a variety of interventions to be available to "managers" of the system, not only if a pareto efficiency objective is to be achieved but also where wider economic, social and environmental challenges are to be addressed. These interventions encompass measures to regulate the market for road space, either by physical measures, legal controls or nascent market mechanisms, as well as through a variety of regulatory and control measures relating to public transport. Such interventions are intended to have an impact on both operations and supply generally, as well as on demand, specifically modal split. Table 6 provides an overview of regulation in selected ECMT and observer states.

Table 6. **Local and urban transport: Overview of regulation by country**

COUNTRY	REGULATION/OWNERSHIP
Austria	Municipal undertaking and some private operators
Belgium	Bus/Light Rail/Tram provided by regional, publicly-owned undertaking
Czech Rep.	Bus/Trolleybus/Tram provided by municipal undertaking
Denmark	Bus service provided by municipal undertaking. Limited local train services
Estonia	Bus/Trolleybus/Tram services operated by separate municipal undertakings, co-ordinated by DoT. Suburban rail: Estonia Rail
Finland	Bus/Metro/Tram operated by city transport. Five private bus companies and one municipally owned provide services under contract. Ferry services joint owned by city & state Rail: State Hybrid System
Lithuania	Some bus services contracted from private operators
France	Hybrid system, some bus/trolley-bus services operated under contract concession held by subsidiaries of national companies. Some cities operate private services. Rail provided by state railway
Germany	Hybrid systems in place. Public transport provided by municipal authority, some private bus operators
Greece	Bus operated under contract concession held by subsidiary of national company light rail Urban Community of Bordeaux: operated as concession by Transport for the urban community of Bordeaux
Hungary	Bus/trolleybus/tram/ railway and metro operated by former municipal undertaking, Commuter Rail Services by Hungarian Railways (MAV)
Iceland	Bus/trolleybus/tram/light rail/regional metro S-Bahn all provided by various LA undertakings and German Rail, are co-ordinated at regional level by VRR
Ireland	Bus/suburban rail operated by autonomous divisions of state transport, responsible to Department of Public Enterprise. Light Rail – **current status??**
Latvia	Bus/Trolleybus/Tram operated by separate companies. Co-ordinated by Municipal Authority Suburban services by State Rail
Lithuania	Bus/Trolleybus operated by municipally-owned companies with additional private bus operations
Italy	Municipal undertaking and some private operators
Luxembourg	Bus provided by municipal authority with some independent operators Rail Services by Luxembourg Railways (CFN)
Netherlands	Mostly municipal undertaking and bus: regional bus undertakings, state railway
Norway	Bus/trolleybus services in inner city provided by municipal undertaking working with private bus companies serving suburban areas
Poland	Bus and tram provided by municipal undertaking, suburban rail services operated by state
Portugal	Municipal authority controlled by board responsible to central government
Spain	Public transport operated by city-controlled authorities under a common municipal directorate. Suburban rail run by regionally-owned public company FGC, other services, national railways
Sweden	Public transport services managed by city planning authority with bus/rail operations contracted out to private companies
Switzerland	Public transport provided by municipal undertaking, private operations
Turkey	Bus and underground rail operated by municipal authority; controlled by board responsible to central government, contract some bus services
UK	Hybrid mix
USA	Services operated by transport authority serving wide area, some contracted services

Source: Material drawn from *Janes Urban Transport Systems,* 2001.

In the case of public transport on the supply side, the trend has been to improve cost efficiency, in many cases through the progressive introduction of forms of competition. The competition spectrum encompasses a number of regulatory regimes, ranging from deregulated through limited competition to fully regulated, under which a monopolistic (normally publicly-owned) company is charged with the operation of the system. Under such an arrangement the only forms of competitive pressure are indirect.

The **Deregulated Free Market Model** is the dominant form in the UK outside London. Even here, however, socially necessary services are provided on the basis of a competitive tendering process. Under the **Deregulated or Open Marke**t, no restrictions apply to transport operators, except those imposed by general law on business practices, vehicle construction and use and highways and traffic matters.

Limited Competition models embrace a number of alternatives. Under both a tendering and in a franchising system, potential operators bid for the right to operate in a certain area for a specific time period according to clearly defined contractual rules. The main difference between tendering and franchising tends to be the larger scope for the operators (winning bidder) to modify the product or production size under a franchising agreement. Also, on average, a franchising agreement will impose more risks on the operator than a tendering contract. Thus, in a tendering situation, the operator produces what has been asked for, while in a franchising situation the operator behaves more like an entrepreneur, while still following a number of ground rules which have been agreed upon at the letting of the contract. A further distinction can also be drawn between franchises and concessions:

– **Franchise**: In franchising arrangements, the franchisee is granted an exclusive right, usually as a result of a competition, to provide a service, which meets a number of quantity, quality, and price standards laid down by the authority.
– **Concession:** Again, these involve the granting of an exclusive right to provide a service but without payment by the authority, although the authority may attach conditions such as maximum fares or minimum service requirements.

Franchises can take a number of forms:

– *Total franchises* include both the operation and provision of necessary infrastructure/rolling stock;
– *Operations franchises* exist where the franchisee operates the system, but with rolling stock and infrastructure provided by the franchisor, normally a public authority also responsible for the planning and financing of public transport;
– *Management franchises* occur where a public body is responsible financially for both operation and for rolling stock/infrastructure, but where an outside franchisee provides the necessary management competence for the operation of the system;
– *Planning franchises* operate where there is public operation, and infrastructure and rolling stock are owned by the same authority, but where the planning of the system is done by a franchise.

Of these four alternative systems, the first two are the most common. Substantial use of franchising systems is to be found in Scandinavia, France and London, in addition to examples in Switzerland and Spain.

The most common Limited Competition Models are: the so-called Scandinavian model, based on minimum cost tenders at a route level and represented in Denmark, Finland and Sweden, with a variant in Norway; and the French model, based on network management contracts. However, the systems in Scandinavia and France are different in organisational structure. Scandinavia has chosen to use total tenders or franchises, implying that the operator also owns the rolling stock and facilities for maintenance. In France, the most common type of franchising arrangement is an operating franchise, where a public transport organisation owns the rolling stock and other infrastructure and leases this out to the operating companies, of which the dominant ones are private. While franchising in France is not new, over the last twenty years or so, legislative changes now provide for local public transport system construction and the creation of public/private partnerships. Clearly, these are most relevant for new, rail-based transport systems.

Public Monopoly: In this regime, transport operations are provided exclusively by one operator. That operator will often be the public agency itself or another public corporation but can also be a privately-owned enterprise. Regulated, publicly-owned monopolies are the dominant organisational form in 10 EU Member States: Austria, Belgium, Denmark, Greece, Italy, Luxembourg, The Netherlands, Portugal, the Republic of Ireland and Spain. However, it is worth noting that even in these countries there can be some variations or fundamental differences from the dominant model. Northern Ireland is now the only significant region of the UK that continues to employ a wholly publicly-owned monopoly model, so widely retained elsewhere in Europe.

Licensing can be employed as a surrogate for more explicit regulation. This is reflected in a number of restrictions on market access and service delivery:

– **Quantity Licensing**: The number of vehicles allowed to operate a defined type of service, or in a defined area, is limited by the authority. Where quantity licensing is practised, this will usually be on top of a form of quality licensing.
– **Quality Licensing:** Operating a public transport service is allowed by anyone receiving a licence and complying with any conditions attached to it.

3.4.2. Contracts, risk and responsibilities

The limited competition model is characterised in a range of contractual forms. An important element is the allocation of financial risks between buyer and seller, because some allocations can be more expensive than others. Two types of risks can be distinguished in the situation where a government agency orders public transport services from a supplier:

– Production risk: risk associated with the production costs of a fixed production quantity, independent of the number of passengers;
– Revenue risk: risk associated with the sale of transport services.

These risks can be allocated in different ways. *Subsidy contracts* result in the operator taking both the revenue and the production cost risk. This is the dominant form of tendering used for socially necessary services in the English Metropolitan areas. *Cost contracts* result in the operator taking the production cost risk and the authority the revenue risk. This is the dominant form of tendering used for socially necessary services in the non-Metropolitan areas. Examples of what might be termed "*hybrid*" *contracts*, where risks are shared between operators and authorities, are to be found in Australia and Sweden. Under *management contracts*, common in France, risks are borne by the authority.

The different possible allocations of risks give rise to the following types of contracts:

– ***Gross Cost Service Contracts*** involve a public authority procuring services from another party, without the operator taking any direct commercial responsibility for the overall financial performance of the service. The operator is responsible for meeting his cost targets. Usually the services will be procured through competitive tendering amongst a number of private operators, but can involve publicly-owned operators, and contracts may be negotiated. In this type of contract, the production risk is borne by a transport company while the revenue risk is borne by the tendering authority. Revenues accrue to the tendering authority.

– ***Net Cost Service Contracts*** are similar to gross cost contracts, except that the operator is responsible for the revenues from the service as well as the costs of providing it and, as such, is responsible for the overall commercial performance of the service. In this contract, the transport company bears both production and revenue risks. The difference between anticipated total operating costs and revenues determines the price the tendering authority pays to the transport company. In London, route-based tendering, both gross cost and net cost, has been implemented.

– Under ***Management Contracts,*** the operational assets are usually owned by the (public authority) client. The operator is responsible for the management of the operations, possibly including service specification within agreed parameters. Whilst the contractor does not own the assets, he may be responsible for their procurement and maintenance to agreed standards as well as negotiating wages and conditions for labour. The performance responsibility for a management contractor may cover a combination of production costs, service quality, ridership and overall financial performance. The management contract is the direct opposite of the net cost contract, with the tendering authority instead of the transport company bearing both production and revenue risks. Apart from these three types of contract, all kinds of variants are possible. The success of contracts will be determined by the incentive structures, including those incorporated in the contract and those provided by other regulatory instruments.

4. AN OVERVIEW OF THE REFORM OF CONTROL AND REGULATION IN URBAN AND LOCAL TRANSPORT IN CENTRAL AND EASTERN EUROPE

When the countries of Central and Eastern Europe abandoned communism in the late twentieth century, it was with the intention of adopting some form of market economy. But what kind? The decision did not necessarily commit governments to switch to a fully deregulated, privatised system along the lines of the Washington Consensus. Nor did it imply they would embrace an approach favoured by Western European states in the fifties and sixties, and characterised by massive intervention in the economy and direct control of all major public utilities.

While the evolution from state-run to market economy is far from complete in Eastern Europe, there is already clear evidence of a difference in the treatment of some industries compared with others. For instance, in telecommunications, some countries have not only opened up their markets to competition, they have also allowed foreign companies to take over huge market shares. On the other hand, there has been resistance to radical change in the field of transport.

The position in relation to the transport sector might be characterised as a struggle between the forces of restructuring and inertia inherited from the erstwhile communist system. Inappropriate, inherited investment programmes, poor infrastructure maintenance and continued reliance on less advanced technology, poor working conditions and skills development, neglect of environmental concerns, fiscal and financial problems and organisational obstacles, in particular between a public sector unwilling to give up control and an emergent private sector, continue to hold up reform and progress.

The effect of political and economic restructuring on transport has been reflected in the development of new networks and links, adoption of new technology from the West and upgrading of infrastructure, together with new management and organisational structures, although the extent and rate of change has not been uniform in the transport system or between states. Thus, while the airline industry appears to be in transition to the private sector, there is no move to privatise the railways. Likewise, large parts of the bus system remain under public control. Here, different countries have taken different approaches.

In Poland, the former national bus company, PKS, has to compete with Polski Express, a company owned by the British bus firm, National Express. Regulation of Polski Express is provided by PKS and the Transport Ministry. Significantly, bus schedules for both operators are co-ordinated by a regulator based within PKS. In the Czech Republic, the bus system is almost wholly privatised. By contrast in Slovakia, where the buses were once run by the former national Czechoslovakian transport company, CSAD, most of the system remains in state hands. In Hungary there is enthusiasm for the involvement of the private sector, but progress has been slower.

In major cities such as Bucharest, Sofia and Budapest, control over public transport lies with the municipal authorities. Even in a smaller city like Tallinn in Estonia, which has a privately-owned bus company, it is quite small in comparison with the city-owned operator. MRP Linide Ltd has 29 buses, less than a tenth of the number of its public rival, the Tallinn Bus Company.

In Sofia, a city with 1.2 million permanent residents, and students and foreign workers who bring the number up to 1.4 million, responsibility for trams, trolleys, buses and the metro lies with Mass Urban Public Transport, MPUT, a municipally-run organisation with a hundred-year history. The Municipal Council in effect directs MPUT, approving budgets which include revenue support and fare policies. In 2001, the municipality provided operators with a third of their total revenues. However, the city authority stressed this compensation was not a subsidy but represented the cash needed to cover free travel for pensioners and discounted fares for others, including students. MPUT is having to contend with more congested roads. The number of cars in the city increased fourfold during the 1990s. However, around 85 per cent of people still travel with MPUT.

In Budapest prior to 1990, the State used to provide two-thirds of the operating costs of the Budapest Transport Company (BKV), the operator of all urban transit services, with fares supplying the remainder. Three-quarters of all trips were made by public transport. In 1990, ownership pf BKV passed to the Municipality. At the same time, budgets were constricted. On top of this, the Government prevented fare increases. The outcome was a drop in the quality of service. As the economy improved, car use increased along with congestion. Inevitably, ridership fell. The Government has withdrawn its subsidy of BKV, although it does cover the cost of discounted fares to students and pensioners. Despite the decline in passengers levelling off, BKV is not recovering enough money to cover its costs, leading to a further decline in its assets.

In Bucharest, with a population of two million, the main operators are RATB, which runs surface public transport on behalf of the municipality, and METROREX, which operates the underground railway at the behest of the Ministry of Transport. The city does not have an independent public transport authority. RATB is highly subsidised. Between 1990 and 1995, the municipal subsidy accounted for three-quarters of total revenues. It seems unlikely that this level of subsidy will be maintained. In recent times the quality of service, including the speed of public transport, has been declining, partly as a result of increasing traffic and partly because of the poor state of the infrastructure.

Tallinn is unusual in having a private bus operator, albeit operating on a small scale. But the city which owns the two major transport operators faces the problems common to other capitals: falling ridership, loss of government support and the prospect of its public transport system becoming a marginalised service for low-income groups only.

At the same time as they are losing custom, many operators in these and other cities in Eastern Europe are being required to be more cost-effective, which inevitably includes the notion of doing more for less. While this discipline can be beneficial, it can also lead to a spiral of decline as loss-making services are cut, leading to a loss of custom and generating further cuts in service.

From this snapshot, it is quite apparent that state and city authorities remain in charge over the bulk of surface transport within the region. Some commentators, like Sturm (2000), clearly favour a greater relaxation of state control, while acknowledging that the present approach enjoys majority support with the region. That approach is characterised not so much by the application of old-style socialist principles as by a high degree of state control, some of it centralised, some decentralised. It is to be interpreted, not so much as support for the former *status quo*, as a means of securing the aims of social policy through regulation and state intervention. In that respect it is broadly similar to those Western European countries which accept the same philosophy and have yet to go down the road of full-scale privatisation and deregulation, and perhaps never will.

Nevertheless, there are significant differences between East and West. By and large, in the East much regulation of transport remains under direct political control, in contrast with the West, where responsibility is undertaken by independent regulatory agencies or by civil servants, albeit operating themselves under political direction. In Poland, the Czech Republic and Slovakia, regulation of transport is the joint responsibility of the transport industry, the finance industry and privatisation offices or ministries. In Hungary, the transport ministry relies on a newly-constituted transport authority for its decisionmaking. In none of the four countries is there an independent regulatory agency, even though some degree of privatisation has occurred in the region. Such arrangements appear to reflect a suspicion within the political class that public administrators continue to need direction at the tactical level. Ministers have not yet reached the point where they are comfortable with simply giving regulators or civil servants a clear remit at the strategic level and then letting them get on with the job.

It might have been expected that the eastern countries would have looked for inspiration to the West as they reformed their transport systems. And indeed, the Czech Republic, Slovakia, Poland and Hungary drew on the experience of their neighbouring market economies in the field of regulation. It is somewhat surprising that there has been little evidence of an organised exchange of information between the four countries. Moreover, following the accession of the four countries into the EU, European directives are a main guiding factor for national legislation in the transport sector.

5. COMPETITION FOR THE MARKET *VS.* COMPETITION IN THE MARKET: THE EMERGENCE OF COMPETITIVE TENDERING AS THE PREFERRED OPTION FOR URBAN AND LOCAL TRANSPORT

5.1. Strengths and weaknesses of alternative regulatory and control frameworks for local transport

This competition spectrum can be divided into two main types. The first involves the granting of an exclusive right to an operator to provide services, i.e. competition for the market. The second involves no such exclusivity and allows operators to compete in the market. However, as we have noted above, there can be considerable variation in practice within each of these categories. Similarly, their potential to afford efficiency objectives or wider societal goals ranges significantly, and each has its advocates and detractors.

Established theory would suggest that private firms are likely to be more effective in maximising profits due to a variety of financial, market and intervention incentives, provided by takeover constraints, bankruptcy constraints, shareholder monitoring and lack of interference from politicians and civil servants. The EU ISOTOPE study demonstrated the financial effectiveness of deregulated systems. On average, they reported covering 85 per cent of costs, compared to 47 per cent for both limited competition and regulated markets. However, this does not necessarily signify efficiency. In terms of labour productivity, the best performance was achieved by the limited competition systems, where vehicle-kms per member of staff are 8 per cent higher than in deregulated markets and 18 per cent higher than in regulated markets, although this may reflect variations in input prices including labour costs. This may indicate that subsidies are too low in deregulated markets. In terms of cost efficiency, the costs per vehicle-km for deregulated systems are 52 per cent less than those for regulated systems and 36 per cent lower than those for limited competition systems. The main reason for the poor record of deregulated services seems to be that, without exclusive rights, service patterns are unstable and levels of integration are low.

Competitively tendered franchises typically address two different purposes: the control aim and the efficiency aim. The control aim is reflected in a planned system under which transport authorities define route structures, fares and the overall structure of the public transport system. The control role reflects social welfare objectives. The efficiency role seeks to create a more efficient public transport system, both as regards internal efficiency (x-efficiency) and allocative efficiency.

These two roles can be conflicting. Systems that maximise net social benefits frequently do not give the most internally efficient public transport system. Case study evidence suggests that profit maximisation can reduce net economic benefits by between 44 per cent and 54 per cent compared to perfect planning. In contrast, there is evidence to suggest that, in certain instances, open access (competition-in-the-market) may increase net social benefit when it leads to new services or new pricing structures. In contrast, competition tends to reduce net social benefit when it leads to duplication of services or excessive price wars. However, public intervention of some sort is likely to be required to maximise welfare due to user economies of scale (user benefit from increased service levels) and second-best arguments (subsidy required to offset the impact of congestion, accidents and environmental pollution by cars).

Competitive tendering has produced quality public transport service. Audits in Los Angeles and Denver found competitively-tendered services to be equal to or better than publicly-operated services. London Transport found that a competitively-tendered service was generally of higher quality, including those provided by the public operator. Competitively-tendered services have also been evaluated as equal to or better than non-competitive services in Copenhagen and Stockholm.

Issues also arise over the form of contract and selection of preferred bidder. Competitive tendering may be the most appropriate selection method for operational-level decisions but may be less appropriate for tactical- and strategic-level decisions. Net-subsidy contracts should be more efficient than full-cost contracts, but this assumes perfect knowledge and/or risk neutrality, neither of which is likely to apply in real-life situations. Some of these problems and other issues related to mobile and fixed assets can generate barriers to competition (Banister *et al.*, 1992b). It has been strongly argued that tenders covering both operations and provision and upkeep of assets favour the incumbents. This is particularly true at the time of renewal of franchises. If heavy capital costs are involved, this favours the use of operation franchises like those in France. More evidence is required on these matters.

Overall, the data suggest that, in comparison with controlled competition, deregulated services are cheaper, but tend to be substantially worse from the point of view of attractive public transport. Closed markets sometimes achieve similar standards of attractiveness for passengers, but at a higher price. The ISOTOPE database demonstrated that regulated markets may be effective in terms of consumption, in that load factors are 62 per cent higher than those in deregulated markets and 127 per cent higher than those found in limited competition markets. This may not, however, indicate efficiency. It may indicate that too few bus services are being produced at too low fares. Overall, therefore, there is support for the hypothesis that regulated markets are efficient in terms of consumption, deregulated markets are efficient in terms of production and limited competition markets are somewhere in-between the two ends of this spectrum.

5.2. The emergence of competitive tendering as the preferred option for local transport in the EU

The current European Union regulatory framework was designed for a public transport industry in which suppliers were exclusively national, regional or local. Now, the sector is facing the emergence of a single European market in the provision of public transport. At the same time, there is an ever more apparent need to modernise public transport so that it can make its full contribution to tackling problems of environmental damage and congestion.

Recent years have seen the opening of national public transport markets on the basis of national legislation, and the emergence of multinational operators. According to the European Commission and as evident above, market opening has generally had positive impacts. Experience and research in Member States demonstrates that, at the local urban and regional levels, controlled competition can lead, with appropriate safeguards, to more attractive services at lower costs.

Changes in the attractiveness of services are best measured by trends in ridership. This has to be treated with caution, because it is difficult to disentangle the effects of different factors. In the six Member States where controlled competition has been the norm for some years, the use of buses and coaches, measured in passenger-kilometres, increased by 14 per cent between 1990 and 1997. By contrast, the increase was 5 per cent in the eight Member States where closed markets were predominant during this period, while bus and coach use fell by 6 per cent in the Member State where deregulation is the commonest approach, the United Kingdom.

Having reviewed the situation, the European Commission felt that it was now necessary to update EU law to take account of these developments and to agree on more commonality in approach. The proposed Regulation, COM (2002) 107 final, will not determine the goals which public services should achieve, the way they should be pursued or the balance between the role of authorities in specifying services and operators' scope to experiment. It does not lay down institutional structures for managing public transport, and does not prevent Member States from deciding which bodies should act as "competent authorities". Nor does it suggest a single European mechanism to be used in all Member States. Instead, it extends the range of tools that authorities can use, within the framework of European law, to implement their choices. Neither will authorities be obliged to follow procedures that are disproportionate in relation to the scale of their activity. Small contracts can be awarded directly without competition.

The proposed Regulation is based on the principle of controlled competition. This approach draws on experience in Member States and recommendations arising from research undertaken by the Commission. The proposed Regulation is intended to:

- ensure better value for money and better quality services;
- ensure that potential operators have a real opportunity to gain fair access to the markets through the award of financial compensations and exclusive rights;
- harmonise key aspects of the competitive procedures in Member States;
- promote legal certainty about the rights and duties of operators in relation to Community law on state aids.

5.3. Adequate public passenger transport

A key element in the provisions of the proposal is Article 4, which establishes the concept of "…adequate consumer-oriented public passenger transport…". This also makes specific provision for integrated public transport in relation to services, information and ticketing. In assessing the adequacy of public passenger transport services, in defining selection and award criteria and in awarding public service contracts, competent authorities would be required to take account of:

- Consumer protection, the level of tariffs for different groups of users and the transparency of tariffs;
- Integration between transport services;
- Accessibility for people with reduced mobility;
- Environmental factors;
- The balanced development of regions;
- The transport needs of people living in less densely-populated areas;
- Passenger health and safety;
- The qualifications of the staff;
- How complaints are handled.

5.4. Public service contracts

Article 5 establishes as a general rule that authorities' interventions in public transport should take the form of public service contracts. Article 6 states that competitive tendering should normally award public service contracts. It defines some important aspects of the content of public service contracts and sets a limit on their duration -- no more than eight years for buses. It also includes the ability to include performance-based bonuses and penalties into contracts. Articles 7 and 8 define the cases where public service contracts may not have to be competitively tendered. It also outlines the safeguards which should be put in place for directly awarded contracts.

Article 10 contains provisions which authorities can use to specify minimum criteria that any operator must comply with. It permits authorities to secure public service requirements which are separate from, or additional to, those embodied in public service contracts. Article 17 provides for a transitional period. Tendering of public service contracts should not be compulsory where safety standards, in the provision of rail services or the co-ordination of a metro or light rail network, would be endangered. It should also be possible for competent authorities to facilitate new initiatives which arise from the market and which fill gaps not currently served by any operator.

Studies and experience show that, where service is provided under public service contracts whose duration is limited to eight years, the performance of the specific tasks assigned to the operators need not be obstructed. However, longer periods may be necessary where the operator has to invest in infrastructure, railway rolling-stock or other vehicles which are tied to specific, geographically defined transport services and which have long payback periods. In accordance with the principle of non-discrimination, competent authorities should ensure that public service contracts do not cover a wider geographical area than is required by the general interest. Compensation payments, which exceed the net cost incurred by an operator as a result of fulfilling a public service requirement, are liable to be examined under Community rules on state aids.

5.5 Current status of the EU's proposed regulation

The amended draft EU regulation, COM (2002) 107 final, is currently awaiting an agreed common position between the European Parliament and European Commission. The intention had been that agreement would be sought and agreed by the end of 2002.

6. THE LESSONS LEARNED FROM EXPERIENCE IN ECMT MEMBER STATES AND OBSERVER COUNTRIES FOR EFFECTIVE REGULATORY STRUCTURES AND PATTERNS OF CONTROL IN EASTERN EUROPE

6.1. Regulation and control reforms: The pace of change in Europe

While there have been substantial reforms in individual member states, reforms at a European level have been limited, despite initiatives which include Regulation 1893/91 (on public service contracts in local public transport), Directive 91/440 (on international rail services) and Regulation 12/98 (on international coach services), as well as a number of Green and White Papers.

The main impacts of competition in the market have occurred in the bus and coach markets. Experience from both Great Britain and Sweden suggests that the unbundling and privatisation of bus and coach services can lead to cost reductions of 40 per cent, while deregulation could lead to increases in demand on competing intercity coach routes of up to 50 per cent (Thompson and Whitfield, 1995; Fagring, 1999). On the road, competition has had less of an impact on the local urban bus market.

Lack of competition in railway markets is only a small part of the issues for regulatory reform in European railways. According to Perkins (2002), many observers argue that competition from other modes is quite sufficient in almost all European product markets to prevent any abuse of monopoly powers by the railways. Most public debate over the European Commission's policy focuses on the introduction of competition through vertical separation of train operations from infrastructure management.

With respect to competition in the market for railways, Preston *et al.* (1999) conclude that head-on competition is typically not feasible, but limited entry, in the form of “cream-skimming”, may be feasible for high-density routes. Analysis of the Piacenza-Milan corridor, for instance, indicates that competition will be stimulated if the infrastructure manager adopts an objective of maximising social welfare rather than maximising profits (Shires *et al.,* 1999). However, the main reform with respect to passenger railways in the European Union has been commercialisation, so that railways are now operated as public sector companies rather than government departments. Shires and Preston (1999) claim that, in 1994, the more commercially oriented railways had 32 per cent higher productivity than the more directly state-controlled railways. However, between 1994 and 1997, the productivity gap reduced from 32 per cent to 25 per cent.

Shires and Preston (*op. cit.*) also argue that the average EU railway is too large and the average railway’s traffic too limited in its use of infrastructure. The optimal-sized network is estimated to consist of around 2 900 route-kms and 23 000 train-kms per route-km per annum. Evidence with respect to the vertical integration of railways is mixed. Cantos Sanchez (2001) has demonstrated evidence of the diseconomies of scope of joint passenger and freight services (at least above a certain output level). This also suggests the possibility of benefits from vertical integration. Shires *et al.* (1999) found that operating costs in Sweden have reduced by around 10 per cent since separation. However, in Sweden, separation is based on a publicly-owned track authority utilising marginal cost pricing principles. The situation in Great Britain is substantially different, being based on a privately-owned track authority utilising a variant of average cost pricing. In both countries there is a problem in that the track authority is a monopoly. Else and James (1994) suggest the problem may be more severe than this if the operations are provided by area monopolies. This results in multiple marginalisation and a situation where prices are higher and output lower than that which would be provided by an integrated monopoly. In Sweden, this situation is avoided by regulating the track authority, Banverket, so that it charges for access according to marginal cost principles and provides lump-sum subsidy to cover the deficit. In Great Britain, this situation may have been made worse by requiring the erstwhile privatised *Railtrack* to act commercially, although it was moderated by the price and output regulation of train operators. However, the form of regulation chosen (RPI-X, also known as price-capping) may lead to a dynamic inconsistency where capital costs are sunk.

An important advantage of vertical separation is that it creates a level playing field for competition in the market, although problems concerning the determination of access rights and charges remain. Overall, however, the verdict on vertical separation remains uncertain.

6.2. The challenge for the Central and Eastern Europe Countries (CEECs)

Many of the countries which joined the EU in 2004 are following the restructuring promoted by the Commission. Many other governments in Central and Eastern Europe are following the same path. More importantly, most governments in Central Europe have achieved deep restructuring in response to the end of the command economy and the collapse of their traditional markets and, over the last year, have shown growth in freight and passenger transport for the first time since 1989.

Road freight transport plays a dominant role in freight transport in Europe. Its effective operation depends on the efficient movement of goods. The examples provided by multinational private companies like DANZAS, KUEHNE and NAGEL provide evidence that the private form of ownership is most efficient. The process of transformation from public to private ownership in Central and Eastern European countries is under way and in some of the countries, for example Poland, Hungary and the Czech Republic, the process is well under way. However, there is still a need to learn from the experience of others, from both positive and negative examples. Hauliers from CEE countries, unfortunately, are still not competitive with most of the western and particularly EU hauliers. They still have serious difficulties with access to the European transport market. The creation of strong and efficient road transport companies in CEE countries, often in close collaboration with EU hauliers (e.g. through the creation of “joint ventures”) may contribute to solving this problem. Railway restructuring is following a variety of different paths, conditioned by local market and political conditions.

We have noted that European directives are now the principal guiding factor for national legislation in the transport sector in the four new Member States located in Central and Eastern Europe. However, EU regulations and directives are not blueprints. They leave a lot of room for interpretation by governments as they seek to implement the rules drawn up in Brussels. Any programme of reform, however, has to contend with some realities which are giving headaches to all transport planners across Europe and beyond, especially in the cities.

In both the states joining the EU and in other Central and Eastern European states, the competitive pressures arising from rapid growth in private transport, land-use change and privatisation pose major challenges for the transport sector, and in particular for urban and local transport and the railway sector. As economies have prospered more and more, commuters are switching from public transport to the private car. Unrestricted use of the private car is also costly in terms of pollution, social inclusion and such effects as global warming. This is, of course, as much a phenomenon in Eastern Europe as in the West, even if the pace of change and the extent of car use and availability differ. Whether these states will repeat mistakes made in the EU States and North America will depend, to a significant extent, on the adequacy and effectiveness of the regulatory structures deployed and their operation.

Politicians in the former eastern bloc countries have been used to complete mastery of their economies, which was the essence of the command-and-control structure which held sway after the Second World War. While they recognise that the market economy can deliver increased production, there is still a tendency to believe that direct political interference in utilities, including public transport, can improve outcomes.

Much regulation of public transport in cities and, to a lesser extent, the transport system generally remains in the hands of politicians or tends to be distinguished by a high level of direct political interference. While overall strategy needs to be set by ministers and elected assemblies, the challenge must be to pass tactical control down to civil servants and regulators and to leave it there. They will need to learn the discipline of advising from afar but ultimately "staying their hands", even in the cases where they believe direct interference would deliver a better result. If they don't, such actions will undermine the individuals involved in the oversight of regulation. It will also discredit the process, making it more difficult to attract private finance and expertise.

The goal must be an efficient and transparent system, operating within broad democratic accountability. However, it has to be acknowledged that a different form of supervision of public transport or the introduction of newly-privatised operators will not, by themselves, solve the problems faced by cities or countries in the East, which are wrestling with the difficulties of mass transit in the 21st century. Transport has been, and in some areas continues to be, heavily subsidised. Subsidies will remain an important part of the equation. Where privatisation is ruled out under public sector budgetary pressures, there is still the temptation to cut budgets. Although this can be a useful discipline, if applied too rigorously it could lead to a drastic loss of custom, already bleeding away through the increasing popularity of the private car.

The risk, already recognised in places like Tallinn, is that public transport could become the last-resort mode, mainly or solely used by those on lower incomes, as has happened elsewhere -- the most notable example in the EU being Belfast in the UK. If this were to come about, it would lead to increasing opposition among the middle classes towards their subsidising of services which they no longer use. The form of regulation will more naturally follow when politicians have decided on clear objectives and priorities for public transport. Up to this point, they have not done so. Let it be noted that this is not a situation confined to Eastern European cities, however.

6.3. Lessons for the CEECs

The reform of land passenger public transport in Europe has been relatively slow. There has been little convergence of transport policy ideas, interests and institutions at a European level. Policy emphasis has tended to be on transport infrastructure and in particular on the Trans-European Network and technological solutions to problems concerning interconnection and interoperability. In part, this is due to the principle of subsidiarity which, influenced by the seminal work of Tiebout (1956), suggests that much of the responsibility for public transport should rest with local and regional governments. However, this assumes that there are no external effects between jurisdictions. With the emergence of a pan-European public transport industry, led by British and French conglomerates, this is no longer the case. There is a risk that an unregulated public transport monopoly in one Member

State could compete unfairly in other Member States where public transport markets are more open. Such international spillovers are clearly of concern to the European Commission, but are difficult to deal with through competition law.

For scheduled interurban public transport, where passengers can book in advance and pre-plan their journey, user economies of scale are less important and can be more easily internalised. Price/quantity regulation is probably not required, although non-economic regulation is still needed. For rail, there is, however, the problem of the interface between urban and interurban operations. This suggests that competition for the market might also be appropriate for high-frequency, short-distance interurban routes. Open access competition for passenger rail might be limited to long-distance interurban services.

The evidence from ISOTOPE (2000) in relation to local passenger transport suggests diseconomies with respect to both scale and density. In other words, on average, European bus operations are too big and too dense. However, large companies may gain advantages in terms of non-human factor inputs. There may be demand-side complementarities related to timetable and route co-ordination. There may also be market power advantages with monopoly or monopolistic trading implications (Mackie and Preston, 1996).

With respect to local and urban transport, five forms of market organisation can be identified, embracing:

– The hitherto largely universal fully-regulated public sector model;
– The so-called Scandinavian model -- essentially based on a mixture of minimum subsidy and minimum cost contracts at a route level (also London);
– The French model -- based on network management contracts with additional contractual incentives;
– The so-called Adelaide model -- intermediate contracts where operators have some freedom to develop services;
– The largely deregulated model, which accounts for the vast majority of bus services in Great Britain outside London.

They can be thought of as a spectrum or be viewed as a series of stages in a progressive move towards full market liberalisation. The main strengths and weaknesses of each are summarised in Table 7.

Overall, there is some support for the claim that regulated markets are efficient in terms of consumption, deregulated markets are efficient in terms of production and limited-competition markets are somewhere in-between. For the choice between "limited competition" and "regulated", if the political will and the technical competence of the authority are present then, on balance, a "limited competition" regime is the best choice, since the stability of the system can be maintained at lower costs and with improved prospects for permanent improvement.

In general, gross-cost contracts with minimum standards for production resources (vehicles, staff) and service levels, as well as incentives for quality of service, levels of patronage and market share in key areas of the city, are a solution which presents a lower risk of capture of the authority by the operator, a relatively low burden for the authority and easier mobilisation of investment resources by private companies than by local authorities. However, because the operator is reduced to a more passive role, it also reduces the opportunity to improve service to the customers.

Net cost contracts give authorities the option of specifying what they want to achieve, and are bound by contract to get it at a fixed price, leaving to the operator the opportunity to make use of his ingenuity in reading and adapting to the wishes of the market, thus improving chances of a higher revenue. The awarding body must have a solid and stable tradition of information gathering. Net-cost contracts, however, effectively lower the contestability of the market. As the operator has the possibility to improve service and efficiency during the life of the contract, net-cost tenders should be longer in duration than for the corresponding gross-cost contract, so that time is given for the proper understanding of the market.

Management contracts may be preferred to gross-cost contracts if the authority perceives that the potential number of tenderers is likely to be very small. If gross-cost contracts are preferred, they should possibly be designed as a "network of contracts", with varying longevity for different components of the infrastructure/assets and service being rendered.

The use of various forms of franchising can be an effective means of solving the need for further efficiency measures in public transport operations, without the risk of failing to address social and welfare goals while, at the same time, reducing the pressure on public budgets. However, the increased consolidation of operators which such a system tends to promote, creates barriers to competition, with the potential to acquire almost monopoly levels of power over the market.

The lessons from this overview do not appear to have been taken up consistently, even within long-standing EU Member States. Within the UK for instance, which has been and continues to be a test-bed for free-market policies, the evidence is conflicting. The attractions of a fully deregulated transport system remain illusory.

Yes, costs can be reduced and subsidies cut, but the price to be paid is a drop in ridership. On the other hand, allowing private companies to tender for defined bus services has been demonstrated in London to yield both efficiencies and increased custom. In contrast, Northern Ireland's publicly-owned monopoly public transport operator continues to fail in even holding on to patronage, while at the same time losing its claim to be a low-cost operator of bus services. Somewhat perversely, securing public funding for this publicly-owned enterprise seems harder than for privatised or privately-financed transport systems elsewhere in the UK.

Nevertheless, a more interventionist approach, -- certainly for urban and local transport and arguably to a lesser extent for other passenger transport -- is more in tune with the mood of eastern bloc countries, where the role of the government in delivering social policies remains exceedingly important. A rush towards uncontrolled privatisation might be neither popular nor productive.

Table 7. **Urban and local transport models of regulation and delivery: strengths and weaknesses**

Model	Strengths	Weaknesses
The Regulated Public Sector Model	• Stability and less risk of total collapse. • Extensive regulation and associated costs need not be incurred. • Wider societal goals implicitly incorporated in business plans and operations.	• Risk of complacency and higher production costs. • Slower adaptation to the needs of customers. • Direct competition is only possible at the level of subcontract suppliers, so efficiency gains must be sought with instruments of indirect competition.
The Scandinavian Model	• Strong incentives to productive efficiency. • **Service integration is easy to realise.**	• Weak incentives to respond to passenger demand, due to the absence of competition. • Danger for regulatory capture of the regional authority by the regional transport company.
The French Model	• Integration of services straightforward. • **Flexibility in transfer of personnel and assets.**	• Limited incentives for productive efficiency. • Absence of comparative performance information. • Substantial tendering costs for bidders. • Availability of information to potential market entrants and overseeing body. • **Political interference.**
The Adelaide Model	• *Opportunity for comparative performance assessment.* • Flexibility in tender size while supporting strategic objectives. • **Incentives for both productive efficiency and market responsiveness.**	• **Potential trend towards arbitrary and inflexible definitions of minimum service standards by the awarding body.**
The GB Deregulated Model	• Direct response to market demand without authority intervention. • **Clear separation of functions and focus of the authority on the social aspects. Possibility for several authorities to intervene simultaneously.**	• *Danger for the appearance of unfair competition.* • *Competition pressure may diminish due to the formation of oligopolies.* • Instability in the network deters potential users. • Conflict with objectives to promote social and wider economic welfare. • Difficulty in co-ordinating operational policy at tactical level with wider transport and planning goals. • **Need for safety net to address pockets of inaccessibility and disadvantaged groups.**

By and large, there may be no special lessons for the East which have not applied to the West during earlier stages of development. The main conclusion, which can be drawn from almost global experience, particularly urban transport, is that subsidies will always have to form a part of the revenue of operators. In the larger conurbations, road pricing may offer scope for controlling traffic which does not just impede the growing number of motorists but also slows down buses. There is an argument, however, for integration with land-use planning and management to be restricted to a planning level, rather than an operational level. Different administrative agencies could be placed under the co-ordination of the same political department.

Although this is still seldom practised at the political and administrative level, there is advantage in formally separating the strategic and tactical stages in the definition of the local or urban transport product. Competitive tendering is unlikely to be adequate at the tactical level because local experience will act as a barrier to entry and external factors are difficult to forecast. However, at an operational level, competitive tendering of some form should be adequate, although even here there may be constraints where the incumbent lacks market discipline and there are few potential entrants. The strategic stage should be the object of decision by the political bodies, which must specify the policy goals and define targets to be met at each of those goals. The institution which fulfils the role of the Authority for local and urban transport must have the representation of the communities with a direct stake in the system. This institution should also cover all areas related to the planning of public and private transport.

6.4. Requirements of an effective regulatory structure

In many countries, theory and application of regulation is a relatively young science. Although lessons can be learned from others' experience, governments still have their work cut out to fashion solutions to fit particular circumstances. According to Baldwin and Cave (1999), where they have succeeded, regimes have generally satisfied the following criteria:

– Enjoyed legislative backing;
– Demonstrated accountability;
– Demonstrated transparent and consistent procedures;
– Expertly and efficiently run.

These conditions, however, are necessary rather than sufficient. On top of that, there exists an inevitable tension between some of the criteria. While legislators create the structure of regulation, if it is to function satisfactorily, the regulatory regime must be free of day-to-day interference from government. Thus, while the regulator must be accountable to political masters, it is preferable that reviews of his or her decisions are carried out by the courts or by independent bodies set up to review the workings of competition. The disadvantage is that such reviews may be carried out by those unfamiliar with the detailed and rather complex workings of the regulated industry.

Transparency and consistency are essential to give private companies or their backers the confidence to make long-term investments. Opacity, or what might be perceived as politically motivated decisionmaking on the part of the regime, can exact a cost in increased regulatory risk. The recent *de facto* re-nationalisation of *Railtrack* in Great Britain could be regarded as an example of this effect. While transparency, however, is demanded from the regulatory regime, at the same time the regulator has to make judgements without having the wealth of detail available to insiders in the industry. Such asymmetry of information can make the process of regulation a somewhat hit-or-miss affair.

The issues of expertise and efficiency are best considered together. Ideally, the regulatory authorities are set specific, measurable aims. This enables a judgement to be made on quantifiable rather than qualitative terms. However, it must be said that regulators are not usually set objectives amenable to metrics. The aims are usually too broad and too general. An example is the exhortation to protect the interests of consumers without the provision of any guidance as to whether domestic customers should be safeguarded at the expense of industrial ones. The justification for this approach is the belief that it would be a mistake to tie down regulators so that they cannot adapt to changing circumstances. The difficulty is that, without clearly defined, measurable targets, it becomes a matter of debate whether regulation is working well or not.

Significantly, Sturm *et al.* (2000) found no evidence of regulatory capture and, with a few exceptions, no evidence of a major role being undertaken by the regulated in the regulatory process in eastern European transport. Indeed, he reports that former state-owned companies have not been able so far to develop proposals for amending regulation in their own interests.

Concern might arise if it were felt that the former eastern bloc regimes were stuck at this point in their evolution from socialism to the market economy, but there is no suggestion at this stage that the problem will endure. As civil society continues to strengthen and deepen, politicians will have more confidence in those aspects of decisionmaking which they, in the best interests of efficiency and transparency, have outsourced to regulators. In other words, this would appear to be a temporary problem.

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Topic 3:

Sustainability of transport: The roles of modal split and pricing

a) The role of modal split

b) The role of pricing

Freight Transport and Logistical Imperatives for the Modal Split

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SUMMARY

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1. THE PROBLEM OF SUSTAINABILITY IN TRANSPORT POLICY

1.1. Mobility as a social challenge with opportunities and risks

The concept of sustainable development has been a key social policy theme ever since the United Nations' Conference on Environment and Development, held in Rio de Janeiro in 1992. In 1987, it was presented in the report by the Brundtland World Commission on Environment and Development as a form of development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Environmentally-sound management of natural resources is seen as a key priority in this context, as part of our duty towards future generations (Willeke, 2002, p. 18).

The need for physical mobility is one that dominates developed and developing economies alike. It is not the place here to examine why this is so, and many international studies have already been conducted on the subject (e.g. Cerwenka, 1983; Rühl/Baanders/Garden, 1983; Heigh/Hand, 1983; Quinet/Reynaud/Marche, 1983; Hautzinger/Pfeiffer/Tassaux-Becker, 1994; Aberle, 1995).

What is significant, however, is that a great deal of mobility nowadays is forced mobility. This is a growing trend and means that:

– administrative and/or structural changes in respect of the basic conditions of social and economic activity, and

– social expectations in the context of social role-playing

increase the demand for transport. Individuals and businesses who try to avoid using transport risk damaging their existence.

This applies in the *passenger sector* to much educational, professional and business travel and increasingly to shoppers' traffic as well as some casual travel embarked on for the purpose of meeting other people.

In the *freight sector*, the growing distribution of labour, with intensive outsourcing processes and logistics optimisation strategies in respect of the global chains for production and trade, are decisive factors which increase the demand for transport.

There is no disputing the fact that mobility (of goods and persons) helps to improve welfare standards in both developed and under-developed economies. Under-developed countries, in particular, frequently suffer as a result of bottlenecks that hamper the transport of goods. However, scientific evaluations of transport's contribution to growth still differ quite considerably (cf., for example, Baum/Korte, 2002a; Baum/Behnke, 1997; Berechman, 2002; Prud'homme, 2002; Vickerman, 2002). They were mainly triggered by Aschauer's theories relating to the contribution made by public infrastructure investment to aggregate productivity (Aschauer, 1989).

The positive effects of greater mobility in terms of social and economic opportunities go hand in hand with other effects that present a threat to sustainable development. A great many international studies have been carried out on this subject, with the emphasis on the negative external effects (OECD, 2000; INFRAS/IWW, 2000; ECMT, 1998; Button, 1993). The extent of such effects varies considerably, however, depending on how they are calculated and internalised. As yet, no scientific or political consensus has been found on the methods used. This has also prevented implementation of the EU Commission's proposals, according to which infrastructure costs should be calculated and apportioned using the principle of marginal social costs (EC Green Paper, 1995; EC White Paper, 1998).

Two main strategies are proposed as ways of securing inter-generational sustainability against the background of rapid mobility growth:

- The decoupling of transport growth from general economic growth, measured in terms of real GDP and the increase in passenger- and tonne-kilometres (Baum, 2002b). Ultimately, this involves activities aimed at *transport avoidance*. For the moment, and assuming a method can be found that is both scientifically acceptable and politically feasible, it is impossible to say with any certainty whether the internalisation of negative external effects results in sustainable transport avoidance. Furthermore, fierce competition within and between modes in the freight sector is helping to improve transport efficiency, keeping empty runs to a minimum and optimising capacity utilisation;

- The *transferral* of the demand for mobility onto modes of transport with comparatively less negative effects for the environment, which in the passenger sector means different forms of public transport (trains and buses) and in the freight sector, the railways and inland waterways. Combined transport is especially relevant in relation to this strategy.

There are no known policies for successful traffic avoidance. Given the impact of such policies and strategies on sectors other than transport, this is hardly surprising, however, and there are clear signs of political efforts to transfer traffic from one mode to another, for example, with the help of subsidies and tax measures. The modal split debate tends to be dominated by the question of sustainable development.

1.2. Particular relevance of freight traffic

Compared with passenger transport, freight transport is characterised by two features that are especially relevant with respect to sustainability:

- Demand for freight transport is derived demand, insofar as the determining factors for the mobility of goods in general and the modal split in particular are largely the result of decisionmaking processes which occur outside the transport sector. Examples of such factors include production and trade structures, production sites and consumer locations, international trading links and logistics concepts. It is also in the course of these decisionmaking processes that the technical and economic demands made of the transport processes are defined. To some extent, however, influences are mutual in that the dynamically evolving service features offered by the different transport modes also affect freight forwarders' decisions, particularly in terms of logistics, outsourcing and market-sizing;

– Medium- to long-term growth forecasts for European freight traffic are two to three times higher than in the passenger sector (period up to 2010-20). The situation is made worse, particularly in terms of sustainability, by the fact that all forecasts show road haulage continuing to increase its share of the market in the future, while, at the same time, the very small share attributed to the railways in the 15 EU Member States of approximately 8 per cent in 2000 (if short sea shipping is included, with approximately 42 per cent) or 14 per cent (excluding short sea shipping) is reliant on high levels of state subsidies.

There are also signs of significant changes in freight traffic's share of the modal split in CEE countries. Here too, there is a significant transfer of traffic away from the railways onto the road, further encouraged by hefty public investment in road building, which contrasts with the low level of investment in railway infrastructure and rolling stock renewal. Politically, the growing trade, and hence traffic, in goods is a welcome development that should lead to greater prosperity in central and eastern Europe. What is not welcome, however, is the modal split as it has developed in the 15 EU Member States.

In this context too, therefore, and especially with respect to the goal of sustainable development, the real problem is the modal split. The following considerations focus on freight traffic.

2. FREIGHT SUPPLY AND DEMAND TRENDS

2.1. General trends

It is significant that, since the beginning of the 1990s, freight traffic has followed a separate growth path to real GDP, whether in respect of individual European countries or of the average for all 15 EU Member States. Global transport elasticity (as a quotient of the growth in freight traffic performance and real GDP) is well over 1. The many reasons for this (Aberle, 2003, pp. 93-98) are analysed thoroughly in Sub-topic 1 and will not be discussed below, where the main focus, as the key factor with regard to sustainability, is the modal split.

2.2. Modal trends

Global transport elasticity, which up until the end of the 1980s was less than 1 in western Europe and since the beginning of the 1990s has been way over 1, is of limited significance, not because of the technical problems associated with long-term elasticities but because a calculation based on the average for all transport modes is misleading. Even where *global* elasticity values are < 1 there are big differences between individual *modal* elasticities. Since the mid-50s, when global transport elasticities have been < 1, modal elasticities for road traffic have ranged from + 2.0 to + 2.5, as opposed to – 0.02 for rail traffic and + 0.4 to +0.5 for the inland waterways.

The following table shows modal elasticity values with respect to Germany (up to 1990, territory prior to reunification; after 1990, the whole of Germany):

Table 1. **Transport elasticities in Germany (geometrical and arithmetical calculation methods) (up to 1990 old federal *Länder*)**

	1971-80	1981-90	1991–2000
Transport elasticities (geometrical method):			
Long-distance road haulage	2.51	1.98	2.59
Rail	-0.02	-0.02	-0.39
Inland waterways	0.55	0.44	1.25
Global value	1.00	1.01	1.54
Transport elasticities (arithmetical method):			
Long-distance road haulage	2.40	1.93	2.54
Rail	-0.02	-0.02	-0.39
Inland waterways	0.60	0.44	1.24
Global value	1.00	1.01	1.53

Source: Aberle (2003), p. 29.

These modal elasticity values for the past forty years are very interesting with regard to sustainability. The greatly diverging growth trends for the different transport modes can be seen clearly from the following table, which shows the absolute and relative values for the 15 EU Member States.

Table 2. **Modal split EU 15 (1 billion t-km)**

	Road	Rail	Inland waterways	Pipelines	Short sea shipping	Total
1970	507	252	102	64	472	1 427
1980	702	290	106	85	780	1 963
1990	946	256	107	70	922	2 301
1995	1 115	220	114	82	1 071	2 602
2000	1 327	249	125	85	1 270	3 057

Source: EU Commission (2002): European Union, *Energy & Transport in Figures*, 3, 4.2.

Freight traffic overall (t-km) rose by 114 per cent between 1970 and 2000. Road haulage and short sea shipping rose by 162 per cent and 169 per cent , compared with only 12 per cent for the railways. Inland waterways traffic rose by only 33 per cent, although with regard to absolute values for this mode it should be borne in mind that only six EU Member States have a significant volume of inland waterways traffic.

Worthy of note but often left out of transport policy discussions is short sea shipping's share of the transport market. In 2000, for example, it accounted for approximately 41.5 per cent of the market (road 43.4 per cent, rail 8.2 per cent, inland waterways 4.1 per cent, pipelines 2.8 per cent).

Table 3 shows how the four-way modal split (without short sea shipping) developed in the 15 EU Member States between 1970 and 2000:

Table 3. **Evolution of modal split for EU 15 (t-km); % values**

	Road	Rail	Inland waterways	Pipelines
1970	54.3	27.9	11.0	6.8
1980	61.3	22.1	9.2	7.4
1990	69.7	17.3	7.9	5.2
1995	72.8	14.4	7.5	5.4
2000	74.3	14.0	7.0	4.8

Source: EU Commission (2002): *Energy & Transport in Figures*, 3, 4.3.

In western Europe, the only two countries to record much higher modal split values for rail freight and lower values for road freight traffic are Austria and Switzerland. Their situation is influenced by a number of specific factors (alpine crossings, special environmental concerns, above-average shares of total freight performance nationally taken up by transit traffic, administrative road haulage restrictions and heavily subsidised rail freight sector).

In the eight countries due to become members of the EU after 2004, rail freight's market share, which until the early 1970s was very high owing to external regulatory measures, is steadily shrinking, even though in the medium term it should still account for a dwindling share of 25 to 30 per cent. As the railways' share decreases, road freight's share is expected to rise.

2.3. Causes of modal trends

All available forecasts suggest that past modal trends are unlikely to change significantly over the next 10 to 15 years.

In its Trend Scenario, the EU Commission (2001 White Paper) predicts that road freight's share of the market will increase from 43.7 per cent (1998) to 47.4 per cent, whereas rail freight's share will fall from 8.4 per cent to 6.8 per cent (market shares including short sea shipping from 40.6 per cent in 1998 to 39.8 per cent and inland waterways from 4.2 per cent in 1998 to 3.5 per cent). An extensive action plan (comprising sixty separate measures) has been devised at policy level in an attempt to reverse these shifts. Under EU transport policy, the aim is for the individual modes of transport to achieve growth rates identical to the 38.4 per cent predicted for freight traffic as a whole (1998 to 2010). Basically, this means maintaining the 1998 modal split via a reduction in growth in the road haulage sector and a corresponding increase in growth on the railways and inland waterways.

It is very unlikely, however, that this target for Scenario C will be achieved. Modal split trends have been the same since 1998, and the remaining eight years are not expected to see any decisive change.

The reasons for the modal trends in the freight sector, which are largely incompatible with sustainable development, are complex. It is totally erroneous to see the price relationship between the different means of transport as the main factor determining freight forwarders' choice of mode.

– Long-term changes in the structure of transported goods are one important factor. In contrast to the decline and stagnation of traffic involving low-cost bulk goods (coal, ore, scrap, building materials, etc.), the volume of high-cost semi-finished and finished products is rising sharply (*goods structure effect*). This is a reflection of the production structure changes occurring in most European countries.

– As economic activity becomes increasingly globalised, international traffic accounts for a growing share of total freight traffic (globalisation effect). Most international consignments consist of semi-finished and finished consumer or capital goods. At the same time, average runs are becoming longer, with the result that traffic performance (t-km) is growing faster than traffic volume (tonnes).

– The dismantling of customs barriers and political frontiers as a result of economic and political integration leads to an intensification of trade and modifies the way labour is distributed internationally (*integration effect*). As a result, all those concerned should see their welfare position improve. Consequently, freight traffic increases.

– Worldwide globalisation is altering the competition stakes. The two-fold aim of logistics concepts, namely, to exploit cost-saving potential to the full and improve the customer-oriented quality of productive processes, places considerable demands on the transport economy (*logistics effect*). What is at stake is the ability to integrate physical transport services into the logistics networks and meet complex information and communications requirements.

The extent to which each mode is able to cope with all the new quality requirements varies, owing to the very different technical and organisational characteristics of each system. Because of the goods' structure and logistics effect, those characteristics of particular relevance for choice of transport mode and, in other words, the modal split are:

– Flexibility;
– Reliability;
– The infrastructure network;
– Information networks;
– A customer-oriented cost situation.

On the other hand, system characteristics relating to mass efficiency, specific energy consumption and environmental benefits are not so important for choice of transport mode. In other words, low specific energy consumption and environmental benefits are generally not enough to compensate for the key characteristics listed above.

Owing to the particular characteristics specific to the road system, road traffic is in a much better position to meet the changing requirements than either the railways or inland waterways. Furthermore, their national structures and many incompatibilities in terms of technical and organisational aspects, not to mention their different mentalities, make it very difficult for the railways to compete successfully on the growing markets for international transport. Road transport does not have these problems.

Another important factor is the average length of transport runs. Statistics for Germany show that in 1999 runs of less than 150 km accounted for 83.7 per cent of all freight (tonnes) carried by road. The distance-based statistics show that many road runs amount to distribution and site delivery services which other modes of transport are unable to provide.

Similar estimates for average transport distances in the European freight sector as a whole show that runs of less than 150 km account for 85 per cent of consignments (Beuthe/Jourquin/Charlier, 2002, p. 282).

With respect to high-cost, semi-finished and finished consumer and investment goods, the carriage charge is of very little importance. In the case of road vehicles, office equipment and electrical goods, it represents between 1.3 and 1.5 per cent of the end product value and between 2.1 and 2.5 per cent in the case of chemical products. This compares, however, with 6.5 to 7.2 per cent for ore and building materials, 4.5 to 5 per cent for iron and steel and 3.6 to 3.9 per cent for foodstuffs (Deutscher Bundestag, 2002, p. 139).

Nonetheless, when assessing the importance of the carriage charge for determining choice of mode, the following should be borne in mind:

– Profit margins in trade and industry are between 2 and 6 per cent maximum. The carriage charge percentages are to be seen in this context.

– Transport costs are an essential part of logistics costs which – depending on the product groups – account for between 8 and 15 per cent of sales. The task of reducing logistics costs, which is so important in the context of globalised competition, is part of any logistics optimisation strategy. The decision in favour of a particular logistics optimisation strategy presupposes, however, that the demands it places on the transport process can be met. Once again, this depends on the system characteristics of each mode of transport.

Consequently, in the case of goods that are very demanding in terms of logistics, it is essentially efficiency in this particular area which determines the modal split and influences logistics costs overall. It is only in this connection that the carriage charge is a decisive cost factor.

This can be illustrated with a straightforward example:

Production-synchronous (just-in-time) delivery of pre-products reduces procurement costs considerably (no need for depots to store incoming goods, etc.). It presupposes, however, that the pre-products are delivered straight to the assembly line as component parts every few hours, without fail. Conditions such as these have a decisive impact on the modal split.

3. LOGISTICAL CHALLENGES FACING THE TRANSPORT SECTOR

3.1. Logistical requirements

The logistical quality of procurement, manufacturing and marketing in respect of high cost consumer and production goods is crucial for competition. Its significance has been greatly enhanced by:

- the growing segmentation of production processes with the reduction in manufacturing depth and concomitant recourse to outsourcing;
- the internationalisation of procurement and marketing as a result of economic globalisation;
- much shorter production cycles with more frequent product variations; and
- extensive knowledge of the international market as a result of efficient information and communications systems.

Traditional mass goods place relatively few demands on logistics. The rapidly growing an, above all, international market for consumer and investment goods, on the other hand, is highly complex in terms of logistics. It is important therefore that the transport processes and individual modes of transport are able to cope with such complexity. This means, in particular, that they are able to offer:

- a high degree of flexibility and reliability;
- a capacity for integration in logistics concepts at the level of one or more firms;
- real-time information about the location of consignments and, where appropriate, their condition;
- a small contribution to logistics costs.

Supply Chain Management (SCM) is a term used in relation to ambitious logistics concepts. It denotes a flow optimisation strategy involving several firms and consisting of several distinct quality stages (Pfohl, 2000). SCM includes a physical component (goods flows) as well as an information component (information flows). An important task is therefore solving interface problems as the overall quality of logistics chains and networks depends on the quality of all of the individual part-functions. That is basically what decides the modal split in respect of the physical flows.

3.2. Capacity of the individual modes to meet logistical requirements

There are major structural differences between the efficiency levels the different modes are able to offer as a result of their distinctive system characteristics. However, transport policy is reluctant to take these into account, as shown by the attempts to influence the modal split quantitatively in favour of rail freight by implementing administrative measures which spell higher costs or poorer quality for road freight. Examples of such measures include prohibitive increases in mineral oil tax, road tolls which are confined to heavy goods vehicles, blanket bans on overtaking on motorways and bans on night driving (so that journey times become longer). A shift in the modal split will only occur providing alternative transport processes are able to offer the same or very similar quality as regards logistics. Scope for adjusting the modal split by means of administrative measures is only likely to arise in the case of transport processes which place few demands on logistics.

The demands made of transport modes as a result of the so-called goods structure and logistics effects and the quality requirements of supply chain management are best met by road freight, thanks to the characteristic features of the road system.

Owing to their technical and organisational characteristics and their low network density, the railways and inland waterways find it very difficult to meet the integration and quality demands placed on them by supply chain management. They also have to contend with comparatively more interfaces, both physical and information-related. This is apparent from both past statistics and present forecasts for European freight traffic (Prognos, 2000; EU Commission, 2001). On the whole, the same also applies to the eight candidates for accession in central and eastern Europe, where rail freight's share of the market looks set to fall between 2000 and 2010, and rail freight traffic is also expected to drop sharply in absolute terms. This is because the railways in these countries are technically backward and because the level of investment in railway infrastructure is very low compared with the road sector. In terms of their railway infrastructure, the objectives set in the context of the TINA project (TINA, 1999) have still not been met in the candidate countries. This merely exacerbates the problem.

3.3. Implications for the sustainability debate

The large share of total freight traffic taken up by road transport in Europe (and the developing countries) is generally not compatible with sustainable development. The negative environmental effects of noise pollution, pollutant substances and CO_2 emissions, not to mention land-use and land lock-up, are greater in the case of road transport than with regard to transport by rail or ship. The same applies to specific energy use. The costs associated with congestion on the roads are also growing, although these are the result of inadequate investment in new roads.

The subject of the external costs of transport and in particular freight transport is very well-documented, thanks, *inter alia,* to numerous ECMT studies (ECMT, 1998; ECMT, 1994).

Where harmful emissions in the road sector are concerned, however, account should be taken in future of the positive impact of EURO norms in respect of certain emissions. Because new vehicle procurement cycles are relatively short, the full fleet of lorries licensed in the EU is being replaced relatively quickly, in favour of lorries that are low on emissions. The importance of EURO norms is clear from Table 4.

Table 4. **Specific emission trends in accordance with EURO norms**
EU emission thresholds for diesel engines (road). Values in g/ kWh

	EURO 0 (1990)	**EURO I (1993)**	**EURO II (1996)**	**EURO III [1)] (1.10.2006)**	**EURO IV [1)] (1.10.2006)**	**EURO V [1)] (1.10.2009)**
HC	2.6	1.23	1.11	0.66	0.46	0.46
CO	12.3	4.9	4.0	2.1	1.5	1.5
NO_x	15.8	9.0	7.0	5.0	3.5	2.0
Particles	-	0.4	0.15	0.1	0.02	0.02

[1)] Directive 1999/96 EC.

Source: European Union, *Brüssel/Verkehrswirtschaftliche Zahlen 2000+2001*, published by the Bundesverband Güterkraftverkehr Logistik und Entsorgung, p. 75, Frankfurt/M.

Trends in respect of total emission values, however, show a rise because of the significant increase in traffic predicted in the road freight sector. While the EURO norms do not offer a solution to the fundamental problem of harmful emissions (or noise pollution), they do alleviate it significantly, thereby narrowing the gap between road freight and the railways and inland waterways.

In the case of CO_2 emissions, comparisons must be based on primary energy consumption, but in many CO_2 forecasts it is unclear whether they are based on primary or end energy consumption. The use of fossil fuels to generate electricity is carbon-intensive, particularly given the high transformation and conduction losses.

The different modes of transport therefore all need to reduce their energy consumption by making use of technological improvements and to improve their overall efficiency as a means of transport. This represents the main challenge facing freight traffic, and this is where microeconomic, macroeconomic and environmental concerns converge.

The most important contribution the railways can make towards promoting sustainable development in the freight sector is to develop their offer of services and improve their quality. For this to happen basic structural reforms are needed. In principle, trade and industry have no objection to making greater use of the railways to transport freight. There are important quality requirements, however, particularly in respect of consumer and investment goods. They include reliability, punctuality and flexibility. This is especially relevant in the case of international rail freight services.

3.4. Opportunities for combined transport

As a combination of at least two modes of transport and involving the use of containers, swap-bodies and trailers, combined transport can help the railways and inland waterways to win new market shares and improve their existing shares. With the stuffing and stripping of containers, combined transport is also a suitable option for smaller parties. It is particularly well-suited to the carriage of manufactured and semi-manufactured goods, the market for which is rapidly growing. In many countries combined transport is heavily subsidised, especially the special transhipment terminals. The purpose of such subsidies is to:

- promote the carriage of goods by rail;
- cut down on environmental pollution by means of a reduction in road freight;
- reduce congestion caused by lorries.

The main problem with combined transport is the discrepancies between costs and calculable micro- and macroeconomic benefits. There are basically two different forms of combined transport:

- *Seaport hinterland traffic*, involving almost exclusively containers that are transported overland to and from seaports. Transfer costs incurred in the seaports are the responsibility of the different land modes. Temporary storage of the containers is also generally required.

  In the case of seaport hinterland traffic, the modal split is largely determined by the available transport infrastructure. Good examples of this are Rotterdam (large shares attributed to road freight and the inland waterways; the construction of the new railway line from Betuwe to Germany should lead to a significant increase in the very low share of rail traffic), Hamburg and Bremen (good rail connections, with rail shares accounting for over 60 per cent of TEU). As for Antwerp, reopening of the old rail link with Germany is also being considered ("Iron Rhine") as a way of increasing the railways' share of the modal split.

- *Other combined transport,* principally involving the road/rail combination and only to a limited extent the combinations road/inland waterways or railways/inland waterways. Most of the scope for the inland waterways in the context of container traffic resides in consignments to and from seaports which link up with efficient waterways.

  Obstacles in the case of combined road/rail transport include the extra costs and time involved in comparison to road transport throughout. In 2000, the ten European combined transport companies (UIRR companies) transported 32 billion t*km using semi-trailers, rolling road solutions and swap-bodies (1990: 19 billion t*km).

In 1999, combined transport (all forms taken together) accounted for 8.6 per cent of all European freight traffic (estimate according to the EU Commission's DG for Energy and Transport; cf. *Energy & Transport in Figures 2002*, 3.4., 18). It should be borne in mind that combined transport generally requires travel distances of at least 500 km (Beuthe/Jourquin/Charlier, 2002, p. 282; Ewers/Fonger, 1993).

Opportunities to influence the modal split in favour of rail by stepping up combined transport will only work if:

- the technical and organisational aspects of freight terminal handling processes are extensively simplified in order to reduce costs and save time;

- shunting operations are kept to an absolute minimum in order to cut down on marshalling and transport costs and save time;

- the infrastructure (route) costs per transport unit can be reduced by means of increased train capacity utilisation;

- the quality of international combined transport services is significantly improved, particularly punctuality and rail transport journey times. The UIRR deplores the fact that, according to a combined transport study conducted in 2000, only 48 per cent of a total of 2 016 trains arrived on time (within half an hour of scheduled arrival time, whereas 8 per cent were up to an hour late, 16 per cent between one and three hours late, 11 per cent between three and six hours late, and 12 per cent more than six hours late. Five per cent (1 021 trains) were more than 24 hours late (BGL, 2001, p. 23). According to the UIRR, the situation in 2001 was no better.

For the moment, specific quantitative potential based on these requirements cannot be properly assessed, although the many constraints which apply to combined transport mean it is unlikely that significant volumes of traffic could be transferred from road to rail. Even optimised conditions would fail to secure any lasting improvements to the negative environmental effects and congestion problems associated with road traffic. Use of road tolls which make road freight more expensive will encourage freight forwarders and industry generally to show more interest in combined transport. The best opportunities are in international traffic, although this is where the railways, by comparison, still face the biggest problems with optimisation.

Lastly, in the context of rail freight restructuring, there is a tendency to drop rail freight services characterised by low capacity utilisation for financial reasons. Indeed, this is an essential part of Germany's MORA C project, set up to develop a market-oriented cargo service. As a result of this tendency, however, consignments will have to travel further by road on their way to and from combined transport terminals. In this context, the financially more interesting option of road transport on its own, without recourse to rail, can restrict combined transport's potential even further.

4. THE ROLE AND INFLUENCE OF TRANSPORT POLICY IN SECURING A SUSTAINABLE MODAL SPLIT

4.1. Structural policy influence

It is unrealistic to expect that extensive restructuring of the world economy will lead to any significant reduction in the movement of goods, despite repeated calls for such a reduction from opponents of globalisation. The only way of restricting such mobility would be to bring about radical changes in the workings of national and international trade, to increase manufacturing depth, stop the geographic dispersal of labour, substantially modify consumer preferences and restrict demand by imposing limits on free trade, accepting, as a result, a significant decline in the levels of prosperity in practically all the countries taking part in the exchange of goods. Such processes would be accompanied by reductions in competition and higher production costs.

Even if general reductions in freight traffic or in the predicted growth of such traffic are unrealistic, ways of modifying the modal split still have to be found and put to good effect. This means transferring consignments away from the roads for carriage by rail and ship.

It is pointless here to stress the considerable capacity reserves that exist in the case of goods transported by rail and by sea, insofar as such reserves are mainly the result of a partial incapacity to meet the relevant transport and logistics requirements. What are needed therefore are efforts aimed at reducing the structural shortcomings characteristic of the services offered by rail and sea transport.

In particular, efforts should focus on:

- improving the market-oriented efficiency of national and, above all, international rail freight services (reliability, punctuality, transport times, consignment tracking);

- encouraging the railways to introduce logistics service packages;

- setting up non-discriminatory infrastructure access for third railways in the interests of intramodal competition;

- promoting technical and organisational innovation in the rail freight sector, which currently lags way behind road freight in this respect;

- relieving state-owned railways of old debts they have incurred;

- promoting a market-oriented approach to railways' organisational structures, with clearly defined business objectives and management responsibilities;

- securing finance for infrastructure investment and defining how financial responsibilities are shared out between the railway undertaking and the State. Owing to the cost functions of rail networks, high investment in infrastructure has to be financed via public subsidies, not commercial profits. This is another argument in favour of open access to all railways (subject to payment of user charges which must cover at least the operating and infrastructure maintenance costs).

With combined transport, in addition to the need for general quality improvements, more efficient train concepts, marshalling procedures and freight terminals are urgently required.

Concerning the inland waterways, performance is hampered by a lack of investment (waterways and locks). The integration of inland waterways in logistics networks is much more difficult than in the case of the railways. Ports also need to be reorganised to become multimodal logistics centres.

4.2. Regulatory and pricing policy influence

The trend in favour of the introduction of performance-related road user charges, with possible further differentiation according to route and time (in the sense of a road pricing system), is causing costs in the road freight sector to rise. Part of this increase is absorbed by the economy in transport prices. Clearly, this will have a positive impact on the discussions as to whether some of the traffic could be transferred to another mode, but it will not be decisive in bringing about any changes in the modal split where these commodity groups are concerned. Modal split effects are only to be expected in respect of goods such as building materials, coal and other low-value mass goods which are very sensitive to transport cost fluctuations. However, this will be the case only insofar as no extra costs are incurred as a result of the change in transport mode (e.g. further transhipment costs).

Rules and regulations, such as mandatory EURO norms, can also serve to promote a sustainable modal split. International rules, laid down to achieve the phased reduction of fuel consumption, can have a positive effect on CO_2 emissions.

Higher administrative costs in the road freight sector generally have only a very limited impact on the modal split in respect of:

- semi-manufactured and manufactured goods;
- goods transported over distances of up to approximately 100 km;
- delivery/distribution traffic (significant in terms of quantity);
- small and medium-sized manufacturing and commercial firms, for whom access to rail freight is much more complicated than access to road freight; and
- industrial and commercial firms without their own connections to rail sidings.

The reasons for this relatively small impact on the modal split are the aforementioned differences between the system characteristics of each mode and the specific qualitative requirements dictated by transport demand.

4.3. Limits to transport policy influence

As an integral part of economic policy, it is up to transport policy to establish the general conditions necessary for coping with the freight mobility requirements resulting from economic activity, but it has no specific remit to control national and international trade, insofar as freight traffic is the consequence of decisions taken outside the transport sector by economic policymakers and manufacturing and commercial firms. For example, political and/or economic integration processes at the level of regions and countries always lead to a significant increase in freight traffic, even though this may cause serious problems in terms of transport and often environmental policy.

The role of transport policy cannot be to keep these developments in check by means of prohibitive administrative measures. Very high taxes, for example, or restrictive bans and regulations which seriously hamper freight traffic also run the risk of obstructing the attainment of political and economic goals.

The role of transport policy is to put in place the conditions which will ensure greater efficiency of all activities relating to the transport economy. In particular, this means:

- providing transport infrastructure of a high standard, in terms of both quantity and quality;
- establishing the necessary conditions for non-discriminatory competition within and between modes;
- using the same method of calculation to charge infrastructure costs to all transport modes, while still allowing for the possibility of an appropriate contribution from the public purse towards the cost of infrastructure investments;
- issuing regulations establishing norms in respect of harmful emissions and noise pollution, vehicle characteristics, etc.

Transport policy measures aimed at influencing the modal split must come within this scope.

However, such scope is very limited. Neglecting road building so that road transport becomes less attractive, as a result of more congestion and the ensuing higher costs and logistics hurdles, threatens the economy's ability to compete unless other modes of transport are in a position to offer equivalent alternatives. Insofar as the existence of such alternatives is very limited, transport policy measures remain problematic.

The main task at hand is therefore to develop modal alternatives and improve their market efficiency so that they become more competitive.

Because of the freight structure and logistics effect, pricing measures which make road freight more expensive have only very limited success. Germany is a good illustration of this. Since 1999, mineral oil tax has gone up five times following introduction of the "Eco-tax". The price of fuel (petrol and diesel) has risen by a total of 0.15 euros per litre (plus 16 per cent VAT). For a 40-tonne lorry, this represents an average yearly cost increase of between 5 250 and 6 600 euros. Despite this, there have been no transfer effects.

A performance-related motorway toll (0.15 EUROS per vehicle-kilometre) will be introduced in Germany as from September 2003 for "heavy goods traffic" (vehicles weighing at least 12 tonnes), increasing the annual burden on these vehicles by between 10 000 and 16 000 EUROS. Taken together with the mineral oil tax increases, this means an extra 15 to 23 000 EUROS in tax per year and per vehicle, i.e. a 14 to 22 per cent rise in total vehicle costs. Even with the introduction of the (additional) road user charge, most experts predict no quantitatively significant modal split effects. What is to be expected, however, is that alternative means of transport will be systematically explored, particularly in the combined transport sector, although the actual use of alternatives depends on a whole series of complex decision factors.

Lastly, attention should be drawn to two aspects relating to price-induced changes in the modal split.

- From an environmental standpoint, there can be no doubt that there are some highly sensitive areas where a strategy combining investment, subsidies and pricing measures is justified as a way of transferring traffic away from the road. One such example is transit traffic through the Alps in Switzerland, where such a strategy is already in place. Taxes increase as modal alternatives become available (NEAT projects, Lötschberg and Gotthard base tunnels). However, this combining of high-quality rail alternatives with road freight taxes, coupled with the gradual reductions in maximum authorised lorry weights to bring them into line with the EU standard is an exception which is not possible on extensive networks in economic areas which are rapidly growing as a result of integration processes.

- Rigid tax measures, such as the lorry tolls of 0.4 to 0.8 EUROS per vehicle-kilometre sometimes requested, present considerable risks. It is likely that in the absence of modal alternatives which correspond in terms of quantity and quality to the demand for freight services, locational decisions will be affected.

  As a result of global competition, these are aspects which have to be factored in. Sustainability concerns, however, have only a secondary role in the decision process. Social policy aspects are confined to the interaction between the different participants in the supply chains. These, however, are always based on individual profitability concerns (Carter/Jennings, 2002).

5. CONCLUSIONS

- Sustainability is both a duty and an obligation for the transport sector. This is underlined by the accumulation of external effects while mobility requirements continue to grow.

- Forecasts show that, in the medium to long term, freight traffic will increase much more than passenger traffic. In addition, freight traffic is characteristically determined essentially by development processes occurring outside the transport sector (derived demand).

- The fact that freight traffic trends are affected by many different national and international development processes also means there is little scope for controlling freight demand using transport economics or transport policy means. In the context of global competition between products, firms and states, administrative measures aimed at reducing freight mobility cannot be seriously discussed.

- Through modal split changes, sustainability considerations can help ease the problem by halting the decline of railway and inland waterway market shares at the expense of the disproportionately high increase in road traffic.

- Account must be taken, however, of the system characteristics specific to each mode. The exacting logistical requirements characteristic of the growing demand for semi-finished and finished products are a major obstacle for the railways and inland waterways, hindering their access to the market.

- The tension that exists between growing freight mobility, the complex performance-related demands placed on modes of transport and the need to ensure sustainability can be eased by means of a strategy combining the following aspects:

  - Improvement of the quality of services provided by the railways and inland waterways, particularly with regard to general logistics. Keywords in connection with increasingly globalised quality chains are internationality, flexibility, reliability, and a capacity for integration (physical and information-based).

  - The important role of combined transport. Cost and quality shortcomings must be eliminated.

  - The need to step up pressure to secure lasting change at the level of the railways' organisational structures, technical facilities and protectionist market strategies, all of which tend to be nationally oriented. This is essentially a supranational responsibility resting, for example, with the EU Commission. National policy measures in this context have only very limited success, insofar as most railways are state-owned. Included here is the opening of infrastructure access to third railways, insofar as it encourages new forms of intramodal competition.

  - Administrative measures to improve road freight efficiency. Euro norms have proved effective for reducing harmful emissions and noise pollution. The introduction of infrastructure charges coupled with efficient competition leads to high capacity utilisation and therefore a further decoupling of freight performance (tonne-km) and vehicle performance (vehicle-km) trends.

- The development of a high-quality railway system is impossible without state subsidies. Funding must be injected into railway infrastructure investment and the development of combined transport terminals. In this context, an essential component of a policy geared towards sustainability is open access for all railways.

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Changing Location and Infrastructure Patterns for Sustainability

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SUMMARY

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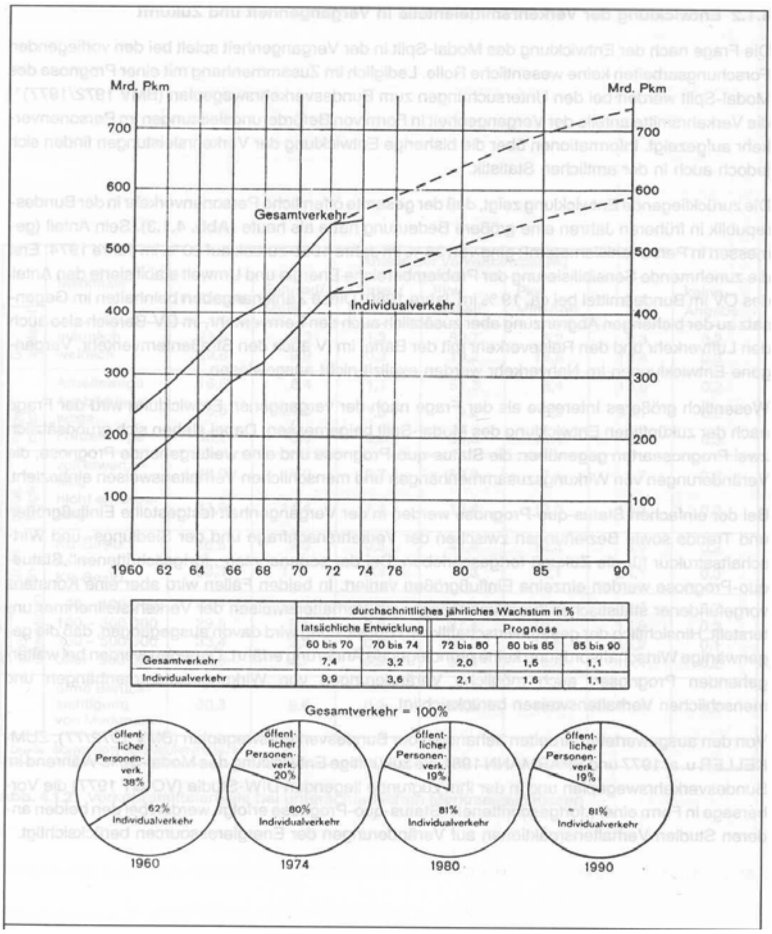
1. HISTORICAL BACKGROUND

Modal split is a fairly new technical term in traffic engineering because, for most of history, the majority of people generally had no modal choice. Even in earlier times, transport in some parts of the world was not sustainable; for example, Venetian ship-building caused deforestation around the Mediterranean. With the invention of new transport technologies such as the railway and the aeroplane, transport scientists had to address the problem of modal choice. To describe the phenomenon, they devised a "modal split" indicator. The term "modal split" was primarily used to describe the "mobility shares" of the various means of transport -- car and public transport. Figure 1 shows a typical forecast from 1972.

Figure 1. **Forecast of person-kilometres**
[the modal split is shown in the circles at the bottom of the figure]

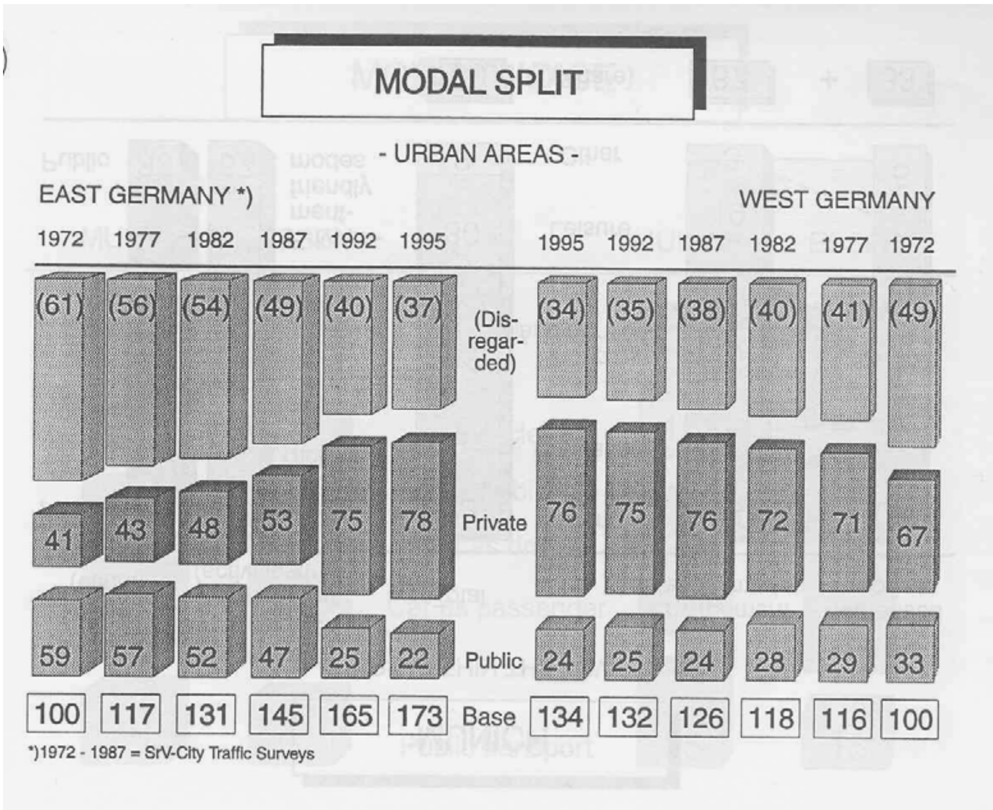


Source: BMV, 1972/77 [1].

This rather restrictive definition of modal split was mainly used by traditionally educated transport engineers who were totally focused on mechanical transport systems. The use of this indicator gave the impression that mobility was increasing. The unit of scale was usually the number of person- or tonne- kilometres for each of the two modes. Sometimes the number of trips made with the two modes was also used [2].

The traditional concept of modal split and transport planning disregards non-motorised transport users such as pedestrians and cyclists. City planners and social scientists, but also traffic engineers with a more holistic view, tried to construct an indicator that would also include these modes. Transport scientists from various disciplines replaced the extremely narrow definition of modal split by the "common standard of today", which includes all modes i.e. non-motorised transport users as well. The problem was to define the correct unit of scale. Kilometres were not appropriate any more and the "trip" unit also had to be specified since many trips are made with different modes. Every trip by car or public transport also has at least one pedestrian trip at either end. Usually, the main mode used during the trip in terms of distance or time is considered to be the dominant mode. Depending on which definition is used, the results differ. For example, in the City of Vienna the split between car, public transport and non-motorised modes is 37 : 34 : 29, or if all trips in public space are counted separately, 16 : 14 : 72. In freight transport, up to now, the dominant role of non-motorised users has not been taken into account.

Figure 2. **If the definition of modal split is restricted to mechanical transport modes only, then the large share of non-motorised modes is disregarded**



Source: W. Brög [3].

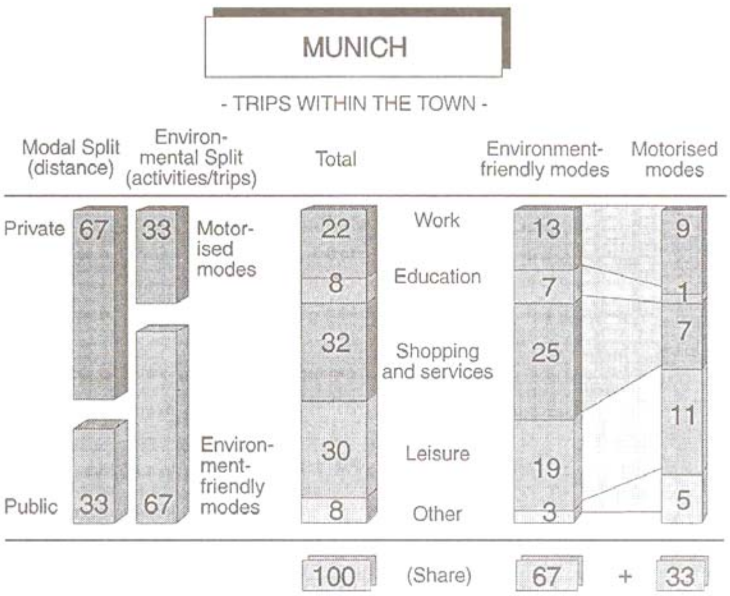
2. INDICATORS THAT GIVE A BETTER UNDERSTANDING OF MOBILITY

The “person-kilometres” or “tonne-kilometres” unit became obsolete with the change in the way mobility was understood. Surveys showed that increasing speeds in transport systems were not reducing travel time, an observation already found in Lill’s law of 1889 [4]. The analysis of worldwide surveys by Schaefer *et al.* [5] also confirmed this important finding. On the other hand, the average number of trips for person per day has not changed with increasing car use.

These two findings had an important impact on the modal split definition. The traditional definition does not satisfactorily reflect the actual state of affairs. The constancy of all mobility indicators (except for distance) has to be taken into consideration. The modal split indicator requires another standard of comparison [6][7]. As Brög has shown in his comparative studies of East and West Germany, a substantial part of mobility was ignored by the traditional definition of modal split.

Furthermore, only the number of trips is taken into consideration and not the number of kilometres (Figure 2). The differences between the definitions are clearly visible in Figure 3. Using distance as the basis for calculating modal split no longer makes sense. This applies to all the various modes (non-motorised: pedestrian, cyclists; motorised: mopeds, cars and coaches; public transport: bus, tram, metro, rail and even air). The purpose of the trip also has to be taken into consideration.

Figure 3. **Distance- or trip-based calculations give different results for the modal split**



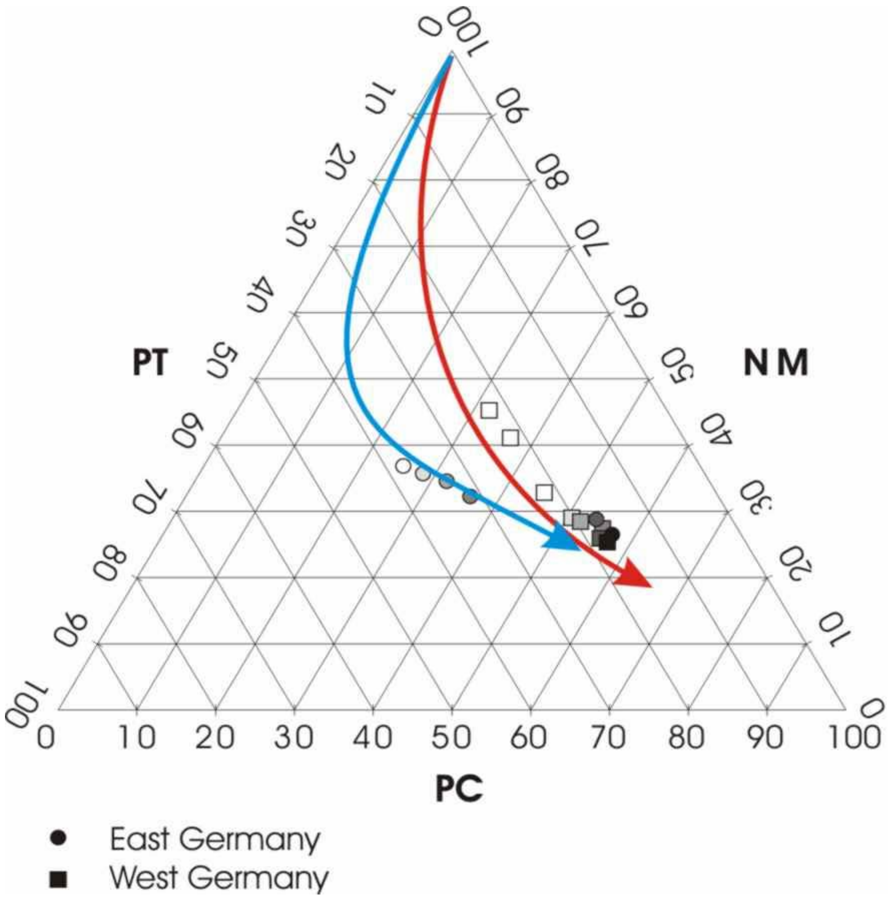
Source: W. Brög [3].

3. TRENDS IN MODAL SPLIT

The dominant trend in transport over the past hundred years has been the growth of car traffic.

Cars, as they are used today, cannot be considered a sustainable mode. Car travel requires much more space, material resources and non-renewable energy than any other land-based mode. The rising trend in car use is unsustainable. Figure 4 shows the path of modal split in a Modal Split Triangle, from the uncomfortable but sustainable area to the present comfortable but unsustainable transport system. If we want to develop a sustainable transport system, we must escape from the bottom right-hand corner. One way of doing this, which is often discussed in the literature, is by pricing.

Figure 4. **The path of modal split runs from sustainable modes (top left-hand side of the diagram) to the unsustainable modes in the bottom corner**



West Germany: red line; East Germany: blue line
(PC = private car, PT = public transport, NM = non-motorised mode)

4. A LOT OF EFFORT, MANY ATTEMPTS BUT FEW CONVINCING RESULTS

With the increasing awareness of the down side to comfortable mechanical transport, countless efforts have been made to change the trends in modal split. Urban transport took the lead in this development. The growing volume of long-distance road haulage in the Alpine valleys has been a problem since the 1980s. Future-oriented transport policy concepts propose a change in the modal split [8].

One of the core measures proposed is pricing, i.e. using financial mechanisms to induce people to adopt more sustainable transport modes. In [9] Rothengatter wrote, *"There is no contradiction between economic roles and sustainability if the prices for environmental goals are clearly set and rationally expected for the future. But the problem is the key issue: to convince people, because they are also voters and buyers."* He thus called for more analysis in regard to the following objectives:

- To convince people that environmental objectives and internalisation measures are scientifically -founded and feasible;
- To simplify and clarify the scientific reasoning and results, so people can understand the message;
- To construct scenarios for different measures if environmental actions also have some negative impacts, e.g. the redistributional effects of CO_2 charges;
- To develop bonus and refund systems if environmental pricing generates high tax revenue, so such measures are not perceived as being designed to balance public finances.

Rothengatter called for a transport system with a more effective feedback mechanism. In regard to priority infrastructure in Europe and its funding, he states: *"Additional capacity must be rapidly provided in response to Europe's new commercial geographical structure. A European infrastructure master plan is required that will both cover the main routes in inland rail, road and waterway transport, in sea transport and in air transport, and co-ordinate measures for the development and creation of infrastructure."*

There is a certain contradiction involved in trying to achieve more sustainable transport without a basic change in existing structures. A clear systemic analysis is therefore necessary.

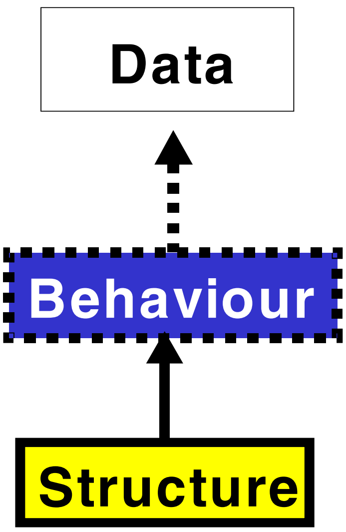
5. DATA AND THE UNDERPINNING METHODOLOGY

The modal split is an indicator (regardless of the base unit used) which is based on data. Data are the reflection of a given perception of reality. The traditional definition of the modal split -- between car and public transport -- reflects the way in which traditionally-educated transport engineers perceive reality. The kilometre unit expresses their “world view”. The definition of modal split, based on the number of trips or tonnes and including non-motorised transport, is not used but embodies another world view. The nature of the indicator and its definition is thus shaped by a certain methodology which, in turn, produces the data. Data are the result of behaviour, in the case under consideration, the behaviour of people or goods activities -- as well as of experts. Modal split is thus an indicator which reflects the behaviour of society and people's world view.

6. WHAT INFLUENCES BEHAVIOUR?

If we want more sustainable transport, it is necessary to change people's behaviour. But the question is how? The technological problems of the past were compatible with and driven by individual egoism (Rothengatter [9]). This statement is correct and will remain so in the future. Why should people change their behaviour?; and is it possible for them to do so anyway? Better understanding of human behaviour is thus required if we want to shift modal split in a more sustainable direction (by pricing). We have to understand what pricing can do and cannot do. For this purpose, it is necessary to understand human behaviour in the transport system, not only on the functional level but also in relation to its causes. Basically, behaviour is always structurally determined (Figure 5). Examples of those structures are building structures, financial, social, value and economic structures, etc. Currently, modal split is an indicator with a car bias. As long as such structures exist, it will be difficult to change the trend, since behaviour is the effect of such structures and the modal split is the result of behaviour.

Figure 5. **Basic relationship between structures, behaviour and data**



7. IS PRICING EFFECTIVE ?

Pricing is the use of monetary measures to influence human behaviour. A comprehensive review of pricing mechanisms can be found in the ECMT Round Tables Nos. 7, 10, 13, 22, 46, 56, 67, 79 and 80. Pricing covers public transport fares, rail tariffs and fares, road pricing, tolls, fuel taxes and parking charges. Several studies have been carried out which confirm the widely-observed weakness of the price-elasticity of demand for car use under prevailing conditions. It is commonly acknowledged that elasticities increase in the long run. This means that individuals require a certain period of time, given the constraints arising from their lifestyle, to modify their behaviour in response to price changes.

Pricing is a financial tool used to make one mode less attractive and to make another one (such as public transport) more so. Experiments with transport pricing have been confined to very specific cases from which it is difficult to generalise. There are a few examples (mainly involving parking charges) of pricing producing a substantial change in modal split. A certain amount of price elasticity -- at least in the short term -- exists, but long-run elasticity, which has been analysed in several theoretical studies [10], has not been observed in practice so far.

The question remains as to whether pricing can modify the prevailing trend in modal split and redirect it towards a sustainable transport system. Analysis of the available empirical studies shows that there is a deeper driving force influencing human travel behaviour than pricing systems. Pricing is a financial structure. This structure is (in general) not permanently present compared with other structures. Built structures, for example, are always present and effective and they have a direct influence on human behaviour and thus on modal split.

Figure 6. **Reduction in commuter trips resulting from daily parking charges**

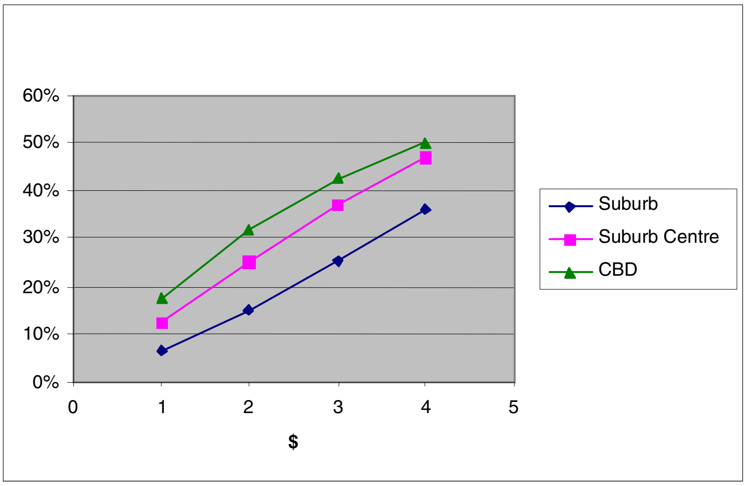


Figure 7. **Impact of fuel tax increase, year 2010**

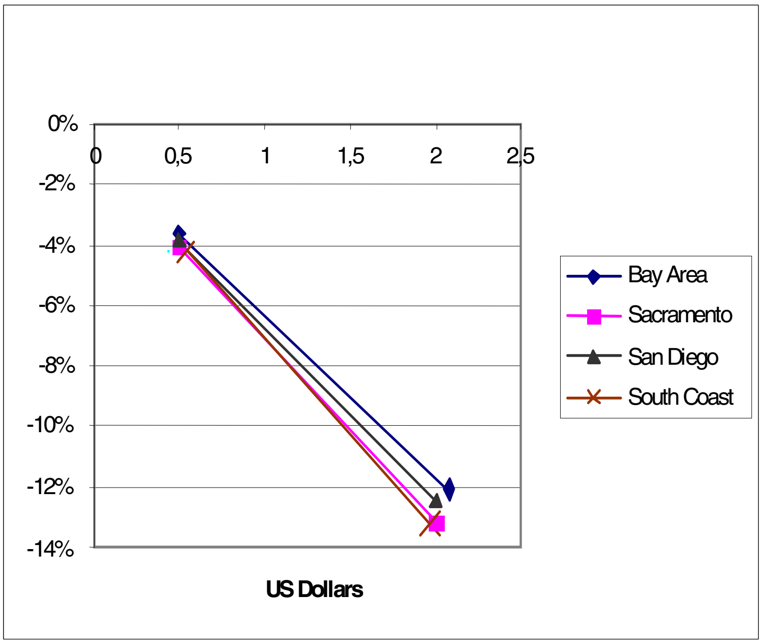
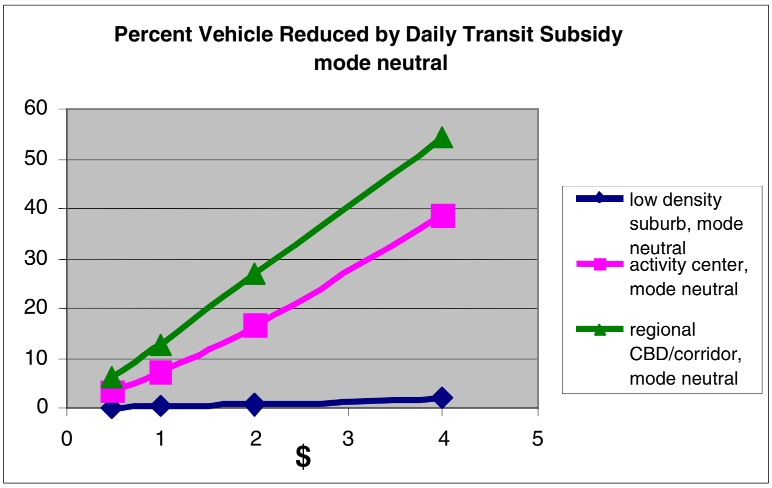


Figure 8. **Percentage reduction in vehicle use resulting from daily transport subsidy, mode-neutral**



If we go back in history, tariffs were always related to travel time. Such tariffs go back a long way in the case of public transport. But there are also other kinds of pricing, for example, road infrastructure pricing, as in the case of the traditional toll road.

From the traffic engineering point of view, pricing is a device to restrict travel. Transport engineers and planners have removed all barriers and restrictions to car traffic by widening roads, building excellent connections and providing enough cheap parking places. City planners have designed city structures with a view to optimising car traffic. This has an influence on people's behaviour. The existing trend points towards an over-capacity of car-oriented infrastructure. Financial barriers are now being proposed or implemented to try to bring this development under control. If pricing is necessary to correct this trend, it shows that the over-capacity of car-oriented infrastructure must be widespread.

8. UNDERSTANDING HUMAN BEHAVIOUR

Engineers and economists work with distances or time, as measured by a machine (clock) or a scale, and with costs. But does human behaviour conform to these physical units?

8.1. Modal split -- the result of deeply-entrenched behaviour, conditioned by evolution

The issue paper of the EST Workshop in Berlin in 2002 [11] provides an excellent review of how human behaviour in transport is understood today. *"There are almost as many views about how human behaviour is maintained and how it changes as there are people who hold the views."*

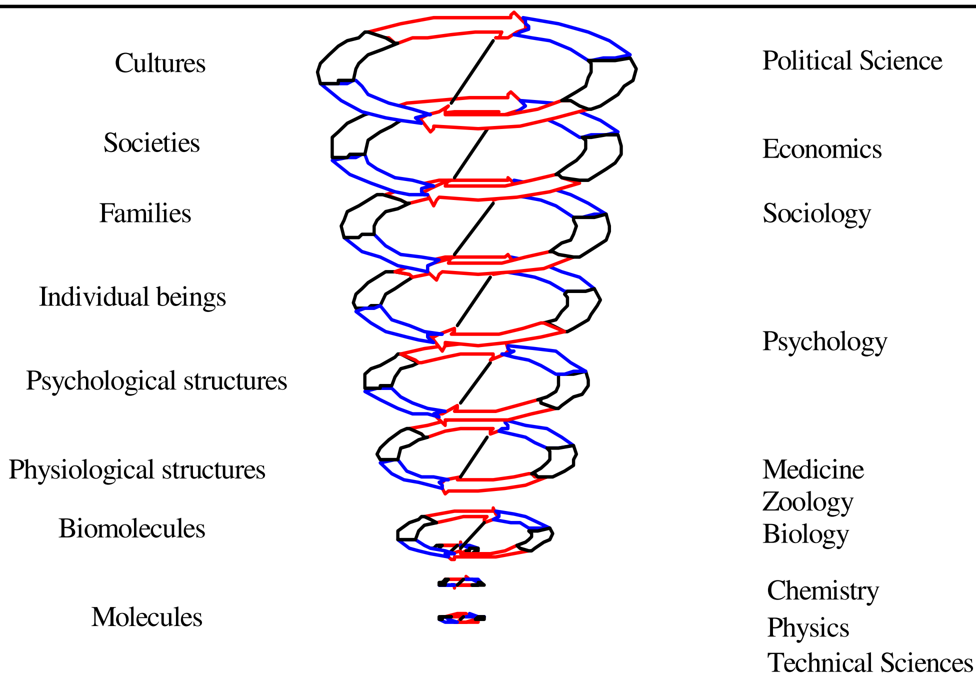
The paper distinguishes five different approaches:

- Interior construct;
- Brain activities;
- Heredity;
- Antecedent external causes;
- Consequences of behaviour.

The paper comes to the conclusion that the best way to change transport behaviour may be to change the milieu in which it takes place.

This confusion is a result of cross-sectional problems, which are not obvious and span several disciplines. First, it is necessary to analyse the five approaches. Afterwards we should be able to understand whether the conclusion derives from strict logical necessity or amounts to only vague recommendations. The tools that will be used are based on evolution and epistemology. They have their roots in the 19^{th} century (Darwin) and have been further developed and popularised by Konrad Lorenz, Rupert Riedl, Bertalanffy and others [12][13][14]. Riedl has published a "hierarchy" of disciplines based on levels of evolution. This hierarchical order, ranging from the basic elements of matter and the structures that emerge from atoms, molecules and bio-molecules to the more complex structures of animals, man, family and society, civilisation and cultures, is mirrored by a parallel order of disciplines (Figure 9).

Figure 9. **Levels of evolution and scientific disciplines**



Source: Rupert Riedl.

The basic problem is the lack of an holistic view. Each discipline is more or less considered in isolation from the others. However, if effects occur on one level, they can also affect other levels and therefore other disciplines. This means that each discipline attempts to find an explanation in its own particular realm and ignores the other level where the problem actually came from. Explanations may also reflect concerns specific to a discipline and may not be related to the processes on the levels in which the problem occurs. At the lower, molecular level of the evolutionary process, human behaviour in a technical environment is usually not a core issue.

According to this distinction, the *interior construct* approach pertains to the upper levels, and ignores the fact that a new kind of transport system may also influence the more basic levels that are remote from human consciousness.

The second approach, which focuses on *brain activity,* addresses part of human behaviour but is not adequate to deal with behaviour as a whole .

In this paper, *heredity* is understood as the part of the process that lays down the preconditions of behaviour. It can be understood as a result of useful behaviour in response to a particular context or the human environment. However, more research is needed to understand human behaviour in an artificially-built environment.

Antecedent external causes do, of course, play a role in the system but cannot explain behaviour as a whole.

Finally, the *consequences of behaviour* are only one part of the equation, the other being the feedback that connects experience with expectations.

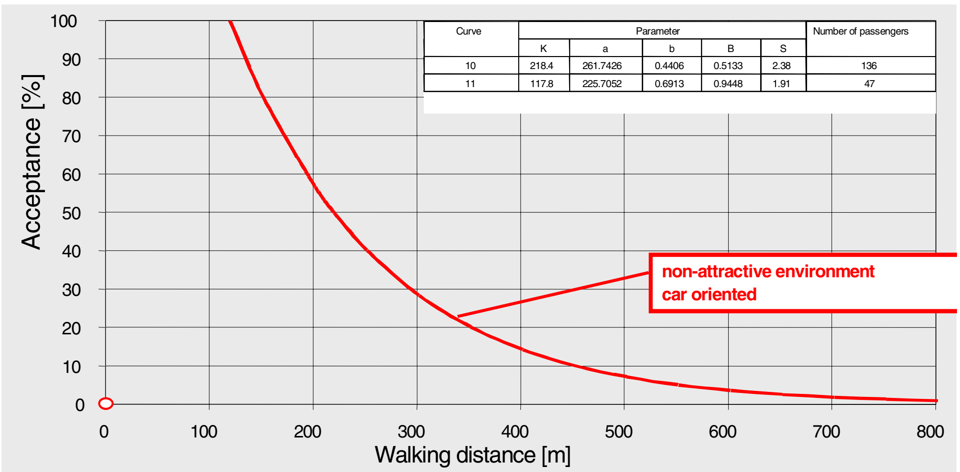
8.2. On what level does the car interact with the driver?

In 1974, Walter published a study about the different time perceptions involved in walking and riding a bus.

Compared to the time spent in the bus, the time spent walking to the bus stop was over-estimated exponentially with the distance; the reciprocal curve was called the "acceptance function" [15]. A similar observation was made by Karl von Frisch when he deciphered the language of bees. The frequency of a bee's dances shows the same mathematical function [16].

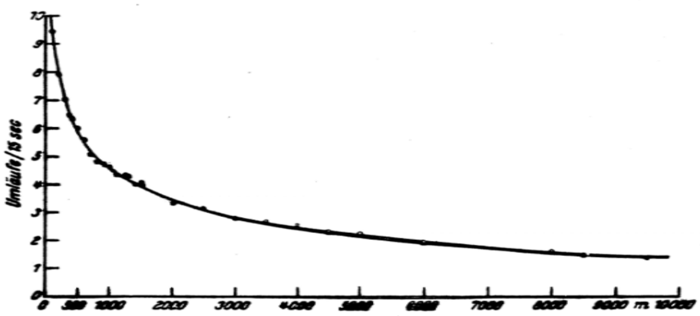
Conducting a "modal-split experiment for bees", Karl von Frisch (1956) discovered that the content of the information was body energy. Knoflacher (81) discovered the homology between these two experimental results. That discovery is now the crux of the explanation of human behaviour in the new transport system. Human body energy (physical and mental) is obviously the driving force for modal choice and determines behaviour and the modal split.

Figure 10. **a) Human "acceptance" function**



Curve	Parameter					Number of passengers
	K	a	b	B	S	
10	218.4	261.7426	0.4406	0.5133	2.38	136
11	117.8	225.7052	0.6913	0.9448	1.91	47

b) Bees' "acceptance" function



Source: Walther, 1974 [15]; K. v., Frisch [16]; Knoflacher, 1981 [17].

Table 1. **Body energy demand for walking and driving a car, respectively**

Body energy	Kcal per minute	In relation to car
Walking 4 km/h	4.3	2
Walking 6 km/h	6.5	3
Running 12 km/h	12.6	6
Running 20 km/h	24.2	12
Driving a car	**2-2.9**	**1**

Knoflacher also applied Weber-Fechner's Law, a fundamental law of the relationship between human behaviour and the outside world, which describes the relationship between sensation, the trigger of our behaviour, and the intensity of stimulation of the physical indicators of the outside world:

$$\mathbf{S = \ln(I)} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

S = sensation
I = intensity of irritation.

The inverse function:

$$\mathbf{I = e^{+/-\,S}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

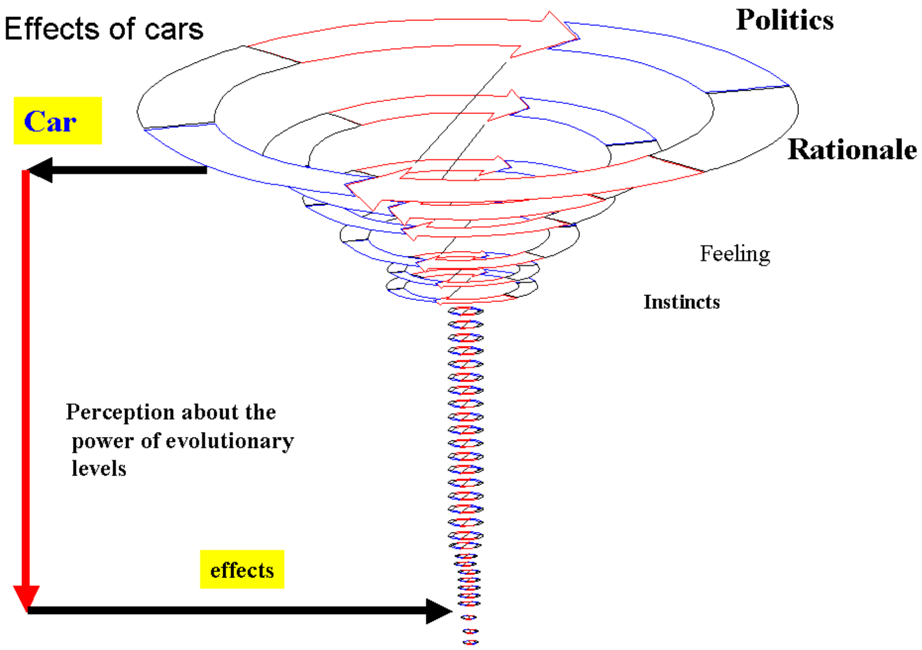
Equation (1) is Weber–Fechner's well-known law. Equation (2) is the inverse function and has the traditional form of the "resistance law" in transportation: $I = e^{-f(x)}$.

We see that sensation can have a + or a - sign. The + sign indicates an attractive sensation on an attractor. This has been shown in many studies by Knoflacher since 1981 [18].

8.3. A far-reaching effect

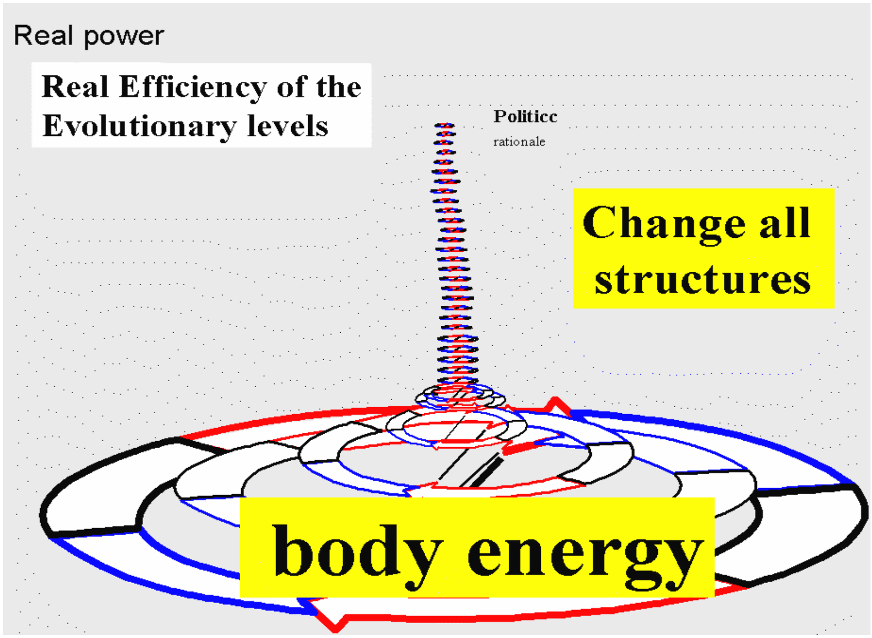
If body energy is the decisive factor shaping modal split, it means that cars move people and determine their behaviour at an extremely deep-rooted level in evolutionary terms (probably the deepest one), and this creates many problems.

Figure 11. **The most recent levels of evolution are the most important in our perception**



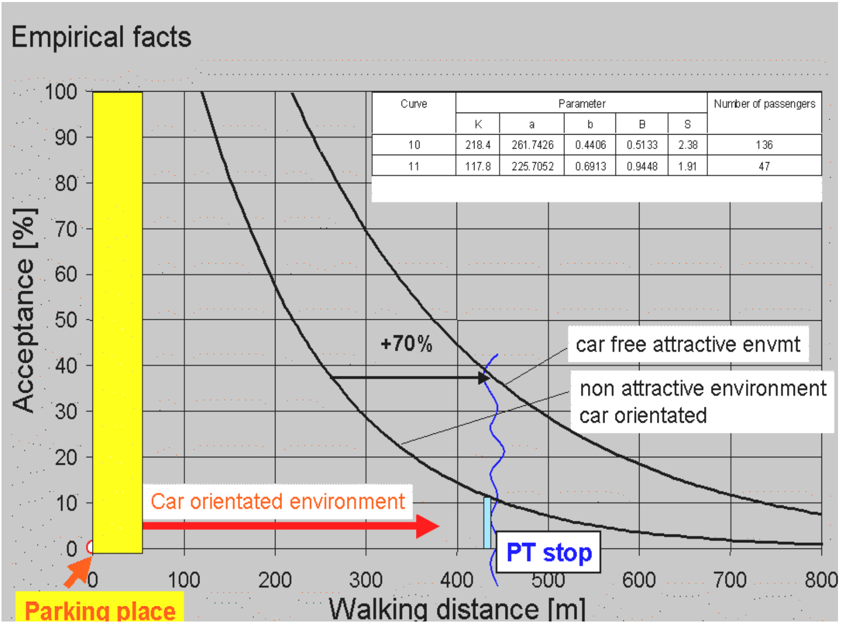
As a consequence, our society over-estimates the effect of the most recent evolutionary level, that which is related to politics and culture, and underestimates or neglects the effects of very old evolutionary levels that are embodied in new inventions, probably for the first time in human society.

Figure 12. **The real power of evolutionary levels is related to their age**



This discovery has far-reaching consequences, since it can be shown that the point of leverage for changes in modal split is the place where man comes into contact with technical modes. For the car, this is the parking place. If we consider human behaviour as described by Weber-Fechner's Law, the decision as to modal choice takes place primarily at the origin and destination of each trip. If the parking place is adjacent to human activities, as is usually the case today, all other modes trigger negative stimuli, due to the lack of space and lack of safety, environmental quality and accessibility.

Figure 13. **Acceptance function for walking distance is the crucial factor**



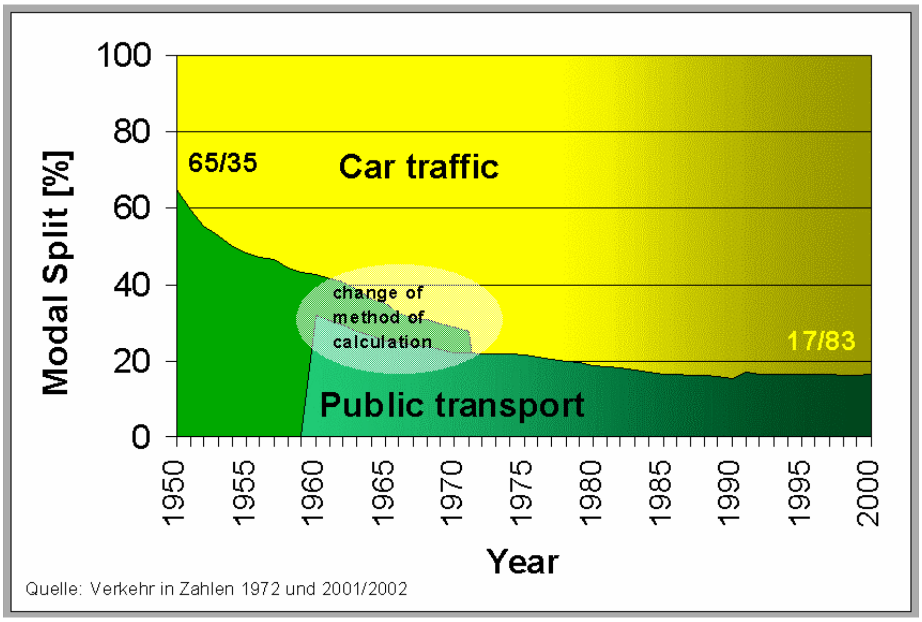
If a public transport stop is 300 or 400 metres away, 90 per cent of the modal split is preconditioned by a set of structural specifics. Man is caught in his own evolutionary trap if physical structures are organised in such a way.

9. EMPIRICAL PROOF

To show the validity of the theory, it is necessary to provide empirical proof. As an example, we will take the trend of modal split in Germany from 1960 to 2001 (Figure 14).

This figure and Figure 15 show increasing car use, and reflect the general trend. If we calculate the relationship between car availability and public transport use, we obtain a perfect reproduction of Weber-Fechner's Law (Figure 16).

Figure 14. **The share of public transport has been steadily decreasing for fifty years**



Source: *Verkehr in Zahlen* 1972 and 2001/2002.

Figure 15. **Increasing motorisation use goes hand in hand with decreasing public transport**

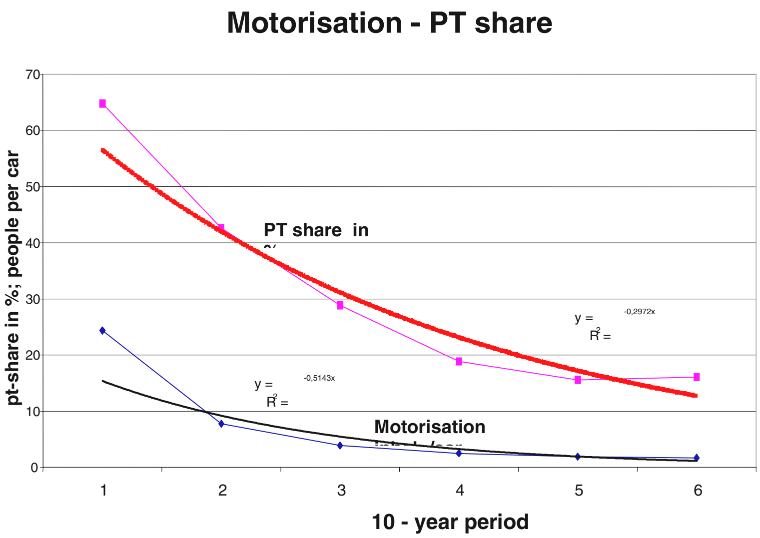
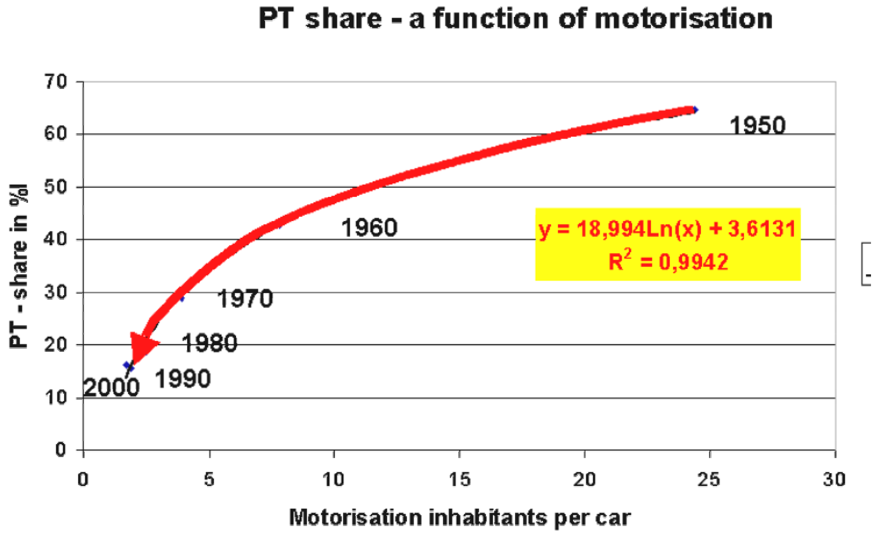


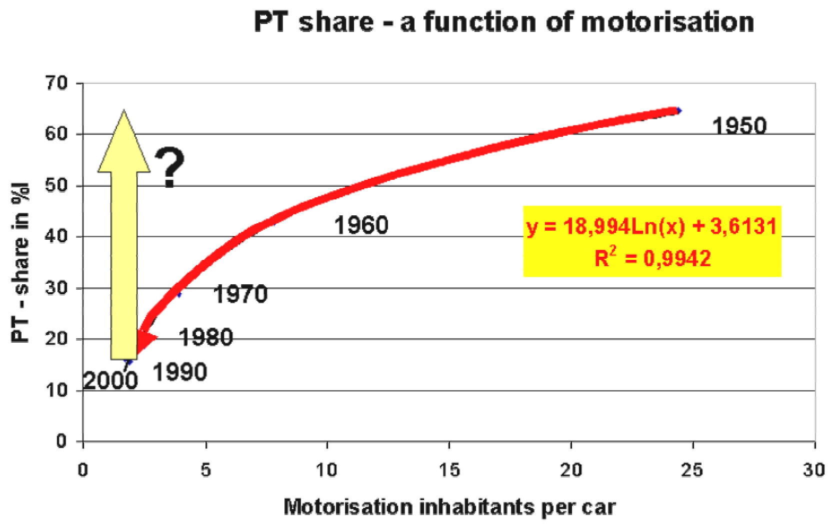
Figure 16. **The rate of motorisation and the share of public transport are connected by Weber-Fechner's Law**



If we want to use pricing to change behaviour, we have to bear in mind that money is a form of energy at the upper levels of evolution. Compared with physical power it is not sufficient to compensate for the effects of physical structures.

If pricing were pitched at the level required to compensate for the effects of physical structures, it would be politically dangerous since it would create social problems (in other words, the rich can afford to pay, but not the poor) (Figure 17).

Figure 17. **The cause of this effect was (and still is) the change in physical structures over the period**



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Modal split and pricing in the context of sustainable transport have to be conceived in the right order. Pricing can have a synergistic or prohibitive effect, but currently we have a synergistic effect between physical structures and prices that is counter to sustainable development.

10. THE DESTRUCTIVE EFFECT OF THE CURRENT PRICING SYSTEM

Today, national parking regulations require parking spaces to be provided close to activities, thereby encouraging car use to the detriment of public transport. Moreover, in many countries an additional fee has to be paid if private parking places are not provided. This is quite the opposite of what is needed to place both modes of transportation on an equal footing. Existing pricing arrangements are designed in an upside-down fashion and do not promote the behaviour required to attain a sustainable transport system. Also, the pricing of parking space is not conducive to sustainable behaviour.

11. THE PROPER USE OF PRICING AS A TOOL FOR CHANGING MODAL SPLIT

In a market economy, value and price should reflect desirable behaviour, but this is not the case today. A person pays less for a parking place with the highest value (at home) and society makes up the difference. A parking place at home has the highest value, but people do not pay for it as they should.

Fair pricing means that people have to pay for infrastructure and the consequences of their behaviour. They should pay for an extensive road network, longer pipelines and cable networks, as well as for the effects of their desire for personal comfort. They should pay for the deficit of public transport, in a certain amount for the damage to cities' economic fabric, and for local unemployment, etc. But at present they pay very little and society makes up the difference.

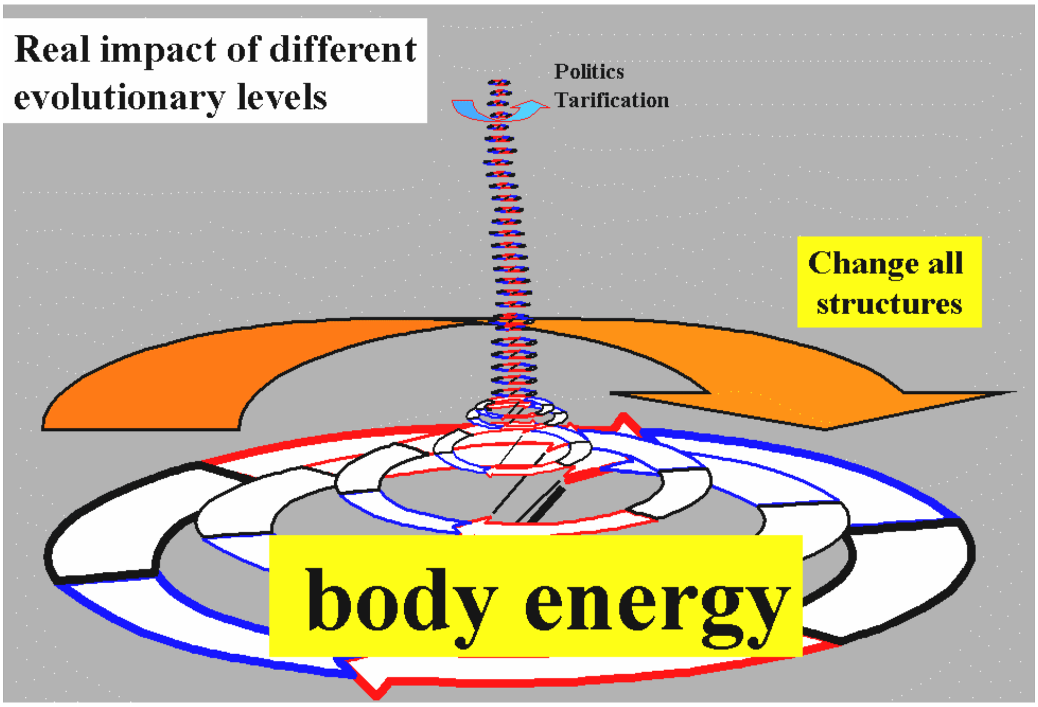
On the other hand, if they park in a place which minimises unsustainable transport behaviour, then they should pay less or nothing. If we accept political goals for public transport, the minimum distance between all activities and the parking place should be at least as great as that to public transport stops. This would change the parking regime totally: decentralised, individually-optimised parking would give way to centralised, system-oriented parking with central garages, which would have to be at least as far away from human activities as public transport stops. Such infrastructure would have to be supported by a fair pricing system.

The allocation of resources under existing pricing rules is totally wrong and counter to political and environmental goals. The structural set-up is such that we cannot expect human behaviour to change in the way it should. People's behaviour is determined by existing structures, but since built and financial structures are wrong, they cause the very problems about which we complain.

12. IS PRICING AN EFFECTIVE WAY FOR DEALING WITH THE PROBLEM?

Pricing deals with money and money is a unit of energy on the social level, which is one of the most recent levels in the ladder of evolution. The causal factor of unsustainable behaviour is also energy, but body energy on the individual human level, which is one of the oldest and most deeply-rooted.

Figure 18. **Pricing deals with money – the energy of our society – on the upper level**



[Please correct – **Pricing** instead of Tarification]

In principle, pricing may be regarded as an effective tool for changing the modal split, but its power lies on the upper social level, which is negligible compared with the individual effects of existing structures -- and the car, illustrating clearly the dilemma for policymakers. Under existing conditions, pricing is of secondary or tertiary importance. However, it will become a powerful tool if physical structures are changed in the way recommended above. Today, the pricing structure is the exact contrary of what would be needed to develop a sustainable transport system. If we introduced a pricing system based on actual human behaviour, anyone who parked at home or close to the shops or their workplace would have to pay accordingly. But, under the current pricing system, those who behave in a way that is conducive to sustainable transport and do not have a parking place at home are punished.

13. ROAD PRICING -- A PUNITIVE MEASURE?

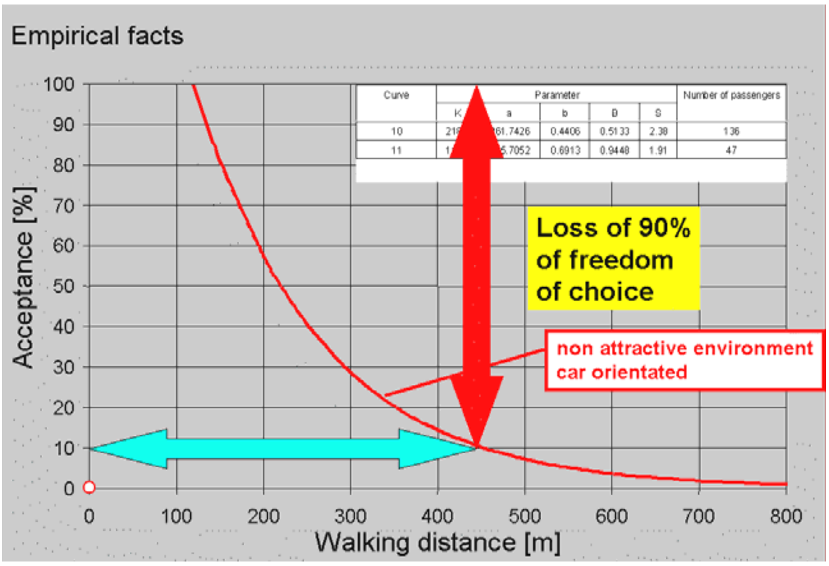
The application of road pricing to people and goods once they are already travelling in cars and trucks, respectively, is punitive for transport system users and is not an effective instrument for a human-oriented traffic policy. It is also unfair to the economy and industry. People and industry will behave in the right manner and optimise their benefits under given conditions.

But, under current parking regulations, people are also punished by virtue of the fact that their behaviour is determined by existing building and land-use structures, which can also be seen as a restriction of freedom of choice. This could be changed if people were able to obtain the right information at the right place, i.e. before they are forced (by inner and outer determinants) to use an unsustainable mode.

14. THE SAME PRINCIPLES SHOULD BE APPLIED TO GOODS TRANSPORT

The same principles should apply to freight transport. Building structures without direct access to the railway system should pay for being in the wrong location since they benefit from cheap sites. Today, these benefits are socialised and paid for by society. If the pricing structure took account of this, it would promote the right kind of behaviour and prevent people from making such structural mistakes. But there is a long way to go, since nearly everything that has been done in the transport system during the last fifty years has been in the opposite direction.

Figure 19. **If the walking distance at the origin and destination of trips differs according to the various modes, as it does today, body energy consumption becomes the decisive factor for modal choice**



15. CONCLUSION

Modal split is a key indicator for sustainable transport if it embraces all modes, from non-motorised users to mechanical transport modes. The invention of rail, cars, aeroplanes and telecommunications has fascinated society, experts and decisionmakers alike, and their consequences have not been recognised for a long time. The development of high speeds was an important step forward since it seemed to save time. But the overall outturn was quite different from individual short-term experiences. Spatial location, a stable entity for thousands of years, became a variable. "Invisible" travel time is a stable constant in the transport system. The myth of growing mobility has to be buried as well. More and more empirical findings from all over the world show the constancy of two very important indicators for the transport system: the average number of trips and the average travel time per person per day. What has changed are distances and fossil energy consumption, attesting not only to the decreasing sustainability of the transport system but also to a dramatic decline in overall efficiency. The indicator of modal split supports these findings, confirming a steady increase in car traffic.

Sustainable transport can be defined as transport systems that are highly efficient within the limits of ecological, social and economic capacity. Non-motorised transport users and, to a certain degree, mass transit systems, characterise such transport.

Pricing is a set of measures that can be used to encourage transport system users to behave in a sustainable way. Its effectiveness depends on the surrounding conditions. It is a measure that is socially very sensitive, which limits its theoretically possible effects. Money -- the tool of pricing -- is related to energy. To use this instrument in the most effective way, it must be applied at the most

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appropriate point of leverage of the system, i.e. at the point of parking (or loading of goods) and not to traffic flows. Today, pricing takes the form of tolls, road pricing, congestion charging, etc. This is ineffective and unfair to users, who are forced to use their cars by existing structures. These structures are optimised for individual situations and not for the system. If the walking distance to a parking place is shorter than to a public transport stop, people will continue to use their car -- and to pay.

Pricing is a means of reducing car traffic in order to obtain a more sustainable transport system. The over-capacity of car transport is manifest; it shows clearly that the choices of the past were misguided. Taxpayers' money was used to remove barriers to car traffic at a very high cost. People use this expensive, artificial "limb", the car, more and more -- and then they are punished by road pricing. If they park near their home or close to their workplace, they are forced to use the car -- they become captive car-users. A fair system of pricing should give people at least the freedom of choice between modes. To this end, pricing has to be focused on parking management. Whoever parks near to home or uses parking facilities close to shops or the workplace should bear the cost of such facilities. Whoever parks his car where there is a freedom of choice between all modes, should pay less. If this balance is established, pricing will become a much more effective means of promoting sustainable behaviour.

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Modal Shifts, Elasticities and Qualitative Factors

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SUMMARY

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1. INTRODUCTION

The current strong growth in road haulage traffic is a major source of congestion and pollution, as well as the cause of many road accidents. This growth is expected to continue over the next few years, as a result of which the problem is likely to become even worse. One solution that has often been proposed and that has the backing of European authorities, is to promote the use of substitute modes such as rail, inland waterways, maritime cabotage and intermodal and multimodal combinations, whose impacts are less severe than those of road. This could be done by adopting a pricing and taxation policy which would take account of the external costs of different modes[1].

Such a policy merits consideration, since in principle it would encourage a better allocation of public resources. However, its impacts depend on how demand would respond to variations in the prices for different modes. Measurements of direct- and cross-elasticities of demand to the prices of different modes can be highly informative in this respect, particularly if they address different categories of freight and take account of the accessibility of firms to transport networks.

However, there are few research findings available in this area, probably because of the lack of data. Furthermore, most of these findings have been derived from data that are incomplete, primarily due to the lack of information about the qualitative factors characterising different modes. Factors such as reliability, flexibility, losses and frequency can have a significant impact on the organisation of a logistics chain, and in some cases may play a determining role in the choice of a mode of transport. This paper addresses both of these aspects of the problem. The first section presents and discusses the detailed estimates of direct and cross-elasticities of demand for different categories of freight that our research group, GTM-FUCAM, has obtained through an analysis of networks. The second section considers the problem of the role played by qualitative factors in modal choices.

2. ELASTICITIES OF TRANSPORT DEMAND[2]

The elasticities calculated by GTM are derived from simulations of different price parameters for the ten NST-R freight categories run on a model of European multimodal freight transport networks. Highly detailed digitised maps of Belgian rail, road and inland waterway networks were incorporated into the corresponding (and less detailed) network maps for western Europe -- ranging from Scandinavia to Spain, Italy and Greece. The resultant maps constitute a geographic information system (GIS) operated by the NODUS[3] software program developed by Jourquin (1995). This program accounts separately for each transport operation (loading, unloading, transit, transhipment, etc.) and the associated costs through the use of virtual links, thereby permitting in-depth analysis through the simulation of intermodality and mode substitution. In the present example, the ten O-D matrices take account of all domestic flows within Belgium, imports and exports to and from western Europe, and transit flows through the country.

The simulations run at different cost levels allowed us to calculate the direct and cross-price elasticities of demand for transport. The elasticities presented here relate solely to flows on Belgian soil; however, they also take account of the accessibility of all networks to origins and destinations in western Europe.

These elasticities are unusual in that they are not calculated by means of standard econometric methods but on the basis of simulations that optimise the choice of modes and highways within a given network. The resulting assignment of flows to the network may be treated as demand for different modes and means of transport on the basis of two assumptions, namely, that: shippers minimise their generalised transport costs; prices as such (which are not known) are closely linked to the cost of transport operations, or in the case of "contestable" transport, i.e. transport subject to genuine competition, to at least the marginal cost. These two assumptions can probably be accepted as reasonable approximations. Generalised costs take account of transport time, but are only specified here in relation to transport operations.

It is worth noting that these estimates are conditional, compared with demand estimates derived from O-D matrices. They therefore take no account of the long-term impacts of cost variations on demand. Moreover, while they provide an accurate measurement of the adjustments of demand to the relative costs of modes, they do not account for the effects of competitive adjustments between modes. In this respect, they cannot be treated as long-term elasticities. Lastly, input mixes have been held constant so that traffic elasticities are simply proportional to tonne-km elasticities (Beuthe *et al.*, 2001).

Unfortunately, it was not possible to account explicitly for qualitative factors that may play a role in the organisation of logistics chains and own-account transport operations within firms, e.g. "just-in-time" deliveries. We have compensated to some extent for this imperfection by calibrating the model to the flows observed.

Table 1 presents the results obtained when costs are reduced by 5 per cent. These elasticities appear to be of the same order of magnitude as those found in the literature, for example, Oum *et al.* (1992), Abdelwahab (1998) and the NEI report (1999). The same applies to the more detailed elasticities by category of freight. It should be noted, however, that some of these elasticities are significantly higher or lower. There are several reasons for this: the spatial distribution of demand; network density, which does not always permit the same substitutability of modes; and the ad hoc treatment of qualitative differences, even though the latter could well reduce the scale of certain substitutions. In addition, it needs to be borne in mind that some elasticities are high simply because they have been calculated on the basis of reduced market shares.

The results in Table 1 indicate that road haulage tonnage is inelastic, whereas the tonnes-km carried are elastic. This illustrates the dominant position of road haulage over short distances, as well as its attractiveness over longer distances. The two measurements indicate that demand for rail transport is elastic, but not as much as that for inland waterways. The elasticities are lower over long distances (> 300 km) than over short distances, where these modes are less competitive. In contrast to road haulage, however, the tonnage carried by rail is more elastic than the tonnes-km carried, in that a change in relative costs has a more direct impact on rail transport over short distances.

Table 1. **Overall elasticities for a cost reduction of 5 per cent**

		Set 1			Set 2			Set 3: Variations in total costs					
		Variation in total costs			Variation in cost of transport movements			Short-distance			Long-distance		
		Road	Rail	Water	Road	Rail	Water	Road	Rail	Water	Road	Rail	Water
Tonnes	Road	-0.59	0.09	0.11	-0.48	0.04	0.04	-0.58	0.08	0.12	-0.63	0.14	0.09
	Rail	2.19	-1.77	1.75	1.95	-1.25	1.50	2.26	-2.06	2.73	2.13	-1.54	0.97
	Water	3.59	0.47	-2.13	2.81	0.32	-1.44	5.47	0.58	-2.62	1.03	0.32	-1.34
T-km	Road	-1.21	0.45	0.09	-1.10	0.42	0.06	-1.06	0.11	0.13	-1.31	0.67	0.07
	Rail	2.03	-1.25	0.94	1.94	-1.14	0.88	2.99	-1.77	3.30	1.92	-1.19	0.67
	Water	1.75	0.33	-1.72	1.43	0.25	-1.53	4.51	0.49	-2.62	0.84	0.29	-1.38

Source: Beuthe *et al.* in *Transportation Research-E* (2001).

The cross-elasticities indicate that modes are substitutable in all cases, although they are not all symmetrical. The cross-elasticities of rail demand are greater than those of demand for road and inland waterways, whereas the cross-elasticities of the latter sectors are greater than those of demand for road. Consequently, demand for rail appears to exhibit greater sensitivity to cost variations than demand for other modes. It is worth noting here that variations in transport time have only a small impact on demand. This is doubtless due to the fact that solely the financial cost of transport time is taken into account and not its impact on the full logistics chain of firms.

The demand elasticities for different types of freight vary substantially for the same reasons given above. The highest in the road sector is that of petroleum products (3) transported over short distances, a market in which transport by inland waterway is competitive, as shown by its high cross-elasticity compared with road. The lowest elasticity of road demand is that for solid fuels (2) over long distances, where road haulage is not at all competitive. Consequently, the corresponding cross-elasticities are all zero (to two decimal points). Rail and the inland waterways are competitors in this market, as shown by their high elasticities.

The freight category for which rail demand is most elastic is that of agricultural products and livestock (0), where rail has a very small market share, whereas demand for the transportation of fertilizers (7) over short distances is the least elastic despite a relatively low market share. In actual fact, rail is fairly competitive in these markets.

The elasticity of demand for inland waterways is highest for iron and steel products (5), given the genuine possibility of substitution with rail for transportation between steel plants and ports; this is shown by the large elasticities between these two modes over short distances. In contrast, the elasticity of inland waterways demand for agricultural products and livestock (0) is extremely small, which is not surprising as this mode is unsuitable for the transportation of such goods. However, the elasticity of demand for long-distance transportation of fertilizers is even smaller.

Table 2. **T-km elasticities by groups of freight**

		Set 1: Variation in total costs			Set 2: Variation in cost of transport movement			Set 3: Variations in total costs					
								Short distance			Long distance		
NST-R		**Road**	**Rail**	**Water**	**Road**	**Rail**	**Water**	**Road**	**Rail**	**Water**	**Road**	**Rail**	**Water**
0	**Road**	-0.96	0.12	0.04	-0.95	0.12	0.04	-0.52	0.00	0.01	-1.11	0.18	0.05
	Rail	13.79	-2.87	0.00	13.72	-2.87	0.00	12.87	-0.11	0.05	13.86	-3.31	0.00
	Water	2.39	0.53	-0.29	2.30	0.53	-0.26	10.57	0.00	-0.31	1.96	0.57	-0.29
1	**Road**	-0.69	0.15	0.09	-0.65	0.15	0.07	-0.14	0.01	0.03	-1.11	0.27	0.14
	Rail	3.51	-1.24	0.05	3.42	-1.05	0.01	9.78	-6.40	1.99	3.37	-1.08	0.00
	Water	1.62	0.13	-0.54	1.43	0.00	-0.36	3.17	2.26	-1.74	1.52	0.00	-0.45
2	**Road**	-0.52	0.89	0.12	-0.39	0.00	0..0	-0.91	1.61	0.21	0.00	0.00	0.00
	Rail	0.36	-0.55	1.07	0.27	-0.18	0.87	0.59	-0.69	1.71	0.00	-0.33	0.13
	Water	0.00	0.46	-2.13	0.00	0.46	-1.51	0.00	0.23	-3.25	0.00	0.81	-0.32
3	**Road**	-4.50	0.01	0.06	-3.98	0.01	0.02	-7.92	0.01	0.13	-0.10	0.00	0.00
	Rail	1.02	-0.14	2.43	0.72	-0.02	2.43	2.99	-0.45	8.71	0.16	0.00	0.06
	Water	6.98	0.08	-1.05	5.96	0.00	-1.05	15.39	0.14	-1.81	0.00	0.00	-0.06
4	**Road**	-1.67	1.41	0.09	-1.47	0.23	0.07	-2.06	1.77	0.11	0.00	0.00	0.00
	Rail	0.54	-0.54	3.39	0.47	-0.17	3.12	0.68	-0.65	4.18	0.00	-0.20	0.53
	Water	0.05	0.13	-7.44	0.05	0.08	-7.20	0.07	0.14	-9.70	0.00	0.28	-0.72
5	**Road**	-2.09	0.68	0.14	-1.98	0.50	0.02	-2.38	0.71	0.26	-1.78	0.64	0.01
	Rail	1.71	-1.10	2.60	1.61	-0.89	2.39	10.87	-4.89	3.39	0.90	-0.62	2.52
	Water	2.25	3.30	-11.72	2.17	2.85	-10.82	7.31	5.19	-7.24	0.64	2.64	-13.17
6	**Road**	-0.98	0.10	0.22	-0.77	0.09	0.12	-0.91	0.01	0.24	-1.14	0.34	0.17
	Rail	3.66	-1.11	0.07	2.63	-0.82	0.06	8.08	-2.88	0.48	2.96	-0.78	0.00
	Water	0.66	0.07	-0.30	0.55	0.04	-0.17	2.47	0.24	-0.87	0.01	0.00	-0.07
7	**Road**	-0.72	0.03	0.33	-0.70	0.03	0.27	-0.89	0.00	0.58	-0.50	0.06	0.00
	Rail	0.43	-0.09	0.04	0.43	-0.09	0.02	0.01	0.00	0.00	0.46	-0.15	0.04
	Water	0.66	0.00	-0.41	0.63	0.00	-0.35	2.63	0.00	-1.77	0.15	0.03	-0.02
8	**Road**	-1.10	0.18	0.13	-0.77	0.18	0.08	-0.21	0.00	0.12	-1.54	0.28	0.14
	Rail	2.22	-0.95	0.37	2.18	-0.80	0.37	0.55	-16.51	0.00	2.23	-0.83	0.38
	Water	3.17	0.90	-1.72	0.77	0.56	-1.44	3.04	1.99	-2.00	3.19	0.72	-1.68
9	**Road**	-1.18	1.12	0.02	-1.18	1.12	0.02	-0.24	0;02	0.03	-1.54	1.52	0.02
	Rail	1.76	-1.57	0.33	1.75	-1.56	0.33	0.52	-2.45	0.00	1.76	-1.54	0.33
	Eau	7.69	0.08	-9.89	7.62	0.08	-9.89	49.71	0.00	-2.37	4.11	0.71	-11.26

Source: Beuthe *et al.* in *Transportation Research-E* (2001).

Definition of NST-R groups

0: Agricultural products and livestock
1: Food products
2: Solid fuels
3: Petroleum products
4: Iron ore and scrap
5: Iron and steel products
6: Minerals and building materials
7: Fertilizers
8: Chemical products
9: Miscellaneous products

It is interesting to compare these results with the findings of an earlier study. An analysis of time series for tonnes-km transported over the period 1970-89 produced estimates of the elasticities of transport demand in relation to prices and industrial activity (Beuthe and Noullet, 1992). The results for the inland waterways were highly significant, those for rail less so; whereas no valid results were obtained for road haulage, probably due to the poor quality of the data available and the particular conditions prevailing in Belgian transport markets during that period. The direct price elasticity of inland waterway transport was -0.51 and that of rail -0.113. The cross-price elasticity of inland waterways in relation to rail was 0.291 and to road 0.220. The cross-price elasticity of rail in relation to inland waterways was 0.07 and to road 0.043.

All these elasticities are lower than those derived from the network model. Clearly, they are long-term elasticities that take account of competitive adjustments. The influence of qualitative factors in different modes is also apparent in the data and, to some extent, must dampen the reactions of shippers.

In contrast, it is worth nothing that elasticities in relation to industrial output are highly significant and close to unity, which would indicate that transport volumes are more or less proportional to industrial activity.

Van de Voorde and Meersman (1991) have obtained very similar results with slightly different specifications.

We can conclude this section by drawing attention to a number of important points. The estimates presented in Tables 1 and 2 must be interpreted as short-term elasticities in that they take no account of the induced effects of cost variations on demand or of competitive adjustments. These estimates are more a measurement of the theoretical short-term impacts on market shares, and therefore the competitive potential of different modes with regard to demand. In particular, it would seem that the price elasticity of demand for rail and inland waterways transport could be greater than is generally thought. This suggests that a pricing and taxation policy aimed at promoting modal shifts could prove effective under certain conditions.

Another major observation is that elasticities can vary substantially from one category of goods to another. This variation is attributable to the specific characteristics of goods, the spatial distribution of demand, as well as differentiated accessibility to transport networks. This should warn us that exercises in forecasting overall trends can lead to mistaken evaluations when applied to specific situations. Estimated elasticities are therefore particularly useful for regional industrial planning analysis.

However, the reader must remain aware that, due to a lack of data, we have not been able to make an explicit provision in generalised costs for the monetary equivalent of qualitative factors which may have a major impact on modal choices. Consequently, it is reasonable to assume that some of these elasticities derived from network analysis may well be overestimated.

3. THE IMPORTANCE OF QUALITATIVE FACTORS

Although for many years systematic and quantitative studies have been made of the qualitative and subjective factors in passenger transport, it is only in the past decade that attention has been focused on these aspects of freight transport. Table 3 below describes a number of studies that have addressed this problem and ranks the factors that influenced the decision by order of importance as established by the decisionmakers interviewed.

As Table 3 shows, cost is ranked in first place in three out of the eight rankings that include the cost factor and three times in second place. According to these rankings, reliability of delivery appears to be the second most important factor, followed by transport time. However, there are wide variations between rankings, undoubtedly due to the small size of samples in certain cases, but such variations are not surprising if account is taken of the fact that the rankings correspond to groups of firms operating in different industries and located in countries with different networks. Furthermore, the importance assigned to these factors also varies according to the specific logistics chains in place.

These partial results suggest that any forecast of a change in the modal split based on estimates that fail to take explicit account of qualitative factors as variables in the decisionmaking process should be viewed with caution. Admittedly, by calibrating assessment models it is possible to take implicit account of these qualitative factors to estimate parameters and make forecasts within a restricted field. However, if the role played by these factors is an important one, then model specifications that fail to take account of such factors introduce a bias into parameter estimates, leading to incorrect forecasts in broader fields of investigation.

The findings of a number of in-depth interviews with transport managers provide another source of information. These interviews were part of a preliminary test for a wider questionnaire-based survey currently being conducted by a group of Belgian universities (FUCAM, RUG, UA, UCL). In addition to a number of questions regarding the firm itself, the interview proposed a set of alternative transport solutions for typical shipments from the respondent’s factory or establishment. The decisionmaker was then asked to rank these alternatives by order of preference according to a stated preference analysis. The alternatives proposed were simulated on the basis of the standard solution in terms of percentage variations (+/- 10 per cent and 20 per cent) in its level of attributes. The choice of alternatives deliberately precluded any correlation between attributes.

The person interviewed was the transport manager for the factory or establishment from which goods were despatched. The following six factors or attributes characterising a transport operation were utilised: frequency of services; door-to-door transport time (including loading and unloading); reliability of transport measured in terms of the number of shipments delivered on time to the destination; carrier’s flexibility or speed of response to a request for an unscheduled transport operation; and the cost of the operation (including loading and unloading).

Table 3. **Most important attributes of freight transport**

Authors	Type of respondent	Order of importance
McGinnis (1989)	Review of the literature.	Cost/price/tariff
		Reliability of delivery
		Transport time
		Loss/damage
		Market climate
Jeffs and Hills (1990)	Interviews of around one hundred shippers in the paper, printing and publishing industry (UK). Cost was ranked in ninth place.	Level of customer service
		Reliability of delivery
		Flexibility
		Loss/damage
		Transport time
Matear and Gray (1993)	Survey of 132 Irish firms importing and exporting goods to and from the UK.	Flexibility
		Loss/damage
		Reliability of delivery
		Cost/price/tariff
		Relations with carrier
Jovicic (1998)	Shippers of various goods (Denmark), modal choice, RP and SP analysis of 1859 firms.	Cost/price/tariff
		Transport time
		Risk of loss
		Risk of delay
		Frequency
		Flexibility and information
n/e/r/a (1997)	1 000 telephone interviews with ITU freight forwarders -- cost excluded (Europe).	Reliability
		Transport time
		Flexibility
		Control/traceability
		Environment
INRETS (2000)	Choice between road and intermodal transport in the EU and Switzerland. 200 interviews.	Cost/price/tariff
		Flexibility
		Logistical considerations
		Transport time
		Reliability of delivery
Danielis (2002)	SP analysis of 42 firms (costs ranked in first place for non-road transport).	Risk of damage and loss
		Cost/price/tariff
		Transport time
		Reliability of transport
Bolis and Maggi (2002)	SP analysis, based on survey of 32 firms, of the choice between road haulage and intermodal transport for Alpine crossings. Ranking according to elasticities.	Reliability of transport
		Cost/price/tariff
		Transport time
		Frequency
		Flexibility
STRATEC	SP analysis by mail survey of 302 firms of the choice between road haulage and intermodal transport. Various modes on North-South corridors. Ranking according to elasticities.	Transport time
		Cost/price/tariff
		Traceability
		Closeness to terminal

Note: RP = Revealed Preference; SP = Stated Preference.

The rankings provided by each decisionmaker provided a basis on which to calculate the weight of the relative importance assigned to the attributes characterising different transport solutions. These factors of relative importance are presented in the following Table 4.

Table 4. **Relative weighting of attributes in decisionmaking functions**

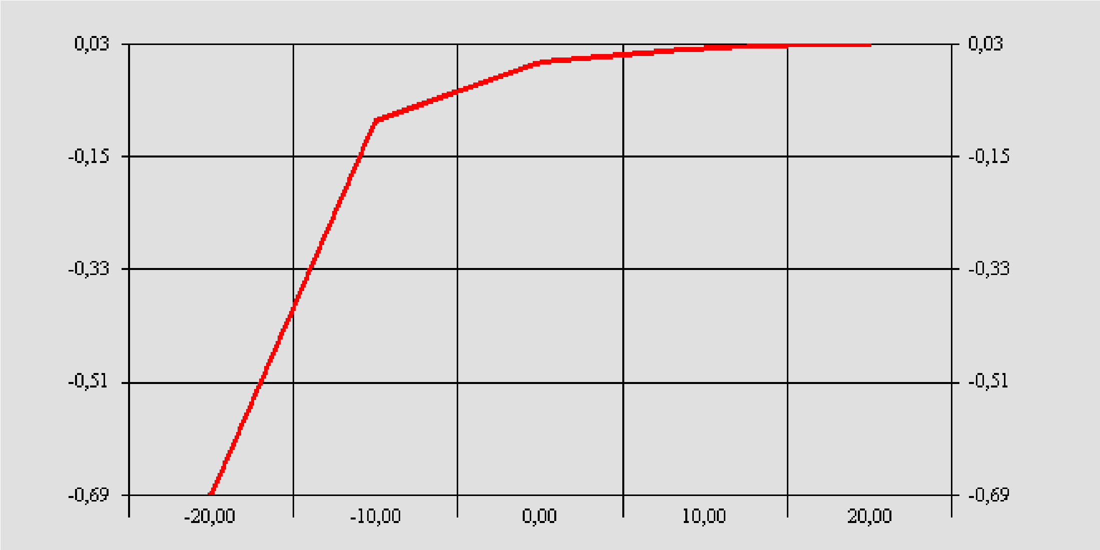
Attributes	Steel (1)	Steel (2)	Food	Materials	Soft drinks	Chemicals	Cement
	Multimodal 991 km	Road 40 km	Maritime 5 000 km	Road 50 km	Road 115 km	Rail 1 200 km	Road 82 km
Frequency	.007	.010	.159	.108	0	.158	.002
Time	.029	.054	.125	.182	.062	.171	0
Reliability	.114	.032	.208	.081	.354	.184	.064
Flexibility	.042	.164	.069	.227	.116	.072	.005
Losses	.090	.523	.036	.152	.174	0	.002
Cost	.723	.217	.403	.250	.293	.415	.927
Total	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Source: Calculated on the basis of data collected by the FUCAM, RUG, UA and UCL Group.

The calculation method is based on the UTA multi-criteria model (Jacquet-Lagrèze and Siskos, 1982; Scannella and Beuthe, 2001) which derives the manager's decisionmaking function from the order of preference given to the different transport alternatives proposed. The decisionmaking function is additive and is the weighted sum of the partial "utility" functions of each attribute. Each partial function is non-linear but is composed of successive linear segments.

The following diagram illustrates a partial function of this type for the cost factor of steel manufacturer (1). The ordinate scale in this diagram plots "utility", and the abscissa scale the negative percentage variations (-%) from the cost level in the standard solution whose variation is obviously equal to 0 per cent. This convention has been applied in order to show a positive relationship between utility and percentage variations, in that an increase in cost will clearly have a negative impact on preference. In this case it may be seen that utility decreases rapidly in response to a cost increase in relation to the standard situation (0 per cent), whereas it remains practically stable if cost decreases. The decisionmaker concerned therefore penalises the more expensive solutions, which will in practice be rejected if account is taken of the very high weighting (.723) of the cost factor.

Example of a partial utility function for the cost factor



Returning to the relative weighting of attributes, we can see that, for the specific cases given in the table, it is primarily the cost factor which plays a determining role, although it varies in size from .217 to .927. These variations, as well as those in other factors, can undoubtedly be attributed to the type of transport operation carried out by each firm. Although it is not possible to conduct a rigorous analysis here in view of the very small sample size, it may be noted that cost is the most important factor in long-haul transport movements (where costs are highest).

The time factor is considered to be no more important than frequency of services. Reliability is assigned greater importance, as are flexibility of service and risk of loss. It is quite possible that the percentage variations applied were insufficient in certain cases to secure a change in preference. In other cases, these factors are accorded greater importance, probably due to the way in which customers' logistic chains are organised. A survey conducted on a much larger scale should make it possible to identify the variables that would explain such differentiated behaviours.

This analysis also permits calculation of the monetary equivalents of attributes on the basis of the coefficients applied to each attribute within the decisionmaking function. It would be helpful here to draw a distinction between two different values, namely, the amount that the decisionmaker is prepared to pay for an improved level of a given attribute, i.e. "willingness-to-pay", and the amount that the decisionmaker is prepared to accept as compensation for a reduction in the level of that attribute, i.e. "willingness-to-accept". These two values can easily be calculated by means of the functions specification used by UTA, in which functions are made up of successive linear segments. The segments around the reference point (0%) exhibit differing slopes, indicating the latitude available to the decisionmaker to consider an increase or decrease in the level of an attribute.

In the case of the steel manufacturer (1), for example, the decisionmaker would be prepared to pay 0.07 euro per tonne for a saving of one day in a transport operation that takes ten days; however, he would ask for compensation of 2.00 euros for delay of one day. By the same token, he would pay up to 0.08 euro for a 1 per cent increase in reliability, but would require at least 1.70 euros to compensate for a 1 per cent reduction in reliability. The calculations made using data for other attributes indicate that the levels of compensation which would be considered acceptable are in all cases greater than the amounts that shippers would be willing to pay for an increase in different factors. This finding matches the customary results of analyses of consumer behaviour (Department of Transport, 2001), but cannot be explained in terms of the same mechanisms (such as a budgetary constraint on consumption).

This point warrants analysis in greater depth through a larger survey. However, it is worth noting that this analysis of stated preferences was made in respect of the current situation in which the shipper is taken as reference point. This situation is, in all likelihood, an outcome of a certain form of optimisation which is specific to the shipper and his customers. It therefore follows that the shipper would undoubtedly be willing to pay more for a higher level of service, but is highly reluctant to accept a lower level of service, even in return for financial compensation. It is also possible that a reduction in the level of certain attributes would require complex and costly reorganisation of the shipper's transport operations. At all events, this finding has implications for the type of modal rebalancing policy currently under consideration by the European authorities.

4. CONCLUSIONS

It is not really possible to draw any firm conclusions from this discussion, other than the fact that much research is still needed to assess and gain deeper insight into demand for freight transport.

Notwithstanding the above, there are two lessons that we can learn. Firstly, a large potential clearly exists for the substitution of road haulage by rail and inland waterways. The estimated elasticities provide a strong indication to that effect, even though they need to be interpreted with caution. However, the degree of substitution varies from one category of freight to another.

Secondly, the few findings available from research into qualitative factors clearly indicate that such factors play a major role in decisions to use one mode rather than another. The criticisms constantly levelled by shippers at the operating procedures of certain carriers clearly reflect the transport requirements of shippers and the criteria governing their decisions. These qualitative criteria can be so determining for certain types of freight transport that a pricing and taxation policy would not alone be sufficient to secure the desired modal shifts.

In view of the wide variations in the scope for modal substitution and in the qualitative requirements of firms from one industrial sector and geographical location to another, we feel that a sectoral analysis of transport conditions, and of a number of specific case histories, might prove to be particularly useful. Such an analysis would make it possible to identify practical examples of deficiencies in terms of organisation, service and equipment that currently oppose the use of other modes, and to find remedies to such shortcomings, at least in the case of major transport flows.

NOTES

1. See Beuthe *et al.* (2000) and (2002).

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3. See also Jourquin and Beuthe (1996) and Jourquin (1998), report D5 on the European Commission's TERMINET research programme.

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Integrated Policies for Improving Modal Split in Urban Areas

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SUMMARY

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1. INTRODUCTION

1.1. Context and definition of problems

There is clear agreement that mobility evolution does not follow a sustainable trend (Green & Weneger, 1997) and, consequently, the belief in the desirability of perpetual growth in mobility and transport has begun to fade. As this is true both in urban areas and for interurban relationships, the case of cities and metropolitan mobility is particularly complicated, owing to the concentration of activities involved and the historical street pattern of many western cities. Orfeuil (2000) says that we are more and more mobile but, at the same time, the pressure of traffic, especially of cars, is a real concern for most cities.

All traffic statistics confirm this concern over and over again and, in spite of the efforts made, the situation grows worse by the day. At all scientific forums, professionals and politicians present new ideas and projects in an attempt to do their bit towards solving the problem, but global figures continue to rise inexorably. It is also fair to say that many improvements have been made in a bid to stem the harmful effects that mobility generates on public health, the environment and public peace and quiet. Improvements have been made in both vehicle technology and the integrated design of communication routes. Notwithstanding, the fundamental cause of the problems still remains -- mobility is increasing in a virtually uncontrolled fashion and, to make matters worse, the imbalance between modes is constantly on the rise.

Furthermore, it is not feasible to apply drastic measures for mobility reduction, because a large percentage of the levels attained in development and quality of life rest on the possibility of making more and more trips. Motorised transport has facilitated and even stimulated just about everything related to progress (OECD, 2002). It can even be said that private vehicle usage has turned into an element associated with carrying out the activities of the current welfare state society -- holidays, leisure pursuits, shopping, etc. - without dropping its high percentage of commuter trips. This means that not only are private vehicles used by the majority for holiday trips, for instance, but also that the actual holiday activity is often based on the use of a private vehicle.

The increase in the number and complexity of trips made is giving rise to a growing number of negative effects that have not been quantified to date but are acknowledged by everyone (Banister *et al.*, 2000). In addition to consuming scant natural resources, such as mineral energy sources and land, transport produces negative impacts on biodiversity, global warming, air pollution, noise and severance as well as a deterioration in urban tranquillity and quality-of-life conditions.

The recent European Commission White Paper (2001) declares that it is difficult to conceive of desirable economic growth without an efficient transport system permitting full advantage to be taken of the internal EU market and globalised trade. At the same time, it states that the new IT society has not only failed to do anything to slow down the need for travel but rather permitted the opposite to occur. After analysing the changes in the different modes of interurban mobility (urban mobility lies outside the direct responsibility of the EU), it sets out the need to shift the balance between modes, integrating transport into sustainable development policies. To achieve this target, it proposes a number of actions for each mode in a competitive framework. They are based on two main axes: limiting uncontrolled growth through the internalisation of harmful effects and revitalising the modes that are currently less competitive. Other proposed actions are targeted on ensuring intermodality. This policy framework is somewhat contradictory because, on the one hand, it predicts efficiency through inter- and intramodal competition yet, at the same time, it calls for co-operation between modes and operators to achieve a more integrated transport system.

Confronted with this unsustainable situation, as became apparent from the debates at ECMT Round Table 102, cities have to be reconciled to traffic. There is a need to surmount the apparent contradiction that assumes that the increase in mobility, which has been the cause of economic attraction and the base of growth, has not turned into a noose strangling today's cities, destroying the opportunities and quality of life they provide.

We are therefore confronted with the paradox that the phenomenon of private vehicle traffic, which allowed cities to expand and to achieve prosperity, has today created an unmistakeable deadlock. Furthermore, the negative effects of traffic congestion and the deterioration of living conditions in compacted city centres give rise to schizophrenic behaviour: cities are sought for their concentration of services and opportunities, but the effects of such concentration force people and businesses to flee from them. This is why we are witnessing the rise of the type of cities we refer to as polynuclear, in which the most attractive activities escape from city centres and relocate to outlying districts, thereby producing an even more destructive mobility pattern. It is precisely the expansion of cities through the gradual incorporation of sparsely populated peripheral areas -- an expansion aided by private cars -- which produces an increase in the lengths of distances travelled and less concentrated flows, so much so that conventional forms of public transport cannot compete in such areas (Raux, 1996).

1.2. Actions envisaged

There are two basic approaches to reorienting this process. The first is aimed at achieving a shift from private vehicle usage to public transport, especially rail-based modes. In the long term, this implies bringing about a change in the activity concentration/location conditions in metropolitan areas. Furthermore, public transport must be sufficiently competitive in terms of quantity and quality. Section Two of the above-mentioned EU White Paper highlights the different levels achieved by cities in meeting this goal of a better balance between public and private transport. Jones (1996) believes that reducing car patronage in favour of other modes calls for an intervention by the public authorities in order for the system to be managed in a balanced way.

The second approach, with a far more distant horizon, is to bring about a change in mobility behaviour, thereby reducing the total number of journeys made. Goodwin (1997) proposes that the "focus of mobility analysis must shift from the state of behaviour to changes in behaviour." In short, this means incorporating the social costs of mobility into the decisionmaking process in such a way that the activities of each individual/family unit are organised to incorporate the restriction of making a minimum use of private vehicles, particularly as solo drivers. Brög (1996) expresses this idea in a timely fashion by saying that "behaviour actually begins in the mind".

Both strategies involve the *decoupling of transport demand* from economic growth. This means that the city-transport network system should be efficient enough not to hamper the implementation and development of activities and consequent economic growth, but still be capable of limiting, and even reducing, journeys made by private cars.

This all calls for a mix of "carrot and stick" measures and a clear awareness by city dwellers of the problems facing their cities, and this requires their participation in the decisionmaking process.

Alongside these two major strategies lie what could be termed as accompanying measures for cutting down external effects, namely, technological improvements to vehicle efficiency, traffic management, real-time information to optimise the decisions drivers take and traffic safety, etc.

1.3. Benchmarking and learning from experience

The aim of this paper is to illustrate one of the key elements of any strategy for achieving the two targets: shifting demand onto public transport and reducing total private vehicle trips. This key factor involves the integration of policies and measures at all levels. Two very different case studies in the Madrid metropolitan area can highlight some of the possibilities for achieving a more balanced modal split through the co-ordinated integration of actions taken from the planning to daily management stages. The first experiment consists of the creation, in 1995, of an HOV lane in a congested radial metropolitan motorway. The second case study consists of the construction of a new metro line as the main axis for new developments suffering from poor accessibility.

2. TOWARDS A MORE BALANCED MODAL SPLIT

The EU Green Paper (1995) stresses the importance of integrating different public transport subsystems. This integrative move involves upgrading several administrative issues, such as integrated ticketing, information and fare systems. Likewise, the T114 THERMIE paper (1995) mentions three types of functional integration for public transport modes, namely, administrative, fare-related and physical integration. The first fosters the role of Public Transport Authorities in co-ordinating all public transport services within a specific area. Fare integration means that travelcards and other integrated transport tickets facilitate the use of modes other than private vehicles. Physical integration refers to intermodal centres or interchanges. All three together provide a comprehensive image of the public transport network and services as a single system with the users as its customers. Several elements intervene in the final decision by travellers to use public transport in preference to private cars, but one key element for increasing its use is integration between modes (Monzón *et al.*, 2001).

Data from different cities vary quite considerably, as shown in Table 1, which includes the main metropolitan features of thirteen European cities and their use of public transport. Public transport patronage ranges from 20 to 60 per cent and is apparently related to economic level and density of population. These factors alone, however, do not explain all the differences. Public transport figures also depend on many other factors, including the individual city's specific policy measures and strategies.

Table 1. **City characteristics and public transport patronage among motorised trips**

Cities	Population (inhabitants)	Total surface area (km^2)	Motorisation rate (cars/1 000 inh.)	GDP per capita (EUR)	% Public transport patronage
Athens	3 700 000	1 450	330	10 935	31.7
Barcelona	4 339 593	3 236	443	17 793	47.0
Brussels	1 850 000	1 362	434	24 400	29.0
Helsinki	957 000	764	360	33 300	40.0
London	7 285 000	1 574	333	27 200	56.0
Madrid	5 022 290	8 028	357	17 771	54.0
Manchester	2 585 700	1 272	446	-	20.0
Paris	10 952 000	12 070	451	35 946	29.0
Prague	1 635 046	3 326	470	5 430	30.0
Stockholm	1 823 000	6 500	380	-	56.0
Vienna	2 602 000	8 841	430	24 356	50.8
Vilnius	534 000	401	292	3 489	60.0
Zurich	1 270 000	1 834	483	55 742	48.0

Source: EMTA barometer, 2002.

All the cities recording the highest use of public transport possess a good-quality public transport system with sound integration between modes in terms of the three aspects explained above -- administrative, tariff-related and physical integration.

In addition, in recent years, a number of new laws and regulations have been introduced to achieve an intermodal transport policy with a view to reducing private car use. They are also designed to foster better integration of transport and land use. Examples of these are the Dutch Plans ABC, launched under the slogan *"the right business in the right place"* (Ministry of Housing and Public Works, 1991) the French *Plans de déplacements urbains* (Ministère de l'équipement, du logement, des transports et du tourisme, 1982), the British Local Transport Plans (Department of the Environment, Transport and the Regions, 1999) and the Italian *Piani urbani del traffico* (Ministero dei Lavori Publici, 1995) among others. There are many differences among them but they are always based on the axes referred to above: shifting trips away from private vehicles and integrating transport policies into urban development.

3. INTEGRATED APPROACHES

The Citizens' Network EU Green Paper (1996) makes a clear stand for the *integrated approach:* integration of private and public transport and better co-ordination in the latter. This implies a complete integration of the whole passenger transport system, which must be designed and managed as a single system composed of various modes, both public and private.

Integration must also be achieved between transport systems and land use. Land-use patterns potentially have a substantial impact on travel behaviour and especially on mode choice. Some researchers consider this is a clear route for cutting down the number of trips (Banister, 1999), while others are not so convinced. However, there is enough evidence to conclude that land use is capable of influencing travel behaviour (Bert van Wee, 2002) and, as a consequence, there is a need to co-ordinate new development with transport networks and the provision of services.

There is a second type of *integration* which is related to the implementation of policy measures in cities. This implies that the effectiveness of implementing an isolated measure is fairly poor. There are a number of barriers that can reduce its benefits (Monzón, 2001). The logical approach is to design *policy packages* where one instrument can reinforce another and help to overcome the barriers to their implementation. A broad survey conducted among 70 European cities to identify their current policymaking practices revealed that most cities (72 per cent of the 66 respondents) actively combine policy measures. The most commonly combined measures are development patterns, bus priority, bus/rail frequency and parking charges (Matthew, 2001).

A package of instruments is likely to be more effective than selecting any one instrument on its own. Jones (1996) concludes his above-cited paper by stating that successful achievement of a reduction in motorised mobility requires, *inter alia*, "analytical techniques that will enable suitable packages of measures to be devised and evaluated, and a sufficient understanding of the behavioural processes affecting car use so that packages of measures can be devised that are reasonably assured success."

Synergy can be achieved by combining instruments; in other words, the overall benefits are greater than the sum of the parts. Identifying which instruments are capable of achieving such synergy lies at the core of successful transport planning (May, 2003). One example which can illustrate this is the introduction of a road-pricing scheme and a new tramway in the same area and at the same time. Pricing would reduce private vehicle demand, which can be transferred to the new tramway and generate revenues to pay for the tram implementation. At the same time, the introduction of a new, modern tramway could increase public acceptance of the associated pricing measure, to the extent that users perceive some benefits from the higher cost of their car trips. A policy package also forms a way of compensating losers; thus, for example, road pricing could give rise to extra traffic in the limits outside the priced area, which could be controlled by traffic and parking management measures, and residents could be assisted by reserved parking spaces or concessionary fares on public transport services.

4. CASE STUDIES

Two case studies of projects developed in the metropolitan area of the Spanish capital serve to illustrate the application of the above concepts. Both are oriented towards demonstrating the effectiveness of certain policy measures, in terms of a more balanced modal split, when applied as part of an integrated policy strategy. The Madrid metropolitan area has a radial structure but rather different characteristics in terms of population and mobility patterns, as shown in Table 2. The two experiences to be analysed in this paper are located in the N-VI (HOV lane) and in the N-III (metro-line) corridors respectively.

Table 2. **Demand characteristics of radial corridors in the Madrid region (Regional household mobility survey, 1996)**

CORRIDOR		N - I	N – II	N – III	N - IV	N – 401	N - V	N - VI
Car / 1 000 inhabitants		367	296	340	273	273	287	433
Modal split (%)	**Car**	72.6	63.1	73.1	58.8	55.2	54.1	63.1
	Rail	7.0	16.0	3.0	17.5	24.4	23.8	13.7
	Bus	20.4	20.9	23.9	22.7	20.4	22.1	24.1
Global daily trips		423 815	555 380	114 906	416 712	506 759	481 436	560 725

4.1. HOV lane in a congested radial corridor

4.1.1. HOV lane experiments

Lanes reserved for *high-occupancy vehicles,* or HOV lanes, were first used in San Francisco in 1973, when private vehicles with two occupants were allowed to use bus lanes. The US Federal Highway Administration recommended construction of these lanes as an economical alternative to new, suburban commuter rail lines. This policy was intensified as from 1990 on environmental grounds[1], with the result that over three thousand kilometres of HOV lanes had been created by the turn of the decade and the figure has continued to rise, albeit at a slower pace. Operating policies have changed in the US over these decades. In the 1970s, the minimum permissible occupancy level was 3+ to obtain federal-aid funding, but in 1987 the legislation was changed, and now most HOV lanes are for 2+ occupants (Fush and Obenberger, 2002).

HOV lanes in Europe came onto the scene much later, the first being built in Amsterdam in 1993, but it was closed the following year owing to legal problems. The next experiment was the Madrid HOV lane, which was opened in January 1995 and forms the subject of the research presented here. Shorter HOV lanes were subsequently opened in 1998 in Leeds (UK), in 1999 in Linz (Austria), in 2000 in Stockholm (Sweden) and in 2001 in Trondheim (Norway).

Table 3. **European experiments with HOV lanes**

Starting year	City (country)	Type	Length	Cut-off limit
1993-1994	Amsterdam (Netherlands)	Metropolitan	10 km	3+
1995	Madrid (Spain)	Metropolitan	16 km	2+
1998	Leeds (UK)	Urban	1.6 km	2+
1999	Linz (Austria)	Metropolitan	2.8 km	3+
2000	Stockholm (Sweden)	Metropolitan	8 km	3+
2001	Trondheim (Norway)	Urban	0.8 km	3+

The longest HOV lanes in operation are those in Madrid and Stockholm (16 and 8 km, respectively) and they are located on access arteries to the capital cities. The other three examples are shorter sections (less than two kilometres long) of access routes into smaller cities. There are also variations in the minimum number of occupants required.

Consequently, the Madrid example, which has been operating for over seven years, comprises a consolidated experiment suitable for carrying out many analytical and research studies, serving as bases to assess user behaviour in lanes of this type.

4.1.2. Demand management through HOV lanes

The implementation of an HOV lane is one possible demand management measure associated with a specially-designed infrastructure reserved for certain types of vehicle. All the techniques classed under the generic title of "demand-side management strategies" group together a mixed bag of possible demand-side mobility tools, all of which are oriented towards using the existing infrastructure in a more efficient manner.

All HOV lanes are directly oriented towards increasing private vehicle occupancy and, in the case of the European examples, form an efficient support measure for bus services. The lanes reserved for private vehicles with an occupancy rate above a fixed threshold -- usually two occupants but in some cases three -- therefore comprise a demand-side management measure. The leaflets publishing the results of the ICARO (Sammer *et al.*, 2000) Project used the expressive slogan "*use the empty seats"*. In this manner it brought to light that a large percentage of the capacity available in the transport system was precisely to be found inside private vehicles. If the average vehicle occupancy rate

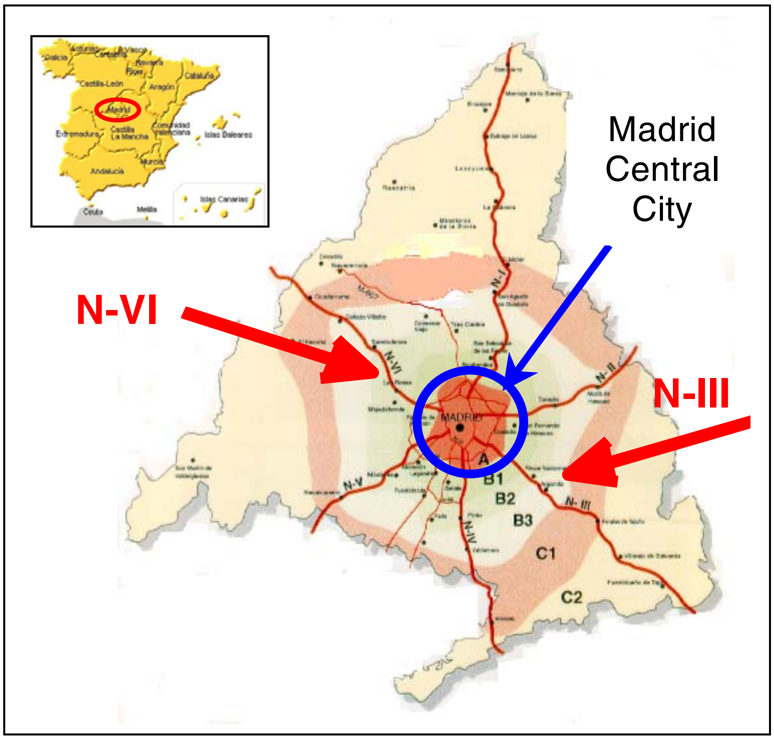
-- which on working days in Europe is 1.3 travellers per vehicle -- could successfully be increased, this would meet the target of maintaining mobility while cutting down congestion and the other negative trip effects. From the point of view of transport system managers, it is therefore a question of optimising lane use in terms of the number of people travelling and not of the number of private vehicles being used.

HOV lanes need to be designed so that drivers can offset the inconvenience of finding and taking one (or two) passengers by improved journey times. The difference in journey time and, above all, in reliability must be sufficient to attract an adequate number of travellers to patronise the restricted use lane. This second attribute comprises the essential factor for buses to use these lanes.

4.1.3. The Madrid BUS/HOV system

The Madrid HOV lane is part of the N-VI corridor, located in the north-western sector of the Madrid region (see Figure 1). It is one of the main radial accesses to the City of Madrid. It has undergone consistent population growth in recent times (33.1 per cent from 1996 to 2001). It also has a number of other features, such as its high environmental standards, lower housing density (635.5 inhabitants/km^2), higher motorisation rates (413 vehicles/1 000 inhabitants) and higher income levels than the rest of the region. All these characteristics together define an area where the use of private vehicles holds many advantages over public transport services. This scenario influenced the decision taken to create a so-called BUS/HOV lane on the N-VI motorway, to assist bus service reliability and encourage a higher occupancy rate in private vehicle demand.

Figure 1. **Madrid region, N-VI Corridor**



The BUS/HOV facility was implemented in 1995 as part of an integrated package of measures designed to improve infrastructure and mobility management. The BUS/HOV facility was complemented with a key scheme for ensuring its functionality, namely, the construction of the Moncloa Interchange for suburban buses, which provides a seamless connection via two metro lines and urban bus routes.

The BUS/HOV system consists of a 12.3 km reversible double lane, running from the Las Rozas satellite town to the Puerta de Hierro district, and a 3.8 km bus-only lane to the Moncloa Interchange at the boundary of central Madrid. There are three points of entry for inbound traffic or exit for outbound traffic (see Figure 2). The system operates on a reversible basis with the timetable given below. The cut-off limit for access to the lane is two or more occupants per private vehicle. The HOV lane is located in the median which means that inbound users can only exit at the end of the lane, whereas outbound users have one entry point and three exits.

- Access restricted to buses and HOVs (2+);
  - -- Madrid inbound traffic: from 06:00 to 12:30, Monday to Friday;
  - -- Madrid outbound traffic: from 13:30 to 22:00, Monday to Friday;
- Unrestricted access at other times and on non-working days.

Figure 2. **BUS/HOV lane: Sections and access points**

4.1.4. Modal split results

The public transport network along the N-VI corridor consists of 52 suburban bus routes and four commuter rail lines, connecting the main satellite towns along the N-VI corridor to Madrid's city centre.

Prior to the implementation of the BUS/HOV facility, the situation in the N-VI corridor was characterised by chronic congestion problems. The opening of the BUS/HOV lane greatly improved the situation, increasing private vehicle occupancy rates and improving mobility patterns. In addition, the greater reliability achieved for the suburban bus services has fostered their use through a substantial increase in bus patronage. Daily congestion at the present time is concentrated on the general-purpose lanes, while all the vehicles using the BUS/HOV lane have fluid traffic conditions.

Table 4 clearly illustrates the evolution in demand and the main results. In respect of vehicle numbers, there has been a consistent increase in the number of buses using the BUS/HOV lane as a consequence of the increase in supply and demand. According to the latest survey (Monzón *et al.*, 2002) on the number of passengers in the corridor, the BUS/HOV lane handled 59.3 per cent (27 169) of the total number of travellers during the 2001 morning rush-hour, whereas the public transport share was 52 per cent. In the general-purpose lanes, the majority of vehicles are private cars (99 per cent), carrying 82 per cent of the passengers. Bearing in mind that there are two HOV lanes against three/four general-purpose lanes, the overall result is as follows:

- BUS/HOV lanes: 7 112 vehicles, carrying 27 169 passengers and travellers;
- General-purpose lanes: 15 438 vehicles, carrying 18 610 travellers.

Table 4. **Demand evolution**

N-VI morning peak (07:00-10:00), inbound journeys (2001)

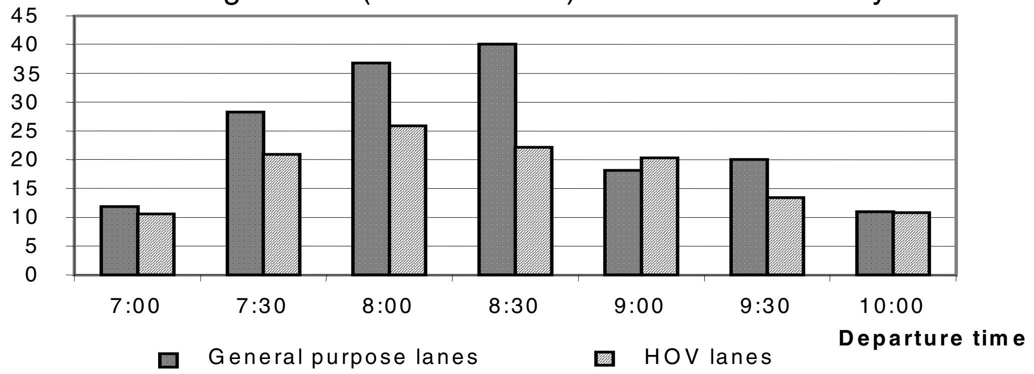
Survey	**HOV lane**				**General-purpose lanes**				**N-VI Total**	
	Bus		**HOV**		**Bus**		**Other vehicles**			
	Veh.	**Pax.**	**Veh.**	**Pax.**	**Veh.**	**Pax.**	**Veh.**	**Pax.**	**Veh.**	**Pax.**
11/1991					244	6 602	15 810	21 430	16 054	28 032
11/1995	268	10 430	5 640	12 471	92	1 170	9 960	11 371	15 960	35 442
11/1996	295	10 905	5 747	11 823	87	1 115	14 976	16 945	21 105	40 788
11/1997	334	12 050	4 884	10 979	116	1 865	13 108	15 041	18 442	39 935
11/1998	346	12 040	6 245	13 100	80	910	14 004	15 792	20 675	41 842
11/2001	**478**	**14 110**	**6 634**	**13 059**	**131**	**2 260**	**15 307**	**16 350**	**22 550**	**45 779**

The main result, therefore, is that, even in a low-density and high-income-level corridor, suburban bus services significantly improved their contribution to overall mobility patterns, rising from 24 per cent in 1991 to 36 per cent in 2001. On the contrary, HOV usage went down in relative terms from 37.7 per cent (1991) to 31.4 per cent (2001). In absolute terms, however, the number of HOVs increased by 14 per cent. The total number of private vehicles in the morning rush-hour period rose from 16 064 in 1991 (where 6 052 had two or more occupants) to 21 941 in 2001 (6 889 HOVs).

The increase in the total number of passengers between 1991 and 2001 was 63.3 per cent in absolute figures, while the number of vehicles increased "only" by 40.5 per cent, which proves the efficiency of the system (see Figure 3).

The figure illustrates that time saving is the key reason for the use of restricted vehicle lanes. This finding is consistent with other experiments carried out across the world which illustrate that the motivation to shift mode depends on the difference in travel times on HOV lanes as compared to the other motorway lanes (Dahlgren, 1998). At the same time, it is also clear that HOV lanes provide a more reliable journey time, which is also a very relevant factor for bus users. Both results together have brought about a preference for bus services, despite their lesser comfort and convenience and the access/dispersion time required.

Figure 3: Travel Time (Minutes) from km 20 to km 5. N-VI Morning Peak (0700-1000) Inbound Journeys.



Source: dynamic measure. (2001)

4.1.5. Reasons for mode choice

The reasons given for not using public transport or private vehicles can help to understand mode choice behaviour on inbound journeys during the N-VI morning rush-hour. All data in this section are taken from an 8 000-commuter CATI survey, complemented with other road counts, conducted in 2001 (Monzón *et al.*, 2003), and its complementary traffic-count series and other socioeconomic variables.

Table 5. **People on bus services running along the HOV lane: Reasons for not using private vehicles**
N-VI morning peak (07:00-10:00), inbound journeys

		%	
No driving licence		28.8	39.8
No private vehicle		7.5	
No private vehicle available		3.5	
Parking problems			8.8
PT quality	Public transport is faster	29.6	51.4
	Public transport is cheaper	7.2	
	Public transport is more convenient	14.6	
Total			**100.0**
Other reasons			3.6

Source: CATI Survey, 2001.

Excluding respondents who have no driving licence or private vehicle available, the majority of bus users chose time saving and convenience as their main reasons for using bus services instead of private vehicles for their N-VI morning rush-hour, inbound journeys. This means that the above-mentioned features of bus journeys (reliable and fast service) are clearly perceived by most users.

On the other hand, the following table illustrates that the reasons put forward for not using this HOV lane are mainly linked to difficulties in accessing it -- more than 50 per cent -- or because it is not suited to travellers' itineraries. Only less than 10 per cent of respondents perceived no time saving or considered it to be a dangerous facility.

Table 6. **Carpoolers in general-purpose lanes: Reasons for not using HOV lane**
N-VI morning peak (07:00-10:00), inbound journeys

	%
Difficult access to HOV lane	**56.1**
Longer itinerary	14.2
Dangerous facility	12.9
No time saving	8.4
Non-awareness of HOV lane	8.4
Total	**100.0**
Others	11.8

Source: CATI Survey, 2001.

The following table shows the reasons given by drivers of private vehicles, using both HOV and general purpose lanes, for not patronising public transport services. It is clear that respondents familiar with the HOV lane perceive better-quality bus services even though they do not use them. Excluding respondents who need to use a private vehicle for their work, the two main motives given by general-purpose lane users for not patronising public transport are convenience/comfort (57.2 per cent) and time saving (13.9 per cent). Where HOV lane users are concerned, and excluding respondents who need a private vehicle for their work, the two main reasons given were convenience (48.1 per cent) and time saving (20.4 per cent). From Tables 4, 5 and 6, we can infer that mode choice behaviour is mainly influenced by journey characteristics such as convenience and/or comfort and estimated time saving, and these are highly subjective factors.

Table 7. **All private vehicle users: Reasons for not using public transport**
N-VI morning peak (07:00-10:00), inbound journeys

	HOV lane	**General-purpose lane**
Public transport less convenient/comfortable	**48.1%**	**57.2%**
Private vehicle quicker	20.4%	13.9%
Non-awareness of public transport services	4.1%	2.3%
HOV lane stops too far from destination	3.9%	3.7%
HOV lane stops too far from home	2.2%	1.5%
Low frequency of service	1.8%	1.9%
Public transport more expensive	0.4%	0.4%
Private vehicle needed	16.9%	2.6%
Others	2.6%	4.3%

Source: CATI Survey, 2001.

4.1.6. Changing behaviour and perceptions induced by the use of the HOV lane

To complete this analysis, the following table shows the transport mode that current carpoolers used to use before the HOV facility was created. It also shows the transport mode they would use if the HOV facility were to disappear. This information helps us assess how the BUS/HOV system is responding to user demand.

Table 8. **Transport mode prior to BUS/HOV lane creation**
N-VI morning peak (07:00-10:00), inbound journeys

Prior to BUS/HOV lane	**Role in car pool**			
	Driver		**Fellow carpooler**	
Car pool	4 260	57.9%	2 194	63.1%
Solo driver	1 461	19.9%	246	7.1%
Suburban bus	960	13.1%	637	18.3%
Commuter rail	612	8.3%	209	6.0%
Others	57	0.8%	188	5.4%
Total	**7 351**	**100.0%**	**3 474**	**100.0%**

Source: CATI Survey, 2001.

Table 9. **Transport mode if BUS/HOV lane were to disappear**
N-VI morning peak (07:00-10:00), inbound journeys

No BUS/HOV lane	Role in car pool			
	Driver		Fellow carpooler	
Car pool	5 408	70.9%	2 658	61.7%
Solo driver	516	6.8%	150	3.5%
Suburban bus	644	8.4%	853	19.8%
Commuter rail	1 006	13.2%	499	11.6%
Others	52	0.7%	151	3.5%
Total	**7 626**	**100.0%**	**4 311**	**100.0%**

Source: CATI Survey, 2001.

A comparative analysis of the foregoing tables reveals a number of interesting findings. Prior to the HOV lane creation, more than 50 per cent of current carpoolers were already accustomed to carpooling. New users of the HOV lane come from solo drivers (20 per cent among drivers and only 7 per cent among fellow carpoolers). This points to a reduction in solo drivers. On the other hand, around 20 per cent of carpoolers used to travel on public transport. Some 20 per cent of current carpoolers are clearly convinced of the benefits of this mode -- 71 per cent of drivers and 62 per cent of fellow carpoolers would continue to carpool even without an HOV lane. These figures are 13 per cent higher than the previous statistics for driver behaviour. Another finding is that fellow carpoolers prefer the alternative of buses while drivers prefer to travel by suburban rail. This is probably related to gender preferences, as other data reveal that men in Madrid use more rail services than women, who prefer to use bus services.

4.1.7. Main findings and conclusions in respect of HOV lane implementation

The following conclusions can be drawn:

- Since its opening in 1995, the HOV lane has proved to be a key factor in the increase of suburban bus patronage and the improvement of bus service reliability. However, this effect is also related to the fact that the buses using the BUS/HOV lane connect directly to the Moncloa Interchange, served by two metro lines and several urban bus routes.

- There has been a consistent increase in the number of buses using the BUS/HOV lane. The number of private vehicles using the HOV lane has also undergone a significant rise. As a consequence, the average occupancy rate has improved as a result of the creation of the HOV lane.

- The number of passengers is growing faster than that of vehicles, implying that a demand decoupling effect exists, which proves the efficiency of the system.

- This means that there has been a net transfer of passengers from private vehicles to bus services, and that new users now choose to take buses more than they did previously.

4.2. Integrated land use and metro extension

The Madrid N-III Corridor shows lower development standards than N-VI, with only 56 000 inhabitants. This could be attributed to the fact that most waste sites from Madrid have been traditionally located by the Jarama River. It is important to highlight that it is one corridor without commuter rail lines (see Table 2). Therefore, in 1996, the car appears to have the highest modal share in the area (73 per cent), while bus demand remains at the same level as for the other corridors, i.e. ranging between 20 and 25 per cent. Summing up, we could affirm that there is a potential for rail services in the N-III Corridor, representing an average 13-18 per cent of the demand and involving 14 000 to 20 000 trips per day.

The N-III is currently experiencing a novel and rapid development attributable to different reasons. One is the shortage of land suffered in other densely-populated corridors. Odd as it may appear, this corridor still makes it possible to track down some locations at reasonable prices and not any further than twenty kilometres from the capital. Once the problems with waste deposits were sorted out, thanks to the help of modern techniques, the corridor started a number of new developments -- both housing and industrial -- on the existing infrastructure. The following table shows the rapid growth of the two main municipalities of the corridor, Arganda and Rivas, which in turn have acquired the status of cities over the last ten years.

Table 10. **Population growth in the two municipalities of N-III corridor (inhabitants)**

	Rivas-Vaciamadrid Distance to Madrid: 19 km	**Arganda Distance to Madrid: 27 km**
1975	847	17 356
1981	653	22 032
1986	5 972	23 872
1991	14 863	26 113
1996	22 620	29 224
2001	32 807	32 927

One of the key points to attaining sustainable development in the corridor would be to reduce car reliance. Bus services could be considered reliable but suffer increasing congestion levels because they use the N-III motorway which runs to Madrid City. Moreover, the expected growth in the area is bound to aggravate this situation.

4.2.1. New metro line at the core of new rapid developments

Anticipating forthcoming conditions, the Regional Government decided in November 1996 to promote a new rail/subway line (Peral-Guerra, 1999), aimed at balancing the modal distribution in the corridor, and boosting new developments around subway stations where possible. It should be borne in mind that the area was mainly populated by young couples who, in principle, are more willing to make use of the car than the elderly population segment. These new subway stations would also constitute the basis for the restructuring of the existing bus lines. A synergetic effect would thus be achieved.

However, the process had to face strong budgetary constraints imposed by the European convergence requirements. The Regional Government was in favour of allowing private participation in the provision of public transport services. Thus, a decision was reached to open the call for tenders for the building and operation of a 18.3 km rail/subway line connecting the Madrid City outercircle with Arganda (Monzón and González, 2000). By the end of February 1997, two groups submitted their proposals, which included project design, demand forecast, solutions to problems derived from operating the line (stations and co-ordination with goods movements), rolling stock supply, timetable and fares and solicited subsidies. TFM -- a consortium of Metro Madrid and a group of construction companies -- won the concession and immediately started construction.

4.2.2. Short-term impact results on Metro Line 9 extension

The operation of the line started on 7 April 1999, representing less than three years within the framework for the whole process. The concessionaire offered to connect and operate the new line as an extension of Line 9 of the metro network, presently affording high connectivity standards with destinations located in the city core. Supplementing the subway system, the bus network -- urban and interurban coaches -- has been restructured so as to achieve an integrated public transport system as well as to improve accessibility to the new stations in the corridor.

The implementation of the subway line has had two important effects on public transport services. First, the generation of an induced demand and, second, the transfer of some users from bus services. Table 11 illustrates these two effects, by comparing data from the Madrid General Mobility Survey of 1996 (EDM/96) with the ad hoc household survey carried out two years after the implementation of the metro line.

Table 11. **Impact of metro line on modal split**
Daily trips from Arganda and Rivas to Madrid central

	1996		**2001**	
	Daily trips	**%**	**Daily trips**	**%**
Car	8 601	57	8 912	51
Bus	6 332	42	2 417	14
Metro	0	0	6 160	35
Total	14 933		17 489	

Source: EDM/96 and 2001 household survey.

The impact on modal split highlights the rapid impact of the new metro line, which attracts 70 per cent of the PT demand and which, together with bus services, has reduced car patronage by 6 per cent since its implementation.

In July 1999, some months after opening the line, the Public Transport Authority of Madrid conducted a survey on the prospective user profile of the Arganda metro line. The main results from the 7 927 interviews recorded in different stations were as follows.

Table 12. **Profile of subway users, July 1999**

24.5% New trippers (reason to trip now)	New residents	6 %
	Changes in study/work place	24 %
	Occasional, recreational activities	47 %
	Others	23 %
75.5% Previous travellers (previous mode)	Car	30 %
	Bus	66 %
	Others	4 %

The survey indicates that 75 per cent of travellers have transferred from other modes: two-thirds from bus services and one-third from the car. The new travellers are still occasional, but some 30 per cent can be attributed to new housing developments and changes in destination (work or study). These results reveal the potential of the subway line in restructuring and attracting new land use and developments.

At this point in the process, it seems essential to mention policies and actions intended to favour the users, in terms of the global appeal of the infrastructure, the rescheduling of bus services and the upgrading of connectivity levels, including the location of park-and-ride facilities near the stations.

4.2.3. Integrated package: new developments centred along the metro line

- The construction of a new metro line with stations at the core of new developments has produced a more balanced modal split: the metro has attracted passengers from the car and even more so from the bus, both modes using the same motorway to Madrid.

- Even in the rapidly growing residential framework, public transport has increased its share of demand, reducing car trip trends from 57 to 51 per cent for all motorised trips.

- Globally, new developments are based on the metro connection, particularly in the case of Rivas, where cycle lanes have been implemented and bus lines redesigned to feed metro services in an integrated approach.

5. CONCLUSIONS

It can be affirmed that the two case-studies in this paper show alternative ways to improve modal split in suburban areas. The two corridors under evaluation have improved their PT share in the short term; the first one through the introduction of a dedicated bus/HOV lane, and the latter by implementing a new metro line with a high accessibility level for the new developments.

In both cases, integrated approaches have been adopted from the planning to the operational stages. All public transport modes have been redesigned to obtain better results and thus compete with car use.

In the HOV lane case, peak occupancy rates have been improved, which has also contributed towards changing commuters' behaviour and attitudes to travel in a car-oriented zone.

NOTE

1. Clean Air Act Amendments (CAA -1990) and the Intermodal Surface Transportation Efficiency Act (ISTEA, 1991).

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Influencing the Modal Split: The Roles of the Different Modes

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SUMMARY

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1. INTRODUCTION

Recent years have seen impressive changes in the European freight transport sector. The removal of barriers and constraints to market access and movements within the EU produced an impressive increase in goods movements that has exceeded the growth rate of GDP, but also important distortions in the use of the different available transport modes.

From the many factors that have influenced the growth in demand for freight transport, the determining factor is the change in the European economy and its system of production and the movement from a "stock" economy to a "flow" economy. This phenomenon has been stressed by the relocation of some industries, particularly for goods with a high labour input, which are trying to reduce production costs, even though the production site is hundreds or even thousands of kilometres away from the final assembly plant or from users. The abolition of borders within the European Union countries has resulted in the establishment of a JIT or "revolving stock" production system.

These changes have major implications, not just for companies but also for policymakers and government regulators.

On the one hand, shippers, hauliers, service providers, rail and terminal operators, logistics companies, etc., are responding to the changing character of the European transport market in a variety of ways.

On the other hand, national governments and the EU are putting the greatest emphasis on having a better modal integration and developing the principles of harmonization of conditions of competition, as recommended by the European Parliament.

But in this context, the historical patterns of usage show exactly opposite trends: a continuous decline of the freight rail modal share and the important development of road.

This paper initially provides an overview of the evolution of the freight transport market in Europe, stressing the situation in the Alpine regions, which are very sensitive to environmental problems.

The role of the different modes in the supply logistics chains will also be analysed, through the results of the surveys carried out during selected European/national projects dealing with the shippers'/hauliers' reactions linked to modal shifting.

Emphasis will be given to the present equilibrium between supply and demand and to the way transport modal segments could contribute to satisfy market segments.

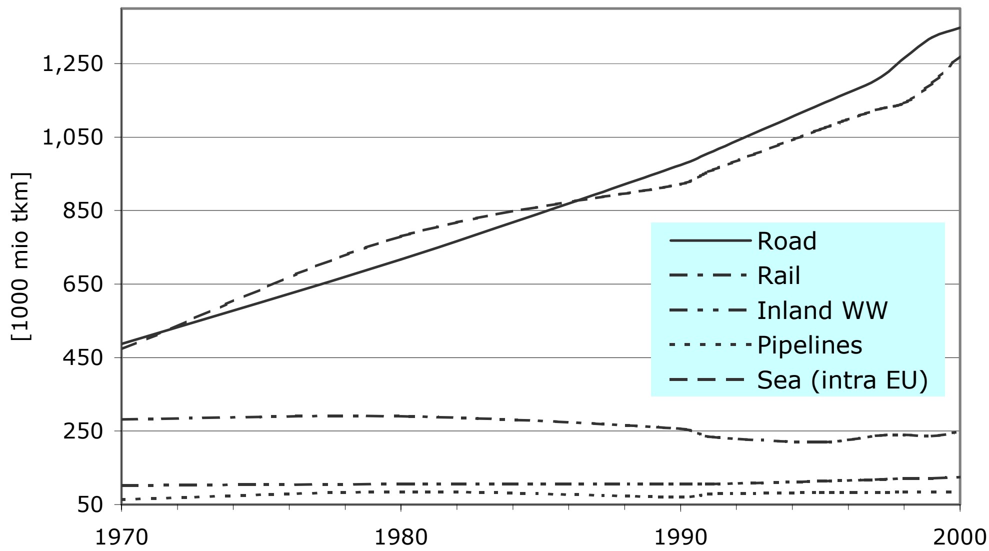
The assessment of the main successes with regard to modal integration (i.e. combined transport, ro-ro techniques and sea freeways, etc.) will follow, through selected study cases.

Finally, the presentation will point out key features on modal integration and will identify lessons that can be learned for transport policy harmonization.

2. THE EVOLUTION OF THE FREIGHT TRANSPORT MARKET: THE SITUATION IN THE ALPINE REGIONS

Of the total 3 078 billion tonne-kms of freight transported in the EU in 2000, more than 1 300 billion were carried by road and 1 270 billion by sea (intra-EU), while the rail mode did not exceed 250 billion (Figure 1). This means that road traffic increased by 180 per cent in the past thirty years, and by 6 per cent per year. However, it must be noted that from 1990 onwards this growth has been lower, with a yearly rate of 3.6 per cent.

Figure 1. **EU 15 freight transport performances by mode (1970-2000)**

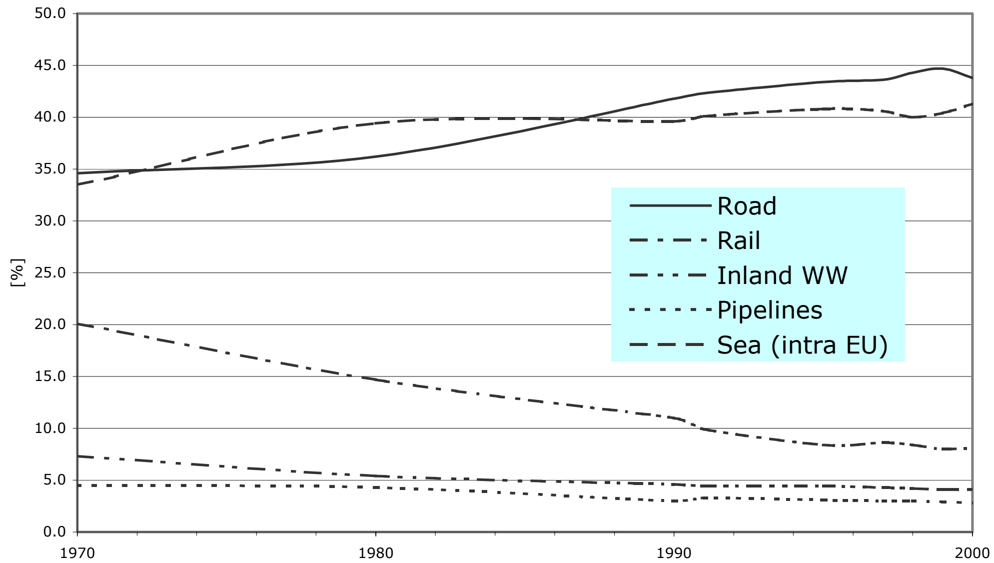


Source: European Commission (2002): EU Transport in Figures 2001.

The opposite situation is revealed for rail traffic, which suffered important losses along the available time series, while inland waterway transport increased slightly.

If the decline of rail is not so evident in terms of absolute values (t-km), the modal split data (Figure 2) show a worse situation, with a very weak transport market position for this mode. Compared to a 43.8 per cent market share for road and 41.3 per cent for sea, the overall share of the rail mode does not exceed 8.1 per cent, with a total decrease of 12 per cent over the past thirty years; the inland waterway mode share has declined as well, although not at the same rate (3.2 per cent), while road and sea increased their percentages respectively by 9.2 per cent and 7.8 per cent.

Figure 2. **EU 15 freight transport modal split (1970-2000)**



Source: European Commission (2002): EU Transport in Figures 2001.

The above-mentioned situation is worse in the Alpine Regions where, from the early 1970s to 2000, the central geographical position of the Alps and traffic demand growth led to a 300 per cent increase in total freight traffic, compared to a total increase of 155 per cent in the EU, and a 1 000 per cent increase in road freight traffic in the area concerned compared to the above-mentioned total growth of 180 per cent. With the implementation of the Customs Union and the Schengen Agreement, international freight transport across the Alps has become even more attractive.

Figure 3 shows the very large increase in total traffic in this area over the past ten years (from 100 million tonnes in 1991 to 152 million in 2001) with a yearly increase of 4.7 per cent. The road tonnage increased its throughput from 58 million in 1991 to 103.7 million in 2001, with a total percentage increase of 87 per cent and of 9.6 per cent yearly, while the rail tonnage remained almost unchanged during this period, with an actual value of 48.5 million.

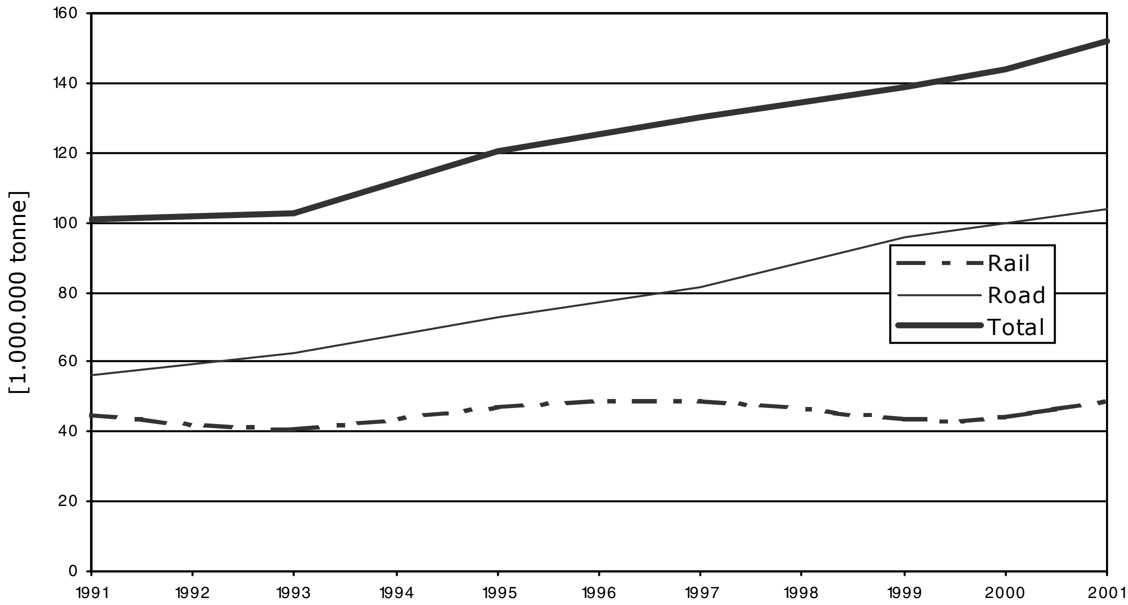
Accordingly, the modal split for road increased from 56 per cent (1991) to 68 per cent (2001), while rail decreased from 44 to 32 per cent (Figure 4).

Currently, there are 14 main routes crossing the Alps. Of these, only ten can offer well-developed transport infrastructure allowing high speed movements of goods and passengers; this means that more than ninety per cent of the overall trans-alpine traffic volume is therefore carried by only ten routes, with capacity constraints regarding road as well as rail.

New investments are underway; however, the related projects are unlikely to materialise for a number of years. Also, the EC White Paper (2001) stressed the need for the two projects in the Essen List -- involving rail links in the Alpine regions (the Lyons-Turin line and the new Brenner base rail tunnel) -- to help in switching part of the growth in road traffic to rail, as part of the European transport policy in the area.

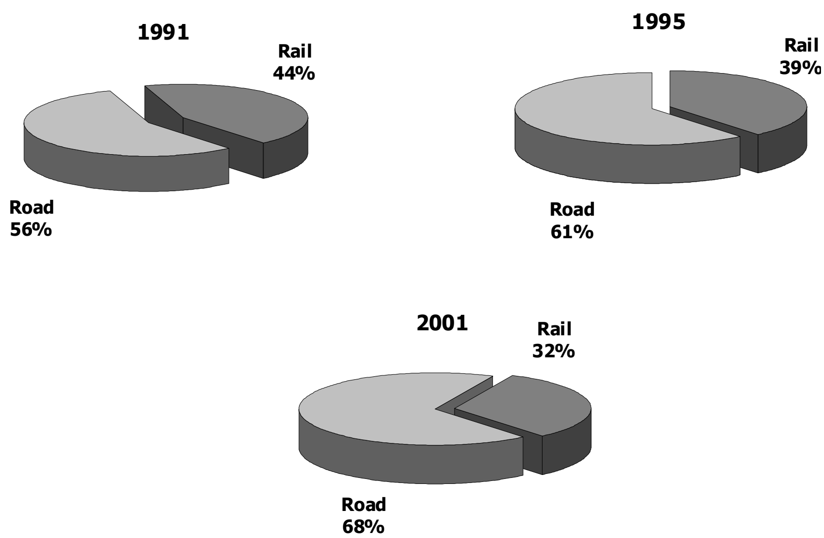
But the actual situation imposes severe limitations to the development of innovative techniques based on modal integration (combined transport between rail and road, rolling road, etc.), whereas their development could have a huge potential at a time when congestion on the road network and access to intermodal terminals/ports has became a crucial issue, especially at critical barriers such as in the Alpine Regions.

Figure 3. **Freight traffic through the Alps (1991-2001)**



Source: European Commission (2002): EU Transport in Figures 2001.

Figure 4. **Freight traffic modal split through the Alps (1991-2001)**

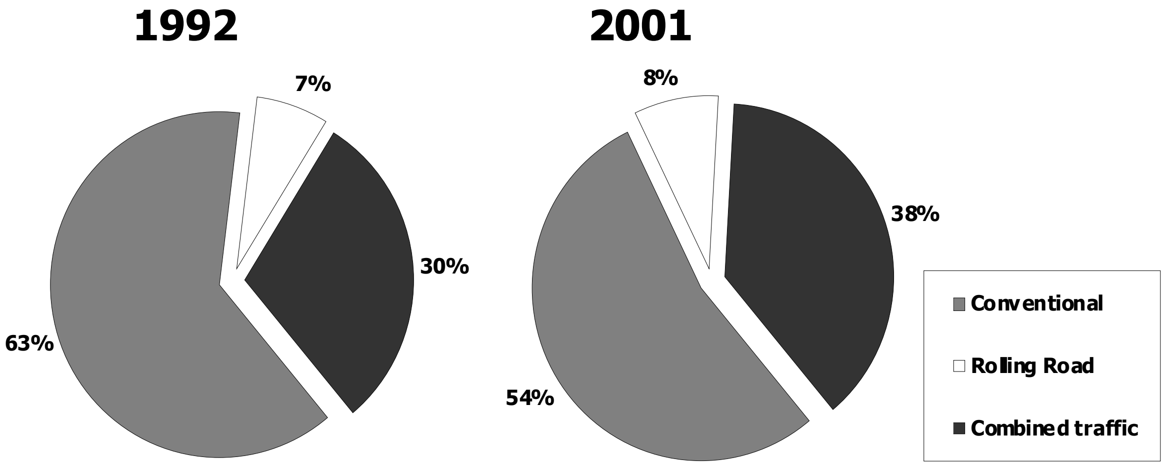


The question therefore arises as to whether, in the transition period between today and the time of realisation of the new infrastructure projects, capacity gains are possible through improvements in the organisation and management of existing intermodal chains, including the performance of the involved operators in terms of price, time, quality of service, etc.

In this context, it is interesting to have a better knowledge of the role assumed by intermodal traffic (combined transport and rolling road) compared to conventional rail traffic.

The time series of Figure 5 show the modal share in the rail sector; combined transport and rolling road increased their role in the Alpine crossings, rising respectively from 30 per cent in 1992 to 38 per cent in 2001 and from 7 to 8 per cent, while conventional rail decreased from 63 to 54 per cent.

Figure 5. **Freight traffic modal split through the Alps – Rail only (1992-2001)**



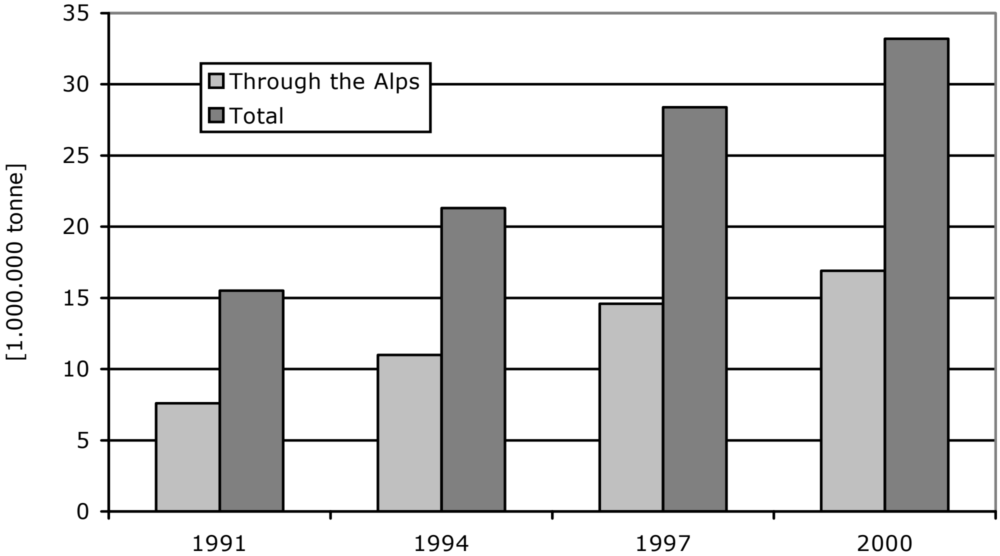
The potential leading role of intermodal transport in the Alpine crossings is confirmed from the statistics kept by the International Union of Rail/Road Combined Transport (UIRR), one of the major payers in this sector (Figure 6).

The trends show that almost 50 per cent of their total throughput is carried via the Alps but also that this rate has remained unchanged during the past ten years. Furthermore, according to the UIRR statistics, a sharp rise of more than 10 per cent per year in total traffic between 1991 and 2000, and the same increase in the traffic through the Alps, can be noticed.

This growth rate has not been maintained during the last three years (1997-2000), when an average value of 4 per cent per year can be noted.

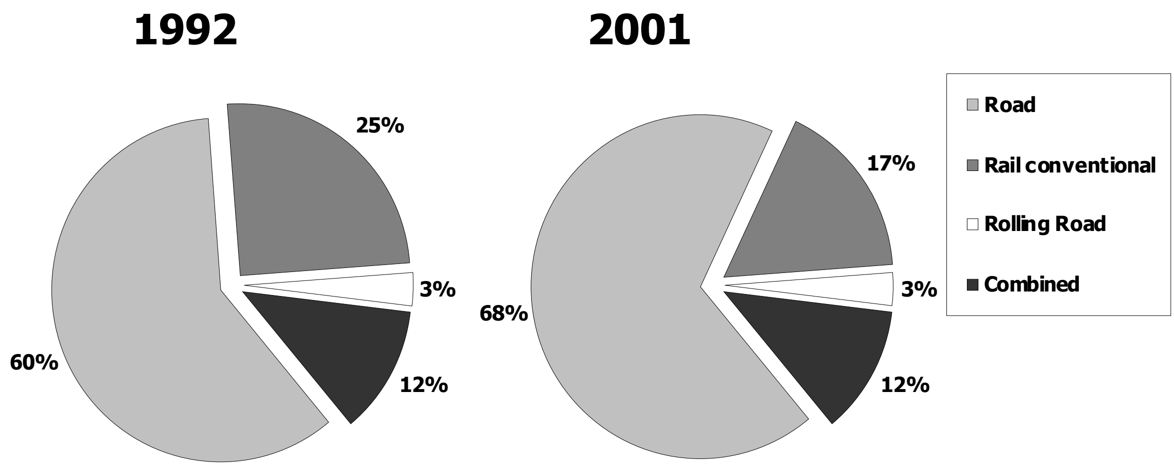
If we look at the position of intermodal traffic in the total modal share figure (including road) the situation looks different; in this case, the data show combined transport and rolling road remaining unchanged (12 per cent and 3 per cent respectively in 1992 and 2001), a road growth of 8 per cent (from 60 to 68 per cent) and a strong decline in conventional rail (from 25 to 17 per cent) (Figure 7).

Figure 6. **Trends in UIRR traffic -- Through the Alps/Total (1991-2000)**



Source: UIRR Statistics 2001.

Figure 7. **Freight traffic modal split through the Alps (1992-2001)**



The analyses presented show the important role played by intermodal transport in the Alpine regions but also an underutilised potential, particularly in such a promising market, with two countries (Austria and Switzerland) which are very sensitive to environmental problems and inclined towards more severe road circulation restrictions.

The main causes of this situation can be briefly summarised as follows:

- The poor performance of the railway with regard to reliability and quality of service; in this respect, it is important to stress the lack of rail interoperability between the 15 EU countries (five different traction systems, fourteen signalling systems, different gauges between France and Spain and Sweden and Finland, constraints on the length and weight of trains and different tunnel shapes, which necessitates specific rolling stock in the case of “high cube” containers or “rolling road” wagons);

- The structural weakness of intermodal terminals with regard to capacity, accessibility and organisation;

- The lack of a well-functioning system of reservation of potential slots across national borders, linked to the priority given to passenger trains;

- The lack of integrated commercial services throughout the international logistics chain.

Finally, the following recommendations could outline, if applied, a clearer future for combined transport and rolling roads, in the medium to long-term.

- The performance of rail, with regard to the reliability and quality of service, should be increased with:
  - a better knowledge at the European level of the available capacities along selected corridors;
  - the individuation of priority slots;

- The exploitation of longer trains should be improved with a reorganisation of the actual network and of rail operations in the intermodal terminals;

- A European information platform should be established in order to improve:
  - The existing shipments reservation system;
  - The information flows among operators along the whole supply chain;

- An integrated approach should be promoted along the intermodal corridors with specific alliances among companies on the main axes;

- Interoperability at border crossings should be increased (i.e. with the use of locomotives for dual-voltage operations);

- The structural weakness of intermodal terminals with regard to capacity, accessibility and organisation should be modified (e.g. 24-hour opening could be foreseen);

- The rolling road future should be better specified (either a transition situation in the face of road saturation or a new intermodal technique to be developed among the hauliers).

3. THE ROLES OF THE DIFFERENT MODES

A more general overview of the reasons for the above-mentioned actual trends in the use of different modes can be stressed considering the point of view of the users involved in the freight transport market.

The results of the surveys carried out during selected European/national projects (IQ and SOFTICE were conducted on behalf of the European Commission in the Fourth Research and Development Framework Programme) were analysed, together with shippers'/hauliers' reactions to selected stimuli linked to modal shifting.

Special attention was paid to the different supply logistics chains and to the segmentation of freight transport demand, in order to have a general understanding of the present equilibrium between supply and demand and to the way in which transport modal segments could contribute to satisfy market segments.

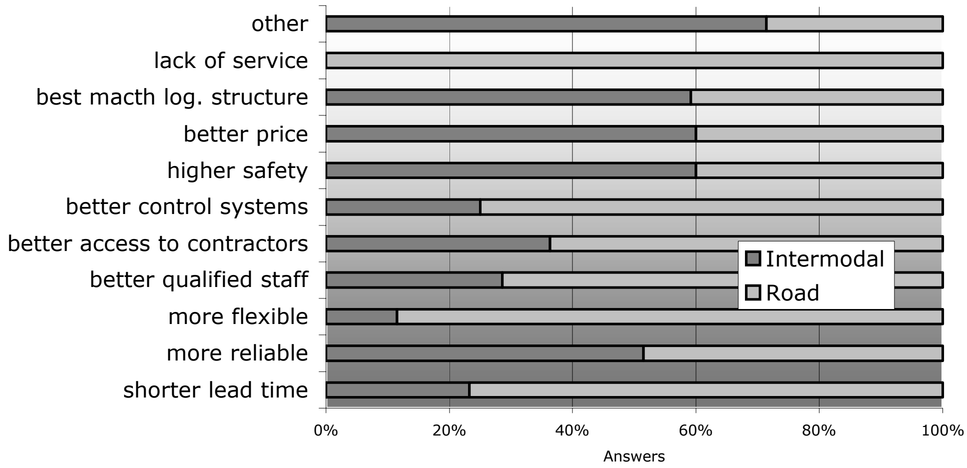
3.1. The IQ Project

In the IQ survey (IQ Final Report, 2000) respondents were asked to rate the strength of different price and quality considerations when making mode choices. Nine different quality considerations were used in addition to price. A preliminary division of the market into 23 segments was used to analyse differences between requirements. These preliminary segments were obtained as combinations of actors (shippers, forwarders, etc.), shipping distances and commodity types.

It was found that quality requirements are set both by shippers and by forwarders acting on behalf of shippers. The focus of shippers is generally on safety and reliability whereas forwarders focus on speed to secure early equipment restitution. The survey also shows that the decisive factors in choosing intermodal transport are, first, price and, second, a more advanced logistic structure, safety and reliability (Figure 8).

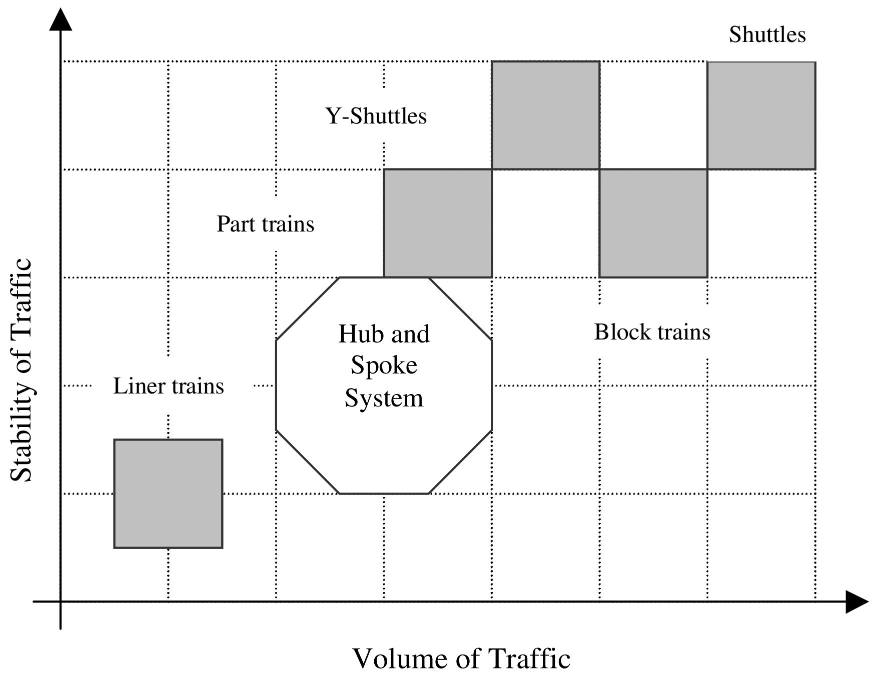
The IQ Project used another survey to explore how quality is affected in general by spatial, technological, infrastructural, informational and managerial factors. For more precise insights into the relationships, fifteen examples of European best practice were identified and studied. Through the systematic analysis of complete transport chains, it was possible to explore how performance is affected by interactions among different intermodal system elements. Because of the central importance of intermodal operating strategies, special attention was paid to the factors affecting the deployment of different strategies to clarify the conditions under which different solutions become commercially viable. The relationship between the volume of traffic, its stability and different train management systems is described in Figure 9.

Figure 8. **Main factors affecting modal choice**



Source: IQ Project Final Report, 2000.

Figure 9. **The role of the different operating systems**



Source : IQ Project Final Report, 2000.

A crucial element of the analysis was to define minimum threshold traffic volumes and haulage distances under which solutions with higher performance can be offered (Table 1).

A key finding is that, at present, a minimum haulage distance of 500 km and a minimum annual corridor volume of 20 000 TEUs are needed for operators to be able to offer high-performance shuttle train services, which are the most stable operating systems as regards traffic volume.

Table 1. **Commercial viability criteria of different operating systems**

OPERATING CONDITIONS	**OPERATING SYSTEM**				
	Gateways with shuttles and Y-shuttles	**Hub-&-spoke systems with shuttles and Y-shuttles**	**Direct block and part-trains**	**Hub-&-spoke systems with block and part trains**	**Liner trains**
Market structure					
Traffic volume[1]	20 000 TEUs	10-20 000 TEUs	10-20 000 TEUs	10 000 TEUs	5 000 TEUs
Traffic stability	very important	very important	quite important	not important	not important
Operational aspects					
Distance	500 km	200 km	300 km	200 km	100-200 km
Terminal accessibility	very important	very important	not so important	not important	quite important
Flexibility of equipment	very important	very important	not so important	not important	quite important
Performance indicators					
Service frequency	6 trains/week	1 daily per O/D	3 trains/week	1 daily per O/D	3 services/week
Reliability	Very reliable	Very reliable	Quite reliable	Quite reliable	Not very reliable

[1] annual

Source: IQ Project Executive Summary, 2000.

3.2. The SOFTICE Project

The aim of the survey carried out during the SOFTICE Project (SOFTICE Final Report, 1999), was to assess shippers' attitudes and to learn how shippers expected their hauliers and logistics providers to react in light of the strong changes in European road freight circulation restrictions.

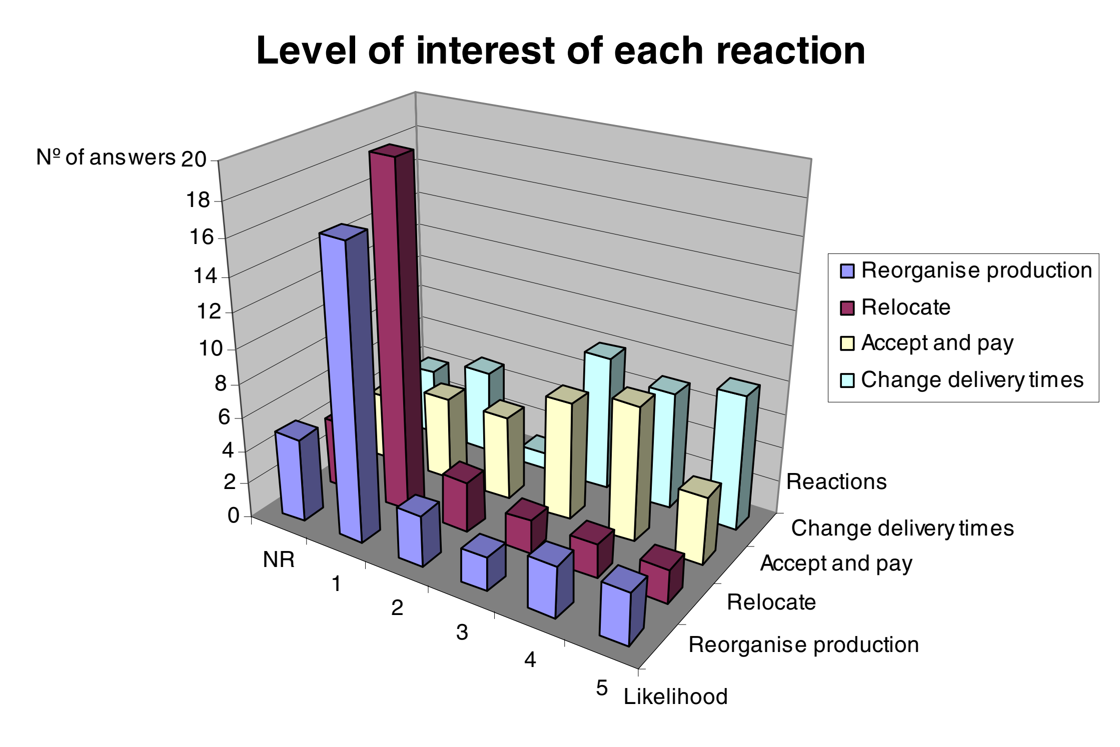
The interviews presented respondents with selected types of stimuli (circulation restriction due to social and environmental impacts, unreliability of deliveries, cost increase due to the application of tolls on motorways, etc.).

Eight generic types of possible reactions to these stimuli were suggested (change delivery times, relocate, reduce frequency of dispatches, no change, accept and pay, reorganise production, change haulier and modal shift.

Figure 10 shows the shippers' reactions to a particular stimulus (potential local restrictions).

The results of the survey showed that, when faced with several stimuli reflecting increasing difficulties or costs in keeping their current transport solutions, shippers are more willing to consider measures like increasing transport prices or changes in shipping times than modal transfers. The unwillingness to change is largely attributed to negative experiences with other transport modes, no matter whether that experience has been direct or just reported by other colleagues. Poor performance and lack of know-how to satisfy clients' changing requirements still seem to be endemic in the organisations involved in using non-roadway modes.

Figure 10. **Shippers' reactions to potential local restrictions**



Source: SOFTICE Project Final Report, 1999.

3.3. The French survey on user needs

An important French survey on shippers' needs, carried out in France (Guilbault, 1994) and covering 1 742 manufacturing and wholesale trading plants, including more than 5 000 shipments, revealed that only one for-hire-and-reward transport shipment in four is a single-route haulage. Therefore, three out of four shipments involve more complex transport operations, such as groupage and consolidation. The above survey also showed that shipments under one tonne represent 73 per cent of all shipments but only 17 per cent of the tonnage. In contrast, shipments over 20 tonnes represent only 5 per cent of all shipments but account for 43 per cent of the tonnage.

The shippers were also asked to declare their mode choices for the different shipments.

Each cluster of companies was assigned to a specific transport mode with regard to its most representative choice in terms both of number of shipments and total tonnes transported.

The results of the survey can be summarised as follows (Figure 11 shows the different areas of modal choice according to weight and number of shipments):

- Shippers with a small number of heavy-weight shipments moved use road transport with a single operation on hire and reward;

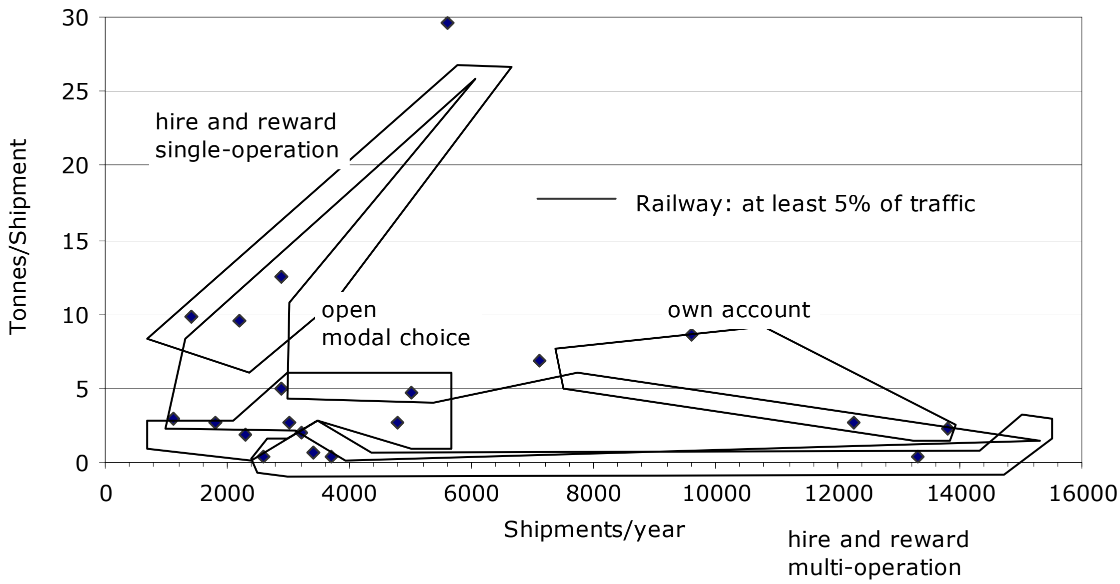
- Shippers with a variable number of low-weight shipments moved use road transport with multiple operations on hire and reward;

- Shippers with a variable number of variable-weight shipments moved use road transport on own account;

- Shippers with a small number of low-weight shipments moved use road transport on hire and reward with single or multiple operations;

- The railway is rarely used (the line in the figure joins the shippers that use it at least for 5 per cent of their production/distribution activities).

Figure 11. **Modal segmentation in the French survey**



Source: Guilbault, 1994.

3.4. The Italian sea freeways

Short sea shipping (SSS) is a strategic sector within the framework of rebalancing modal shift, particularly as it can reduce road traffic flow and the external costs associated with this type of transport. This is especially true in Italy because of its geographic, peninsular position.

Its throughput is characterised by intense development (in the EU it is the only mode of goods transport with a growth rate in the last ten years approaching that of road transport, as mentioned in the previous section) and there are on-going plans and proposals to revitalise the sector. However, there are numerous critical points, particularly in Italy, and these are summarised hereunder.

a) Different cabotage systems

The Tyhrrenian Sea cabotage system is mostly national and dominated by routes to the large Italian islands and 90 per cent of the operators are Italian, whereas the Adriatic Sea system is dominated by routes linking other nations, and mainly Greek and Turkish operators.

b) Features of the port towns

Ro-ro terminals are near, or joined, to towns. Therefore, major intervention is required on the infrastructure for port and land access, investment in equipment and the configuration and positioning of the terminals must be reassessed.

c) Typology of supply services offered

There are only a few exclusively supply services dedicated to all-year-round traffic. Therefore, the terminals are not equipped for handling, storage, warehousing, etc.

The salient features of a feasibility project for the development of combined sea and road (ro-ro) transport along the Adriatic and Tyhrrenian Seas (*Autostrade del Mare*), recently drawn up by the Italian Hauliers' Association (CONFETRA, 2000), are given below and aim at developing the sector because of its major innovative potential.

About 3.8 million tonnes of the entire road traffic moved over 500 km along selected corridors (of a total of 27 million tonnes), are potentially suited for the ro-ro technique[1] and could be shifted to this mode in the short to medium term.

The corridors analysed have been obtained using the following criteria:

- Corridors between areas not over 3 to 3.5 hours' road/rail distance from each other;
- Corridors between areas where the sea route avoids road haulage over 500 km;
- Corridors between areas where overall traffic (in both directions) is at least in the order of 2-3 million tonnes/year[2].

In principle, this hypothesis concerns the regional type corridors shown in Table 2.

This shift could be achieved and adequately improve the economic potential and effectiveness of ro-ro traffic if the shipping companies can meet these market opportunities with diversified strategies, users addressed, in order to promote SSS within the entire logistics chain.

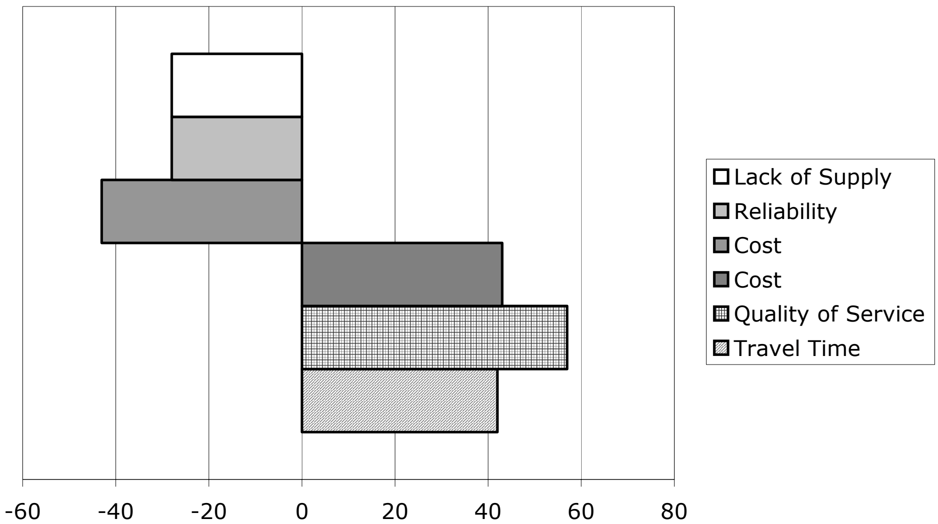
Table 2. **Potential increase of ro-ro traffic along the most important Adriatic and Tyrrhenian Sea routes**

TYRRHENIAN LINES	
Liguria – Campania	600.000 tonnes/year
Liguria – Sicily	300.000 tonnes/year
Tuscany – Campania	400.000 tonnes/year
Tuscany – Sicily	450.000 tonnes/year
Latium – Sicily	300.000 tonnes year
Campania – Sicily	550.000 tonnes/year
ADRIATIC LINES	
Veneto/Emilia Romagna – Abulia	900.000 tonnes/year
Veneto/Emilia Romagna – Sicily	300.000 tonnes/year
TOTAL:	3.800.000 tonnes/year

Source: CONFETRA, 2000.

The fact that, potentially, the users are not so negative towards a modal shift is revealed by the results of a survey recently completed (Uniontrasporti, 2001), showing strengths and weaknesses of short sea shipping compared to road transport; among the strengths, the hauliers indicate quality of service (among quality attributes, the safety of the shipment is a very important task for high-value goods moved on some road routes more exposed to theft), travel times and costs. Among the weaknesses, unreliability, costs (surprisingly, this also appears among the SSS strengths) and lack of supply are mentioned.

Figure 12. **Strengths and weaknesses of the SSS**



Source: Uniontrasporti, 2001.

In conclusion, the main findings of the surveys show the increasing success of road in the freight transport market and a strong resistance by users to shift from road transport to other modes.

When diversified strategies dealing with innovative, more reliable and flexible services are supplied by different railway and intermodal operators (in many cases forming alliances and/or cross-shareholding) as viable alternatives to the road, particularly if associated with specific policy regulations (e.g. road circulation restrictions), the users' reactions are potentially positive, particularly when intermodal operations are foreseen.

And, in this context, national and community financial support for dedicated solutions -- commercially viable in the medium and long term and leading to substantial shifts from road to other modes -- appears necessary, at least in the start-up phase.

4. SOME SUCCESSFUL EXAMPLES OF BEST PRACTICE

Three examples of best practice are presented hereunder. They deal specifically with the potential of intermodal (rail-road and sea-road) transport in specific market segments or within more complex logistics transport chains.

4.1. Kombiverkehr

Founded in 1969, Kombiverkehr is one of the world's largest providers of intermodal transport services, with more than 250 European forwarders and transport company shareholders (DB Cargo is the major shareholder).

The company provides one-stop shopping for anyone wishing to transport goods via intermodal transport. Intermodal services include block train services in Germany and the EU, block train services to German ports and rolling road services throughout the EU.

Currently, Kombiverkehr uses 28 block trains per day to serve approximately sixty terminals/cities (plans call for 42 block trains per day). Rolling road service is only used if there is a governmental subsidy. Actually, subsidies are provided by the German and Swiss governments.

The company also entered into partnerships with other organisations to further develop intermodal infrastructure. In particular, it has partnered in terminal projects in two German ports to expand intermodal handling capability.

In 2000, it provided services for the movement of 2 million TEUs (equivalent to 900 000 trucks), 21 million net tonnes and 14 billion tonne-kms.

4.2. Rail Traction Company (RTC)

Founded in February 2000 and taking advantage of the opportunities offered by the liberalisation of the rail market in Italy, the Rail Traction Company is the first Italian private railway company to be active in transporting cargo over the Brenner axis.

RTC started its activity in October 2001, with two couples of combined transport trains operating between Verona and Munich.

New services between Italy and Germany were added during 2002 and 2003, serving the automotive industry as well as the steel industry.

The company is in operational partnership with LOKOMOTION (owned by Kombiverkehr and BTZ); RTC exploits the service between Verona and the Brenner, while LOKOMOTION connects Brenner with Austria and Germany.

The main performances in 2002 and 2003 are as follows:

2002

- Combined transport: 1 106 trains
- Conventional transport: 450 car trains.

- The punctuality ratio, calculated with a tolerance of one hour, was 80.5%, with a peak of nearly 90% for the car trains.

2003

- Combined transport: 2 760 trains
- Conventional transport: 690 car and steel trains

- The average punctuality ratio grew to 86.2%, reaching 85% in combined transport and 92.4% for the car trains.

The reasons for this success can be attributed particularly to the reliability and flexibility of the service offered. It is important to stress that RTC has recently asked the RFI (the Italian Railways owner of the infrastructure) to improve its network (new slots and new routes) and a new rolling road service is foreseen soon.

4.3. The new Italy-Spain ro-ro routes and the Gioia Tauro Port

Two years ago, an Italian company (Grimaldi) launched a fast ferry service to carry whole trucks from Genoa to Barcelona in twelve hours. This new service, offering speed and punctuality, has been a marked success, allowing hauliers to avoid some of the busiest motorways in Europe at a competitive cost.

This example was followed by other routes between Italy and Spain (Leghorn, Salerno, Valencia), with an impressive increase in the total traffic between the two countries. Actually, out of the 2 million tonnes moved in 2000 in the Genoa Port (ro-ro traffic), 50 per cent is represented by the Genoa-Barcelona round-trip traffic.

In this context, it is also important to mention the example of Gioia Tauro Port. Thanks to its excellent geographic location on the south-western coast of Italy, it has become a natural transhipment hub for the Mediterranean Sea. Vessels transiting the Suez Canal and heading for the Strait of Gibraltar need only a minimal deviation to call at this Italian gateway to the European Community.

With its 3 154 metres of berths, 15.5 m of draft and a total surface of 1.2 million square metres, the container terminal enables the coverage of all Mediterranean ports, with many weekly connections, and main destinations served at least three times a week.

In 1995, the port served only 50 ships and handled 170 000 TEUs. In 2000, more than 3 000 ships called at the port and 2.6 million TEUs were transhipped. A trip from Southeast Asia to Rotterdam or Hamburg by sea would take 20 days or 22 days, respectively. Delivering the containers to Gioia Tauro and using intermodal services via northern Italy and Switzerland would take a total travel time of 14 days.

There are currently two train departures per week to Milan from Gioia Tauro, with nine weekly departures from Milan to Rotterdam.

5. FINAL REMARKS AND CONCLUSIONS

This paper started with the observation that recent years have seen important changes in the European freight transport market. The driving forces behind these changes have then been outlined as well as the actual leading role of road transport.

It is, however, vital to emphasize that this process of change within the freight markets is far from over. In fact, new approaches to logistics management seem likely to accelerate the pace of change and a growing number of companies have successfully used information systems (IT) to achieve a better control of supply chains.

At the same time, it is important to stress that, after strong and persistent growth, road traffic seems to be nearing its limits in some corridors which are particularly sensitive to environmental problems and where severe road circulation restrictions will be adopted in the next few years.

In this context, a new equilibrium will probably be reached, whereby rail/intermodal operators will be able to cope with users' new requirements and needs by adopting specific strategies and offering more reliable and flexible services. The successful examples described above reveal this new, positive attitude.

A final issue is the need for a higher degree of co-operation between the different actors of the logistics chain (namely, for functions with relevant economies of scale, such as marketing, telematics, staff training, etc.); this could give new incentives to the revitalisation of rail, as a competitive alternative among the ever more complex intermodal transport solutions.

NOTES

1. Calculation based on preference selected indicators calculated for each of the lines examined.

2. Transverse links, i.e. those linking north/east and south/west and linking north/west and south/east, have not been considered because of the low incidence the sea route would have on the total distance; among other things, combined road/rail haulage should be more competitive on these links. Also not taken into account are links which mainly cover the hinterland, links where at least one of the terminal stretches does not have easy access to a port and links between regions with negligible traffic.

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Scope and Limits of Charging as a Means of Promoting Sustainable Development

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SUMMARY

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1. INTRODUCTION

Sustainable development is an issue of concern to policymakers, particularly in the field of transport which is posing challenges for society because of its implications in terms of congestion, safety and the environment. Numerous debates are under way as to how to meet those challenges. One solution is infrastructure charging, currently the focus of close attention and high expectations. What is its scope, and what are the limits to the expectations placed in this solution? This paper endeavours to shed light on precisely that question.

Chapter 1 sets out both the policymaking and economic grounds that justify those expectations. The second chapter assesses the efficiency of charging based on what econometrics tells us about elasticities. Chapter 3 addresses the more qualitative analyses that make it possible to compare charging and other ways of promoting sustainable development, while the last section sets out the conclusions, recommending the co-ordinated use of all the available instruments in which charging is a vital but not the sole feature.

Before developing these arguments, we need to specify how the term "sustainable development" is used here. In the strictest sense, it is development which meets the needs of the present without compromising the needs of the future; but it is often used too in a broader, looser sense to mean development which takes full account of any impacts on the environment. The difference between the two is that the second definition covers temporary environmental effects, unlike the first which focuses on natural resource loss and pays little heed to the mostly temporary effects of noise and air pollution. This paper opts for the broader definition, although its main focus will be on the lasting impacts of transport.

Promoting sustainable development in the transport sector means minimising the spatial impacts and reducing the build-up of pollutants such as greenhouse gases, in particular from oil use; it means combating air, soil and noise pollution, controlling congestion and improving safety. All of these goals imply reducing the volume of traffic and the use of non-renewable fuels, altering vehicle emissions to reduce pollution and noise and promoting transfers from polluting to less aggressive f transport.

2. CHARGING: THE NATURAL SOLUTION

To achieve these goals, charging is a natural solution from both an economic and a policymaking standpoint.

2.1. From the economic analysis standpoint

Economic theory, in its most classical form, considers prices to be a vital factor in shaping the choices of economic agents, as it is prices that govern the markets on which those decisions are made, and prices that determine supply and demand. So it is not surprising that prices spring to mind when the goal is sustainable development. Prices are the tools of any economist's trade.

Economists do not confine themselves to describing the role played by prices in the economy, but also acknowledge how worthwhile careful pricing can be. Prices select the most efficient producers (those whose manufacturing costs do not exceed the price) and the most eager consumers (those whose ability to pay does exceed the price). Prices are a way of achieving optimal efficiency, a situation in which no individual's satisfaction can be raised without lowering that of another. This is a natural, automatic process when the economy is operating in competition mode; however, when competition is distorted by externalities, for instance, or goods are administered by government (as transport infrastructure is), any market prices must necessarily be adjusted by a public authority to reflect the cost to the community, and are thus the best means of achieving the optimal efficiency defined above, or any other goal society may have set itself.

Classical economic theory holds, for instance, that pricing is a more efficient way of restricting the use of a good than setting ceilings on the individual use of that good: the goal will be achieved at the least cost to enterprises by controlling prices rather than quantities in the case of goods used in the production process, or by minimising consumer satisfaction in the case of final goods.

2.2. From the policy standpoint

The market economy principles which drive our societies, and which are based on freely set prices as a means of economic regulation, come up against a problem in the transport sector by virtue of the fact that many goods – and "bads" - are non-market and are not priced as part of the natural order of things. So government has to take the place of the market in setting those prices, which in this particular case are basically infrastructure and environmental costs.

Governments and international organisations have been wrestling with this issue for a very long time now. The debate on infrastructure charging goes back some 200 years, but regained momentum in the mid-20th century with the founding of international organisations such as the ECMT and the European Union. The ECMT has conducted several studies on the scientific aspects of the subject (ECMT, 1998; ECMT, 2000) and passed numerous resolutions on the policymaking dimension. From its inception, the European Union has seen sound price harmonization as crucial to the advent of a common transport market. More recently, the European Commission, in its White and Green Papers (EC, 1996; EC, 1998; EC, 2000), made charging its prime instrument for achieving sustainable development, and put forward specific recommendations on the implementation of charging schemes; the extent to which the subject has engaged policymakers and economic experts alike is well known.

3. IMPLEMENTATION PROBLEMS

But these very points, which show that charging is the natural focus of attention, also illustrate the scale of the problems posed by charging as a means of promoting sustainable development.

3.1. Which approach? The contradictory aims of charging

The first problem, which is probably attracting too much attention, lies in choosing the best pricing option: basically, marginal cost or average cost?

The crux of this familiar debate is that charging, even for public authorities concerned only with the public good, is not aimed solely at sustainable development. As well as influencing economic decisions, charging is traditionally acknowledged to have two other purposes, namely, financing the cost of infrastructure management and meeting redistribution and equity concerns. But these two goals run counter to the first. Redistribution may result in an identical charge being made throughout the country for a service with very diverse environmental implications, one reason for this being universal service provision. Oum and Tretheway (1998) have shown than when an institution has tight budgetary constraints, optimal pricing has to be akin to that of a private monopoly seeking to maximise its profits and has, to some extent therefore, to relinquish its goal of correcting externalities. Unfortunately, a shortage of public funds is common in the field of transport, as for example in the case of high-speed trains where charging practices are akin to those of private monopolies and little account is taken of their environmental advantages.

Some may regret that charging is not aimed solely at sustainable development, while others may welcome its being used optimally to serve the public good, with sustainable development a vital but not the only goal and other policy options determining the final mix.

These issues, already developed in detail elsewhere (see the UNITE research programme, and in particular Meyeres *et al.*, 2001), will not be discussed further in this paper, which is confined to two fairly uncontroversial ideas. One is that demand is price-sensitive: if prices increase, traffic declines, meaning that charging is a means of influencing demand. The other is the polluter-pays principle, whereby everyone must pay for damage to third parties. These two principles are an adequate basis on which to build a charging policy that promotes sustainable development.

Finally, charging must be accepted by society at large, which is far from being the case judging from the misgivings aroused by the many, thus far abortive attempts to introduce urban congestion charges in Europe. But this kind of reaction should come as no surprise, as it is common with any new mechanism. Countries which charge for motorway use recall how the tolls, now widely accepted and a feature of everyday life, met with fierce opposition at the outset. Acceptability is now the subject of a good deal of research (including Verhoef *et al.*, 1997; Reitveld *et al.,* 1998) and there is every certainty that the issue will be resolved and is not an insurmountable obstacle.

3.2. Uncertainty and imprecision of the calculations

Whatever the option chosen, the next step is to put a figure on the costs generated by the type of traffic being targeted for charging. This is often criticised as an imprecise exercise, and costing methods do confirm this. The argument merits close analysis.

First, uncertainty is not confined to non-market goods. Look at how erratically the prices of raw materials or securities vary, in some cases rising or falling five- or tenfold in as little as a year, which goes to show that uncertainty is just as serious a problem for market as for non-market goods. Also apparent is the fact that it is possible to sell one and the same good at different prices to similar customers, or in places and at times that hardly differ. Another example of how hard it is to make economic calculations for market goods is that a single branch of industry can encompass firms making large profits and others that are going bankrupt.

As non-market goods cannot be evaluated on a market basis, complex models are required involving numerous parameters, the calculation of which is itself uncertain. There are numerous examples to illustrate and confirm this, including the complex processes used to evaluate the cost of air pollution (see Friedrich and Bickel, 2002) or noise pollution (Kail, Lambert and Quinet, 2000).

There is particular uncertainty surrounding the long-term effects, those which involve pollution build-up and are hence central to concerns about sustainable development, particularly when there are transboundary or international implications. The typical example is global warming. The damage anticipated here varies with the time horizon; the more distant the time horizon, the greater the damage, but the more uncertain the predictions. The taxes required for compliance with the Kyoto Protocol agreements would vary considerably, depending on the implementation arrangements concerning tradeable permits[1]. The value of these permits and the corresponding tax would be fairly high if the Protocol was endorsed by the United States, which is a major energy user and would push up permit prices. Conversely, those prices would fall if the United States did not come on board, because the quota of permits allocated to Russia would easily cover European demand, unless Russia exercised its monopoly power. Finally, the tax required to stabilize energy consumption would vary considerably depending on the time horizon for stabilization. The combined impact of all these factors means that the fossil-fuel tax could range from a few euros to several hundred euros per tonne of carbon, with plausible justifications for each figure.

This complexity and uncertainty are compounded by the risk of manipulation. One characteristic of market goods is that prices are adjusted by a blind mechanism, i.e. the market, which cannot be manipulated[2]. Conversely, the prices of non-market goods have to be calculated and the calculation is controlled, in most contemporary societies, by a whole series of decisionmakers who seek to influence the outcome in their own interests and therefore act strategically. In addition to the uncertainty inherent in the economic calculation is the bias stemming from manipulation, prices being negotiated and individual stakeholders having their own negotiating powers; in all of this, sustainable development concerns would appear to play only a minor role.

In some of these situations of uncertainty, instruments other than charging may be preferable. Regulation is recommended when there is uncertainty as to the anticipated costs or benefits of the effect to be corrected. The exact result, obtained by Weitzman (1974), is a complex expression but the rationale is easy to grasp: if, for instance, the consequences of charging are uncertain because little is known about how individuals will respond to it (uncertainty about demand elasticity), and if the cost stemming from an inadequate response could be very high (uncertainty about the consequences), then it may be best to opt for regulation, which is less efficient but guards against what might be unacceptable consequences. Obviously, in other situations of uncertainty regarding the costs of prevention and damage, then the chosen option should be charging. It would appear, however, that for global warming the consequences of charging would be too uncertain and would fail to guard against major disasters. Therefore, regulating emissions is the preferred option, with quotas on emission permits which would be negotiable; this would ensure[3] that emissions do not exceed an overall ceiling.

In the above example, the problem involved allocating a scarce resource, i.e. greenhouse-gas emissions. Negotiable ownership rights, i.e. permits, are one broad solution to such a problem when there is doubt as to how much the resource is worth to the economic agents seeking access to it. This situation occurs frequently in the transport sector and often involves issues other than greenhouse gas emissions: how are the most efficient airline companies to be selected from among all those applying for slots at a congested airport? How are train-paths to be allocated among rail operators? In theory the answer is pricing, but then there is the problem of identifying the private costs and benefits of air or rail companies. Here, economic analysis recommends the creation of ownership rights and the authorisation to trade or bid for them. While this kind of competitive bidding is somewhat more complicated than art auctions or concession bidding, the system is already being used in the electric power and telecommunications industries, which are no less complex than transport, and there is no reason why appropriate solutions should not be found for that particular sector. As well as the applications for air and rail transport, where current research is very promising (see Nilsson, 2000), another eligible candidate is road traffic; just such a mechanism is now operating in Singapore, where prospective vehicle owners must bid for a certificate of entitlement. With the advances in new information and communication technologies (NICT), this kind of bidding system is set to become more widespread in the future, so why not envisage, in some urban areas, a weekly auction of traffic permits for the following week, or daily auctions for the following day?

3.3. Intended impact still hard to target

Most practical transport charging schemes do not target their impacts very well. Unlike standard goods, which are charged directly to the purchaser, transport goods are often paid for indirectly. The best example of this is road charging; users pay a tax on oil products, tolls for specific infrastructure, as well as parking fees, tax discs or special taxes on car licences, the combination of which actually constitutes road charging. But of course these charges do not exactly match the cost of infrastructure and externalities: they do not vary according to the same parameters, and are not adjusted to reflect congestion density or environmental damage. Some countries have introduced environmental taxes on vehicles according to their pollution or noise levels, but there is room for improvement here as they are usually set-price payments which do not reflect changes in pollution levels depending on factors such as the location of the vehicle, the time of day or roadworthiness. Current charging schemes cannot be adjusted to reflect the wide variety of environmental costs that depend largely on local conditions; any decision to match charges more closely to costs would clearly entail considerable transaction costs (e.g. installation, inspection).

It might, accordingly, be advisable to forego charging and opt for regulation, as an efficient charging scheme, sophisticated enough to cover all the features of everyday situations, would be extremely costly using the current technology. Regulating new-vehicle emissions under set conditions, for instance, or setting speed limits to improve road safety, may be less efficient but the loss of efficiency is largely offset by the gains in terms of enforcement.

However, the current state of the art is likely to progress rapidly, thanks to the potential of new information and communications technology. Satellite tracking systems, for instance, will be able to locate vehicles and provide full information on traffic conditions in the area, thereby making it possible to put a very accurate figure on the corresponding infrastructure and congestion costs. This is the type of system now being developed in Germany for trucks, although the transaction costs would be high. Without being excessively futuristic, there may one day be systems which will analyse a vehicle's exhaust fumes, register the noise it emits, work out how much damage it is causing on the basis of the number of people affected, and then debit an appropriate charge directly from the user's bank account.

4. INSIGHTS ON ELASTICITIES: UNQUESTIONABLY EFFICIENT

Once a charging system has been defined and put into practice, the next step is to assess its efficiency. This depends on how traffic responds to the incentives imparted by prices, i.e. elasticities.

Measuring price elasticities in the transport sector is complex and the focus of much research; the results are wide-ranging as elasticity is highly contingent on individual cases. As transport is an intermediate good (people do not travel and goods are not shipped for the sake of mobility but for a specific purpose or end product), the overall elasticity of transport depends on the usefulness of the end product. The price elasticities of each mode of transport depend on the availability of competing modes, as well as on service quality (journey time, comfort, safety) in the relevant mode -- and all of these factors vary from one practical situation to another.

Let us now look at the insight to be gained from the leading studies on elasticities, and the many reviews of that literature. The best known reviews were conducted some years ago by Oum *et al.* (1992) and Goodwin (1992); these broad studies were later supplemented by other works with a more specific focus, in particular statistical meta-analyses, designed to reveal the basic parameters governing elasticities. Rather than going back over all of this work, we have summarised the main insights it provides.

A distinction needs to be made between own price elasticities, i.e. the impact that a change in the price of a mode -- or sub-mode -- has on traffic in that mode; cross-price elasticities, i.e. the impact that a change in the price of a mode -- or sub-mode -- has on traffic in a competing mode; and elasticities with respect to the other parameters governing traffic (journey time, service quality, level of economic activity).

4.1. Own price elasticities: low but with significant effects

Total freight traffic is relatively inelastic with respect to the price of transport, which is understandable considering that transport accounts for only a small share of the end-product cost. Above all, transport costs affect production patterns: if transport costs fall, greater use will be made of just-in-time systems, more distant supply sources and intermediate shipments. This gives price elasticities of around -0.2 to -0.3 in the short run and around -0.5 in the long run.

The situation is fairly similar for each individual mode. The own-price elasticity of road freight transport appears to vary especially widely. The figures given by Oum *et al.* (1992) range, with the specification of the demand function, from -0.7 to -1.3; those generally accepted in France (Meyer, 1997; Girault *et al.*, 1995) are lower, ranging from -0.25 to -0.5. The long-run price elasticities currently used in France are -0.6 for road transport (SES note dated 2/12/2002).

Price elasticities for rail freight traffic are wider-ranging but of the same order (Oum *et al.*, 1992). The values used in France are markedly lower (Sauvant, 2002).

Price elasticities for passenger transport display roughly the same characteristics. They are less uncertain, possibly because they have been the subject of more research.

For car transport, current own-price elasticities range from about -0.2 to -0.3 in the short run, but are higher in the long run; these figures are drawn mainly from research into urban traffic in the United States and Australia (Oum, 1992; Graham and Glaister, 2002). In France, studies on interurban infrastructure investment programmes give a fuel price elasticity of road traffic of -0.3 in the short run and -0.45 in the long run (Sauvant, 2002). These figures are similar to those given in the Goodwin review (1992).

The studies also give the price elasticities of fuel consumption (Goodwin, 1992; Graham and Glaister, 2002), which are around -0.3 in the short run -- virtually the same as for traffic -- and -0.8 in the long run, a much higher figure than for the impact of fuel prices on traffic. This means that users are likely to bring down fuel consumption per vehicle in the long run, probably by changing to more fuel-efficient models.

With regard to interurban rail transport, elasticities are around unity in absolute terms, and differ according to the grounds for travel, being higher for private than for professional travel (Oum *et al.,* 1992, Goodwin, 1992). In France, the figure used by interurban infrastructure planners is -0.7. Elasticities differ according to the time of travel and are higher at off-peak times, van Vuuren and Rietveld (2002), for instance, finding an off-peak elasticity for the Netherlands of -1.37.

Elasticities for urban public transport are highly variable and more case-specific; they generally stand at around -0.3 (Kechi, 1996; Goodwin, 1992; Oum *et al.,* 1992; Dargay and Hanly, 2002), but are much lower in some studies, at around -1; the figures are higher for private than for professional travel.

Finally, price elasticities for air transport are generally quite high, ranging from -1.00 to -2.00. They are also highly variable, which is understandable given the diverse conditions of competition between air transport and other modes. Here too, elasticities are higher for private than for professional travel, and higher in the long run than in the short run; they also decline with national wealth, as shown in the meta-analysis by Brons *et al.*

By and large, own-price elasticities are wide-ranging and generally less than unity, but only just. The figures also depend on the time horizon: in the great majority of cases, short-run elasticities are lower than long-run elasticities, which are close to unity. Finally, elasticities for off-peak and private travel are usually higher than average.

4.2. Cross-price elasticities involving limited modal transfers

Cross-elasticities are awkward to interpret, as they reflect not only intermodal substitution but also the market share weighting of individual modes. Any conclusions necessarily reflect that weighting, and in fact reveal very little modal transfer.

With regard to freight traffic in France, for instance, the generally accepted figure for the cross-price elasticity of rail traffic with respect to road transport is either +0.35 (Meyer, 1997) or +0.6 (Girault *et al.,* 1995; Sauvant, 2002). Given the relative shares of road and rail, a 10 per cent price increase in road transport would lead to a 6 per cent increase in rail traffic, i.e. 1.5 per cent of road traffic would shift to rail. Relating that figure to the own-price elasticity of -0.7, a 10 per cent increase in road transport prices would have the following impact:

- Road traffic would fall by 7%; and
- of that 7%:
  - 1.5% would shift to rail;
  - 5.5% would disappear.

Similarly, in France the cross-elasticity of rail passenger traffic to road -- or rather fuel -- prices is estimated to range from 0.2 to 0.4: once again, there is very little modal transfer, as road travel prices would have to rise very steeply to generate significant transfers to rail in absolute terms, and most of the passenger traffic leaving the roads because of the price rises simply disappears from the statistics, with only a small share transferring to rail.

As for the cross-price elasticities of road to rail, no significant figures can be produced, be it for passengers or freight, which goes to show how little modal transfer there is in this case!

Cross-elasticities have also been studied by Selvanathan and Selvanathan (1994), using a general economic model to calculate public/private transport elasticities and communications elasticities. Their findings show cross-elasticities to be low, at around 0.1. The studies also give own-price elasticities in line with those we have already seen, together with income elasticities that are high, as the following table shows:

	Income elasticity		**Own price elasticity**	
	UK	**Australia**	**UK**	**Australia**
Private transport	2.0	2.3	-0.5	-0.5
Public transport	1.8	0.8	-0.4	-0.7
Communications	1.2	0.5	-0.1	-0.6

4.3. Other elasticities: level of activity and service quality

This final study addresses the level of economic activity; the elasticities for this variable are significant for virtually all of the statistical adjustments and are usually much higher than price elasticities. In this regard, the findings of Selvanathan and Selvanathan (1994) are amply confirmed by the other studies. Johansson and Schipper (1997), for instance, evaluated price and income elasticities in twelve OECD Member countries and obtained the same findings, which goes to show how strong an impact income has.

Elasticity:	Fuel prices	Income
of car ownership	-0.1	1.0
of average annual fuel consumption	-0.4	0.0
of annual kilometres driven	-0.2	0.2
of aggregate fuel consumption	-0.7	1.2
of total automobile traffic	-0.3	1.2

Similarly, adjustments made for time changes in interurban passenger traffic make considerable allowance for economic activity, shown either as final household consumption or per capita income [e.g. for France: Blain and Nguyen (1994)]: this gives an elasticity of just under unity for each mode. Madre (2002) also finds income elasticities of around 1 for urban and peri-urban traffic.

In freight transport too, all of the studies find high GDP elasticities. Girault *et al.* (1995) and Meyer (1997) for France, Van de Voorde and Meersman (1997) for Belgium and Bennathan *et al.* (1992), based on World Bank data, show the GDP elasticities of freight transport to be just over unity and highly significant.

Overall, economic activity elasticities are around +1 for passenger transport and +1.5 for freight.

There are fewer studies on service quality, probably because it is not easy to gauge and because reliable statistics on the subject are harder to find. Those that are available point out the significant effects of journey time, with elasticities similar to price elasticities (Small and Winston, 1999; Blain *et al.,* 1994), frequency in the case of urban transport (Dargay and Hanly, 2002) and network size in the case of high-speed trains (Blain *et al.,* 1994).

4.4. Elasticities: an overall assessment

For an overview of the phenomena discussed individually above, some models can study them simultaneously. Below are some of the findings of the FIFI study, carried out under the supervision of R. Roy (2003) for the ECMT. The purpose of this study of six European Member States is to determine optimal infrastructure prices by identifying, in each country, the central metropolitan area, other urban areas and interurban transport and then, for each of these zones, breaking time down into peak and off-peak periods and modes into three categories: road (cars, buses, trucks), rail (passenger and freight) and waterways. All of this information is processed by means of the TRENEN model (Proost, 1990), midway between a partial equilibrium and a general equilibrium model. The findings most relevant to this paper concern the price changes that would stem from optimal pricing and the corresponding traffic changes. The table below summarises the findings for interurban traffic in the United Kingdom:

Table 1 Results of the model for interurban transport in the United Kingdom							
Mode	In Euros and millions of pass-ton/km	Price at current prices	Price with optimal pricing	Relative price change	Current volume of traffic	Volume of traffic after optimisation	Relative change in traffic
Passengers							
Car, peak		0.308	0.39	27%	441	421	-5%
Car, off peak		0.301	0.33	10%	590	594	1%
Bus, peak		0.134	0.15	12%	49	51	4%
Bus, off peak		0.101	0.11	9%	57	59	4%
Rail, peak		0.156	0.21	35%	43	38	-12%
Rail, off peak		0.123	0.13	6%	43	44	2%
Freight							
Road, peak		0.086	0.1	16%	170	168	-1%
Road, off peak		0.086	0.08	-7%	318	321	1%
Rail		0.069	0.056	-19%	60	64	7%

and for urban traffic in the Ile-de-France (Paris area) of France (other areas give similar results):

Table 2: Results of the model for transport in the Ile-de-France area							
Mode	In Euros and millions of pass-ton/km	Price at current prices	Price with optimal pricing	Relative price change	Current volume of traffic	Volume of traffic after optimisation	Relative change in traffic
Passengers							
Car, peak		0.553	0.7	27%	91	79	-13%
Car, off peak		0.507	0.55	8%	105	86	-18%
Bus, peak		0.175	0.27	54%	6	7	17%
Bus, off peak		0.175	0.21	20%	10	12	20%
Rail, peak		0.081	0.13	60%	28	30	7%
Rail, off peak		0.081	0.05	-38%	37	47	27%
Freight							
Road, peak		0.129	0.182	41%	34	34	0%
Road, off peak		0.129	0.153	19%	39	39	0%

These findings show both how sensitive car traffic is to charging, and how little modal transfer there is: in the Ile-de-France area, for instance, of the 40 000 000 passenger-kilometres no longer on the road, only 12 000 000 switch to public transport.

Thus, an overview of the findings presented individually in previous sections of this paper shows significant own-price elasticities and very little modal transfer.

4.5. Elasticities: conclusions

In all, the findings show that the price elasticities of traffic, while highly case-specific, are usually moderate but not very far from unity in absolute terms; the widely accepted idea that price elasticities are low needs to be reviewed. The fact that long-run elasticities are very generally higher than short-run elasticities shows that it will take some time -- and patience -- before the effects are felt[4].

Another point that will not emerge from statistical work on elasticities is that the closer the targeting, the more efficient charging will become.

Cross-elasticities are much lower than direct elasticities: the main impact of measures concerning charging is to eliminate traffic, since charging is a tool that cannot -- by itself at least -- generate substantial modal transfer.

Finally, econometric research shows that factors other than prices can affect traffic: heading the list is the level of economic activity, be it the impact of income on private travel or output on freight transport. Research shows the importance of supply-side factors too, namely, service quality, in particular the speed of travel, and network effects measured in terms of infrastructure network size.

So prices are an important but not the sole factor in determining transport volumes and account should be taken of the other relevant parameters which go undetected by econometric analysis.

5. OTHER TOOLS

Again, sustainable development is an important but not the sole reason for the introduction of charging or other approaches that are preferable in the cases of uncertainty discussed above. Mention has been made of the goals of redistribution and equity, or the need for financial resources to cover transport infrastructure expenditure -- these are just some of the key goals set by government, while others include land-use planning, strategic objectives, urban planning and the competitiveness of the economy. It is well known that when there are several tasks to complete, it is preferable to have a toolkit with at least as many tools as there are tasks. This applies to sustainable development too: as one of many government goals, it merits a range of solutions. Charging alone cannot guarantee success, hence the need to bring into play the many factors that govern the volume and mix of transport, the determinants of transport demand which, as outlined earlier with regard to econometric research, are substantial.

These determinants have been the focus of much attention in recent years; besides the statistical work on specific factors described in the section on elasticities, there have also been a number of more qualitative and detailed studies. SACTRA (the UK's Standing Advisory Committee on Trunk Road Assessment) has produced a report on the subject, and a recent ECMT seminar provided the conclusions drawn upon below. The evidence is that these determinants are numerous and differ according to the geographical standpoint (i.e. continent, country, region or city). But in any event they can be ranked according to the degree of control that transport authorities can exert over them, and the policy scope they offer. They are discussed below in turn, beginning with the factors furthest removed from the transport sector, namely, the general economic environment, spatial planning, technological change and measures affecting transport service quality.

The factor furthest removed from the transport sector is obviously the general economic environment, marked by the growth of the economy in overall and structural terms. Again, economic activity elasticities are markedly higher than price elasticities, standing at around 1 for passenger transport and around 1.5 for freight. Admittedly, however, the figure for freight reflects two effects, one being that of growth *per se* and the other that of changes in production patterns, with a decline in the value of goods per tonne (industry is producing more computers and less iron and steel), but an increase in shipments during the production cycle: suppliers are further and further away, and there is growing trade in intermediate goods. Estimates (see Bleijenberg, 2002 and Vickerman, 2002) tend to suggest that one-half of the apparent elasticity of 1 to 1.5 mentioned above can be put down to these changes in production patterns, which stem from falling transport costs, faster transport and higher real interest rates, encouraging the development of just-in-time logistics, and which can to some extent be shaped by transport policy. Charging can have some impact on this aspect of the growth in freight transport, by reducing the incentive to adopt just-in-time techniques and multiple shipments during the production process. Clearly, however, any gains in terms of sustainable development will be at the cost of reduced productive efficiency: care will be needed to achieve the right policy mix.

Spatial planning is also a key factor in the volume of transport. While national planning policy is concerned with issues that hinge very little on transport, the opposite is true at local, i.e. regional or urban area level. First, it is usually the same authorities, town councils or urban communities which are in charge of both transport and urban planning, and examples show that integrated planning achievements can promote sustainable development (Guller, 2002), if only to a limited extent. This kind of planning should also combat natural trends that run counter to sustainable development, such as the current tendency towards urban sprawl, which increases the volume of traffic and erodes the green belt.

To date, technical change has amply promoted transport development through the gains it has brought in terms of cost, speed and service quality, as shown by Bleijenberg (2002) and Vickerman (2002). It has also generated significant advances in sustainable development through pollution abatement, improved vehicle safety, reduced aircraft noise and, to a lesser extent, more fuel-efficient vehicles. Further progress can be expected from NICTs, with smart transport systems improving safety and enabling better transport planning by cutting congestion and pollution, although optimisation will be required in the way such systems are organised (e.g. competition, universal public service, controlled monopoly) and priced in order to provide the best services. ,Another area in which research and technological change are eagerly awaited is that of energy sources and climate change, where the introduction of economic instruments such as taxes or permits has been encountering numerous problems, to say the least.

Besides charging, policies with a direct impact necessarily involve service provision and infrastructure investment. One way of achieving sustainable development is through intermodal transport. Perhaps too much was expected of this solution, which has proved very hard to put into practice and, when it has been achieved, has in some cases proved disappointing in terms of modal split or environmental gain. All the more reason, perhaps, to pursue that goal, which will take great determination on the part of government, as co-operation goes against the grain among businesses which usually compete. Government policy will be required to regulate the relevant markets, develop information and foster co-operation.

As for infrastructure investment, this is the key to service quality and should therefore play a crucial role in achieving sustainable development. It governs service quality because of two vital factors which are ranked by market and statistical research as one of the key determinants in transport demand, the obvious one being speed and the other timetable reliability, achieved by cutting congestion and introducing modern, more efficient traffic management systems. But it also has an advantage over charging, in that it implies much greater commitment: it is easy to go back on a charging decision, but infrastructure cannot be cancelled once it has been built. When the goal is sustainable development, with the focus on the long-term effects such as attracting new businesses, new infrastructure will have a far greater impact than a pricing change, which might subsequently be reversed. Here, past experience has shown that both instruments -- charging and investment -- should be used in symbiosis: new public transport infrastructure has a significant impact on modal split only when accompanied by policies to reduce car use. It has to be said that the goals pursued by charging and by new infrastructure are often poorly co-ordinated, the main purpose of charging being to collect funds to finance infrastructure expenditure; furthermore, such decisions are often made by a host of decisionmakers whose aims are at variance.

Another form of co-ordination worth considering is geographical. One country's efforts to introduce charging may be wiped out, at least where international traffic is concerned, when another country's charges are too low and ruin the desired effect -- charging is one way of exporting externalities.

Overall, it can be seen that most of the determinants of transport demand are to be found outside the transport sector, examples being economic growth, spatial planning and technological change. They do display some common characteristics: the natural trend in these determinants usually runs counter to sustainable development; they are not really in the hands of government and develop independently for the most part; they have other goals to meet, which further limits the expectations placed in them with regard to sustainable development; and finally, their impact is overarching, and can even be said to have decisive implications for the future of transport, as a review of long-term trends has shown (see Bleijenberg, 2002). Nevertheless, these determinants should be brought into play wherever possible, so that they can act in synergy with charging policies.

As for determinants within the transport sector, which basically mean operations and infrastructure, they can be characterised as having a significant impact on sustainable development, being more readily mobilised to achieve that specific goal and subject to greater governmental control; the main problem lies in the host of public authorities running them, many of which have divergent aims and interests. A feature of the current situation is the lack of co-ordination with infrastructure policy.

6. CONCLUSION

Charging is the basic tool for shaping transport to the requirements of sustainable development. It is through charging that, in theory at least, traffic volume and structure can be most efficiently regulated, i.e. at the lowest cost, and optimised to reflect all the other goals to be met.

But efficient charging has its limits, which stem from practical implementation problems and demand elasticities.

To achieve some of the intended impacts, charging would incur prohibitive transaction costs and some aspect of the calculation are subject to uncertainty; hence the need, under specific conditions to be defined by economic analysis, for regulation or negotiable ownership rights, to eliminate the imperfections which might emerge with a charging system. It is worth noting, however, that these problems should be alleviated as technology advances, in particular NICTs, which will help to push down transaction costs and target prices more closely to achieve the desired impact.

The own-price elasticities of traffic are moderate and just under unity; the widely accepted idea that they are low should be reviewed; they are also higher in the long run than in the short run, higher at off-peak than at peak times and higher for private than for professional travel.

Cross-elasticities, on the other hand, are low and there is very little modal transfer: the idea that charging can affect modal split should be reviewed, as there are few repercussions to be expected in this area.

Gradually then, as we become more adept at targeting the impacts of charging, it will become increasingly efficient.

While charging is an obvious and powerful means of shaping transport activity, it is not the only determinant. Heading the list is economic growth which, in the long term, closely shapes the volume and structure of transport requirements. Clearly, there is very little scope for modifying this factor, although it may be possible to exert some influence over the process behind such growth by attempting to achieve a slight reduction in the passenger and freight transport it generates, for instance, by cutting down on just-in-time practices. Spatial planning is another potential area to be tackled, in particular urban planning. Technological change should be directed towards vehicle and traffic management research.

The determinants above lie outside the realm of transport; planners have fairly little control over them and they also serve to meet other objectives, so that there is little to be expected on that front. But then there are the transport sector's internal instruments, namely, operations and infrastructure; we have seen how these can promote the goals that charging seeks to achieve or, on the contrary, undermine them, and it has to be said that their main impact in the past has been the latter.

Policymakers, who face a host of different situations in the transport sector and have a variety of goals to meet, cannot hope to promote sustainable development with a single policy instrument. They need to introduce a range of policies, with charging as an important but not the sole feature, and which have, in any case, to be co-ordinated with other possible means of action.

NOTES

1. In this brief overview, controlling global warming is considered to mean introducing the tradeable permits provided for in the Kyoto Protocol for large energy users (major industries), plus a carbon tax for small users such as transport users and people in individual housing.

2. Provided that the market is close to being a competitive market, the necessary condition if it is to display the recognised advantages of a market economy.

3. If the quota-setting mechanism is correctly defined.

4. In addition, the effects will be hard to trace, as other impacts will have time to take effect: refined analysis will be required to eliminate them from *ex post* statistical work.

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Counterfactual Analysis of Urban Transport Development

If we knew 50 years ago what we know today about the price-relevant costs of urban traffic, could urban development have taken a different turn?

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SUMMARY

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1. PROBLEM AND PURPOSE

This paper will deal with marginal costs of road traffic relevant for pricing. A good starting point, however, is to consider the total costs of different, undesirable side-effects of personal and goods transport. In Table 1 below, the main items are listed in terms of percentages of the value of the total production of all OECD countries, as well as separately for Sweden.

Table 1. **Total costs of unwanted side-effects of road traffic, % of GNP**

Type of cost	**OECD**	**Sweden**
Congestion	2.0	0.4
Accidents	1.5	2.4
CO_2	(0.3)*	0.3
Other emissions	0.4	1.0
Noise	0.2	0.1
TOTAL	**4.4**	**4.2**

* Estimate
Source: European Commission (1995) and SIKA (2002, 2003).

Sweden is among the safest countries in the world so far as road traffic is concerned. The reason why total accident costs are relatively high in Sweden is mainly because of the high value placed on road traffic casualties.

The point of considering the relative total costs in this connection is to draw attention to a puzzling question: why do accident costs play only a minor role in the discussion of optimal road pricing? Compared to the amount of economic literature devoted to congestion tolls and application of the "polluter-pays principle", the literature on accident externality charges is rather thin. This paper aims at counteracting this imbalance. In addition, focusing on accident costs is very much in line with the purpose of a counterfactual analysis of urban transport development, assuming that today's knowledge of the working of the transport system, its costs and benefits, had been available fifty years ago.

2. ROAD PRICING THEORY

In order to calculate the price-relevant marginal cost of road services in general, and urban road services in particular, the following three-term expression should be the starting point:

$$P^* = MC_{prod} + Q\frac{\partial AC_{user}}{\partial Q} + MC_{ext} \qquad (1)$$

P^* =	optimal price of road services;
Q =	traffic volume;
MC_{prod} =	road service *producer* marginal cost;
AC_{user} =	road service *user* average cost (= private marginal cost as perceived by an individual motorist);
MC_{ext} =	transport *system-external* marginal cost.

Traditional road pricing theory, focused on the problem of too many cars for the available urban road capacity, has in recent years been supplemented by some arguably even more fundamental aspects of the urban problem. Taking the system externalities into account has consequences not only for optimal road capacity utilisation, but may lead to calling the prevailing urban transport technology itself into question: is it a basically sound idea that people settling down in towns and cities to be close to each other equip themselves with bulky, noisy and exhaust-fume-emitting cars to move about? In other words, the congestion costs which cars inflict on each other [corresponding to the middle term of (1) above], and which have been thoroughly analysed in positive and normative transport economics for forty years, is one big problem but not the only one, or perhaps not even the biggest problem[1]. This implies, first, that improved knowledge of the costs corresponding to the third term of (1) -- i.e. costs which car traffic imposes on travellers by other modes as well as on non-travellers -- is urgent and, secondly, that a deeper insight into the long-term costs and benefits of the land-use changes associated with the development of the "car society" is important.

The latter issue is not primarily a question of transport pricing policy but of town planning, or basically, in which kind of urban areas people collectively want to dwell. In the "New World", where towns and cities have grown up largely in parallel with car expansion, the consequences of the evolving transport technology requirements have been dealt with by dispersion of activities and by devoting sufficient space for car use everywhere for all purposes.

In the "Old World" countries this is not possible, unless old cities are pulled down and traditional urban life and culture given up. The famous Buchanan Report passionately argued that historic towns must be preserved, "*… it is not a question of retaining a few old buildings, but of conserving, in the face of the onslaught of motor traffic, a major part of the heritage of the English-speaking world of which this country is a guardian* (Buchanan *et al.,* 1963)."

Also in the USA, there are worries about the wider environmental consequences of the uniform standardization of urban transport. "Avoiding the collision of cities and cars" is the first half of the title of a deeply considered American urban policy study, which formulated a set of goals of universal appeal:

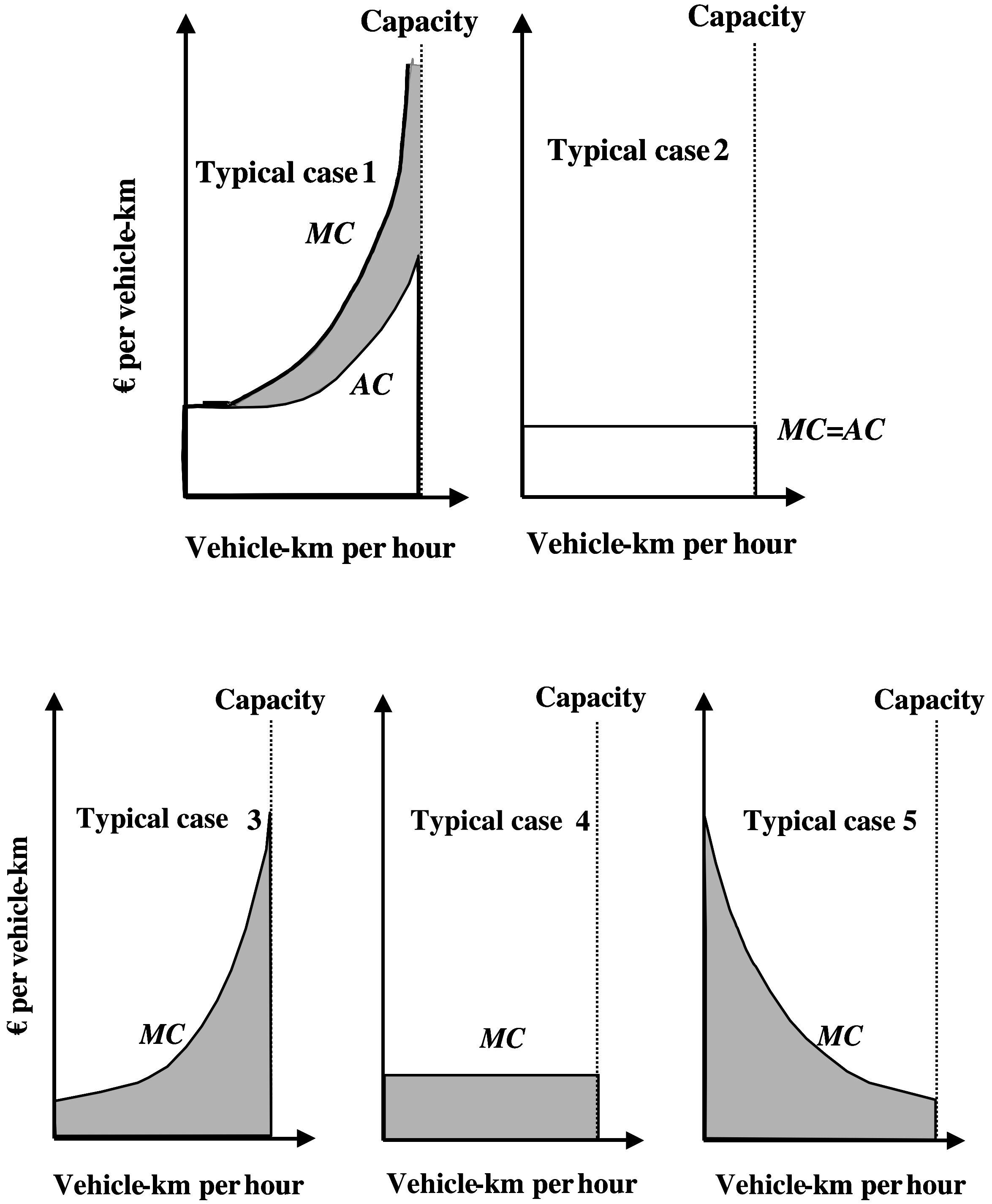
> *Urbanites should have basic access to people, goods and services, whether or not they drive cars. They should have transportation systems that enable them to move about in ways that are secure, commodious, efficient and hassle-free: to view clear skies and breathe clean air: and to choose from among a variety of mobility modes, including walking and bicycling in a safer, non-intimidating environment* (Elmer Johnson, 1993).

3. DECREASING THE SYSTEM-EXTERNAL MARGINAL COSTS OF URBAN ROAD TRANSPORT

Optimal road pricing requires that the relationship between a number of different price-relevant cost items and traffic volume can be determined, rather than just the total costs of each item, which traditional highway cost allocation studies are aiming at. When doing this more completely than is common in the road pricing literature, it is found that the *shape* of cost-output relationships is rather different, which has profound consequences for urban transport policy[2]

First, the system-internal and system-external costs can be distinguished. The basic theory and empirical problems posed by the transport system-external costs are rather different in part from what goes for the better-known theory of congestion costs, which is the main system-internal item. A key point here is that the short-run system-external cost and output relationship does not take the "standard" rising shape in all cases as the capacity limit is approached. In Figure 1 below, two typical cases for the shape of the system-internal average and marginal costs -- (1) and (2) -- are given in the top row, and three typical cases for the external marginal costs are depicted in the bottom row: (3) increasing cost, (4) constant cost and (5) decreasing cost. The marginal cost of traffic noise belongs to the decreasing-cost variety, whereas most components of exhaust emissions have an increasing relationship with traffic volume similar to that of fuel consumption itself. Different components of the price-relevant accident cost are represented in no less than four typical cases.

Figure 1. **Five typical cases for the relationship between the price-relevant marginal cost and traffic volume**
(system-internal costs in top row and system-external costs in bottom row)



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3.1. Noise and barrier effects

The price-relevant noise disturbance cost belongs to the decreasing-cost category (typical case 5). This is not self-explanatory, since there are two forces working in opposite directions. Looking at the total cost relationship, it can be observed that, on the one hand, the physical level of traffic noise (decibels) is increasing in a markedly degressive way with the traffic volume. On the other hand, when it comes to the disturbance *cost*, the willingness to pay to reduce noise is increasing progressively with the noise level. Which effect is the strongest? One authoritative source states that "*a halving of the traffic will reduce the noise level by 3 dBA, but a reduction of 8-10 dBA is required in order that the noise level will be perceived as halved* (SOU, 1989:43 p. 66)." See also Banfi *et al.* (2000), but further evidence on these two relationships is badly needed.

Concerning barrier effects, it is clear that in a street system without cars, pedestrians can cross the street everywhere. As soon as cars are allowed, pedestrian behaviour has to be disciplined: pedestrians have to cross streets only at marked crossings and when crossing signals are green. The complete feeling of security for the unprotected road user also disappears with the first car entering the streets. Insecurity grows with the number of cars using the streets, but the marginal additions to total insecurity will probably become smaller and smaller (typical case 5).

3.2. Accidents

The price-relevant marginal accident cost can be subdivided into various components which belong to different typical cases. It seems that accidents occurring where different transport systems are physically overlapping or crossing each other give rise to the highest externality charges: basically, it is known beforehand that if a train and a car collide, or a car hits a cyclist, the lighter vehicle takes most of the damage, whereas it is not known, *ex ante*, which of all the cars will be most seriously damaged in a multi-car accident. An additional relevant point in the present connection is that this kind of marginal accident cost seems to be falling, i.e. belongs to typical case 5, as distinct from the marginal accident cost, involving only motor vehicles of the same category, which belongs to typical cases 1 and 2.

Let the number of traffic accidents of the latter sort be denoted as **A**, car traffic volume as **Q** and the risk of injury for a car traveller as **r**. In a non-urban road network, r (= A/Q) seems by and large independent of the traffic volume. That is, the number of accidents, A, and the traffic volume, Q, are proportional, given the type of road. This means that the price-relevant road user cost -- the middle term of (1) above -- does not contain any accident cost in the case of car traffic outside built-up areas. In the absence of vulnerable road users in the main part of the non-urban road network, the price-relevant accident cost only consists of the external costs that are imposed on society at large, which can be assumed to be constant with respect to Q (typical case 4).

3.2.1. The accident function in mixed urban traffic

City streets and squares are not just a production system for car, bus and lorry transport. "Livable streets" (Appleyard 1981) are an essential part of urban life, where people meet and take walks, as well as transporting themselves by different modes of transport in pursuit of various occupations. The problem is that protected and unprotected road users do not mix very well. In the classic Buchman report (*Traffic in Towns*, 1963) it was envisaged that future generations may see our careless acceptance of unprotected people mixing with heavy vehicle traffic, and our obduracy for the inevitable result, in a similar way to how we see earlier generations' indifference to basic sanitary needs.

Has a change in attitude happened in the subsequent forty years since *Traffic in Towns* appeared? Traffic safety is now a high-priority goal in developed countries, but it does not mean that a generally accepted solution to the mixed traffic problem has emerged. Let us denote accidents in mixed urban traffic as X. Generally speaking, X-accidents involving both motor vehicles and unprotected road users are by far the most common type of fatality for the latter traffic category. In Sweden, more than 90 per cent of cyclists and pedestrians killed in traffic have been knocked down by motor vehicles. Fatalities involving unprotected road users occur to a large extent in urban areas -- about 90 per cent of cyclist and 70 per cent of pedestrian fatalities.

Is the solution for everyone to protect themselves, i.e. stop walking or biking in the streets? That may enhance traffic safety but it will also make streets much less “inhabitable”. Or should the far-reaching separation of protected and unprotected road users be aimed at? This can be done in widely different ways. One option may mean that pedestrians are fenced off, and cyclists scared off the streets. This would make the road system more efficient for car traffic and most likely improve road safety, but other less measurable qualities of the complex concept of urban amenity will be set aside. On the other hand, separation can also mean car-free streets and so-called pedestrianised areas in the central city and/or residential neighbourhoods. A third possibility is that motorists’ behaviour changes so that cars and vulnerable road-users can mix without danger for the latter.

What are the preferences for the majority of urban dwellers, workers and visitors? This is a difficult question which needs careful weighing up. It is close to asking whether the market mechanism could be a means of weighing up the pros and cons of different parties.

The crucial relationship in a mixed traffic system of protected and unprotected road users is the following:

$X = f(Q,M) =$ number of collisions (and similar accidents) between protected and unprotected road users.

What is the nature of this relationship? Assuming $f(Q,M)$ to be homogeneous to the degree of one is a convenient specification of the function, which is consistent with the general notion that “the number of accidents is proportional to the traffic volume”: if both Q and M are increasing by k%, X goes up by the same percentage. The empirical support for this assumption is not very strong, however. The big problem is the measurement of total exposure of unprotected road users. Travel surveys usually ignore a good deal of trips by foot or bike. The only relevant evidence, to the author’s knowledge, with a bearing on the nature of the function $f(Q,M)$ are the results of a large study of accidents at junctions in Swedish urban areas, where either pedestrians or cyclists are involved (Brüde and Larsson, 1993).

Data were collected from some thirty towns and cities with populations ranging from 25 000 to 1.5 million (Stockholm). Only junctions with more than one hundred cyclists or pedestrians crossing per day were included. Some four hundred different junctions were studied. The accident data consisted of accidents reported to the police from 1983 to 1988.

Applying a Cobb-Douglas function for the regression analysis, the results, separated into pedestrian and cycle accidents involving motor vehicles, were as follows:

Pedestrian accidents:

$$X_1 = k_1 Q^{0.50} M_1^{0.72} \quad (2a)$$

Cycle accidents:

$$X_2 = k_2 Q^{0.52} M_2^{0.65} \qquad (2b)$$

Accidents at junctions are an important type of accident where road use by protected and unprotected travellers conflicts. In Sweden it is estimated that 85 per cent of collisions between motor vehicles and pedestrians and 80 per cent of collisions between motor vehicles and cyclists occur at crossings and junctions.

From these functions it is seen that, given the volume of vulnerable road user traffic (M_1 or M_2), the number of accidents (X_1 or X_2) is increasing *degressively* with increases in the motor vehicle traffic volume Q. This is the root cause of a decreasing system-external marginal cost.

The mixed traffic accident function used for the following discussion is simplified to take this shape:

$$X = kQ^{\frac{1}{2}} M^{\frac{2}{3}} \qquad (2c)$$

where X = fatal accidents involving vulnerable road users,
Q = traffic volume of motor vehicles (cars and heavier vehicles),
M = traffic volume of vulnerable road users (motor cyclists, moped users, bicyclists and pedestrians).

Fatal accidents account for between one-fourth and one-third of total accident costs. For simplicity, we will deal mainly with fatal X-accidents in the following numerical illustrations but, based on previous work in the field, a rule-of-thumb can be used to take all kinds of accidents into account: by multiplying the resulting fatal accident cost by a factor of three, the fall in accident externality charge is obtained.

From the above accident function, the central concept of accident risk can be defined. Let the previously introduced designation **r** be reserved for fatal accident risk for car users, and let us now introduce the designation **R** for the fatal accident risk for vulnerable road users. We need two variations of **R**:

$$R = \frac{X}{M} = kQ^{\frac{1}{2}} M^{-\frac{1}{3}} = \text{risk for vulnerable road user of fatal traffic accident}$$

$$R' = \frac{X}{Q} = kQ^{-\frac{1}{2}} M^{\frac{2}{3}} = \text{risk for motorist of hitting and killing a vulnerable road user}$$

3.2.2. Accident costs

Besides the estimation of the accident functions, the monetising of the accident costs is a crucial part of the price-relevant cost calculation. Total *ex post* accident costs are literally incalculable. They consist of profound grief and suffering in the cases of death and disability, and various material losses in all cases. After a serious accident has occurred, only the latter costs can be assessed in monetary terms. Three components of the *ex ante* accident cost can be distinguished for each particular type of accident, for example, fatalities:

f(r) = willingness to pay for complete safety on the part of the household to which a certain person exposed to the risk of death belongs, as a function of the risk, r. The "value of a statistical life" (VSL) is commonly defined by the derivative of f(r). Assuming for simplicity that f(r) is linear in the relevant range of very low risk values, this relationship can be written = ar.

g(r) = ditto, on the part of relatives and friends of the person exposed to the risk of death; $g(r) \approx br$ for low values of r.

h(r) = ditto, on the part of the rest of society; h(r) = cr.

While the value of a fatality risk reduction for households including potential victims of traffic accidents gives rise to the major part of the total value of a statistical life, the components **b** and **c** representing the values of a statistical life to relatives and friends of victims of traffic accidents, and to the rest of society, respectively, are both quite appreciable. The former value is obviously less certain than the latter, corresponding to purely material costs, but from Jones-Lee (1992), Schwab Christie *et al.* (1995) and Lindberg (1999) it can be taken that the value of **b** is as substantial as some four-tenths of **a**. Using the current Swedish monetary values recommended for Cost/Benefit-Analysis in the transport sector (SIKA, 2002), so far as **a** and **c** are concerned, the following list of values of the three VSL components are obtained, expressed in euros (1 euro = 9.2 Sw Cr):

a = 1 800 000 €
b = 700 000 €
c = 135 000 €

4. ACCIDENT EXTERNALITY CHARGES

Assuming that accidents of a given severity, for example, fatalities which we are now discussing, are valued the same, irrespective of whether motorists, cyclists or pedestrians are the victims, the total expected accident costs (TC) in a mixed traffic system can be approximated in the following way:

$$TC = TC_A + TC_X = (a + b + c)(rQ + RM) \qquad (3)$$

From this function, the price-relevant accident costs or "accident externality charges" can be derived, given the A- and X-accident functions and the values of **a**, **b** and **c**. Informally, it can be put like this: if a new entry by car into a road traffic system will increase the accident risk for the existing road users, this would be the main justification for an entry fee (into an uncongested system). In the second place, a system-external cost will arise as long as the traffic is not completely safe, even if the risk for the existing traffic is unaffected by the new entry, because the new entry takes a risk, too. Formally, the marginal accident cost, for the motorists of the traffic system concerned, is calculated as the derivative of TC with respect to Q.

$$\frac{dTC}{dQ} = (a + b + c)\left(r + Q\frac{\partial r}{\partial Q} + M\frac{\partial R}{\partial Q} \right) \quad (4)$$

However, this expression does not equal the *price-relevant* marginal cost, which should be equal to the accident externality charge P_Q^*. The latter can be extracted from (4) by the following modifications: when it comes to the possible risk increase for existing traffic, only the middle and last terms of the big bracket of (4) are relevant. However, the first term representing the existing risk, r, for motorists is not completely inconsequential. It will appear in the product representing the system-external cost, which is the last term of the expression for P_Q^* in (5) below. In this term, the accident cost (a) falling on the household to which the victim belongs should not be included.

$$P_Q^* = (a + b + c)\left(Q\frac{\partial r}{\partial Q} + M\frac{\partial R}{\partial Q} \right) + (b + c)r \quad (5)$$

The difference between MC and P_Q^* comes to **ar**, as seen, which can be assumed to be internalised in the decisionmaking of the household concerning the travel of all its members. In most previous research on the value of life and accident costing, the **b**-component of VSL is simply ignored. Recognising its existence raises the question of how it should be treated in calculations of accident externality charges. In the external cost **(b+c)r**, which here is taken as representing the price-relevant system-external cost, this component represents the immaterial external cost, and **c** the material external cost. That only **cr** is a generally accepted item of such charges is a sign of the materialism characterising current transport policy; road users should be responsible for the material costs that their risk-taking incurs on the rest of society, but not for the immaterial, emotional costs falling on relatives (outside the household of the victim) and friends. As suggested by the above figures, the latter costs are likely to be of a different (higher) order of magnitude compared to the former.

For empirical calculations, it is practical to put the price-relevant cost expressions in "elasticity form", because this is in line with the available empirical evidence.

$$P_Q^* = (a+b+c)\ (rE_{rQ} + R'\ E_{RQ}) + (b+c)\ r \quad (6)$$

$$E_{rQ} = \frac{dr}{dQ}\frac{Q}{r} = \begin{cases} 0 \text{ in non-urban areas} \\ 0.2 \text{ in urban areas (see Lindberg, 2001)} \end{cases}$$

$$E_{RQ} = \frac{dR}{dQ}\frac{Q}{R} = \frac{1}{2}$$

Table 2. **Decomposition of the accident externality charges of road motor traffic**

Component	Typical case (See Figure 1)
$(a+b+c)Q\dfrac{dr}{dQ}=(a+b+c)rE_{rQ}$	(1) in urban areas, and (2) in non-urban areas
$(b+c)r$	(4)
$(a+b+c)M\dfrac{\partial R}{\partial Q}=(a+b+c)R'E_{RQ}$	(5)

Finally, mention can also be made of a sixth "typical case", which is not represented in Figure 1 above. For practical reasons, it seems far-fetched to charge the vulnerable road users for the costs they impose on others, including congestion and accident costs, but it is, of course, possible to calculate accident externality charges for pedestrians and cyclists in accordance with the same principle as was used for motor vehicles; and, as will be presently shown, the price-relevant marginal accident cost function for vulnerable road users will take a completely different shape as compared to the five typical cases identified so far.

It is assumed that vulnerable road users take all the damage of X-accidents. They will thus not injure the motorists. However, the entry into the road traffic system by another pedestrian or bicyclist will affect the accident risk, R, of their own traffic category. By taking the derivative of TC according to (4) above with respect to the vulnerable road user traffic volume, M, we get:

$$\frac{dTC}{dM}=(a+b+c)\left(M\frac{dR}{dM}+R\right) \qquad (7)$$

By the same reasoning as in the previous case, the price-relevant part of (6) can be distinguished:

$$P_M^*=(a+b+c)M\frac{dR}{dM}+(b+c)R=(a+b+c)RE_{RM}+(b+c)R \qquad (8)$$

The second term of (8) is the exact counterpart to the second part of (5) and (6), i.e. the system-external emotional and material cost of a fatality. The first term is special because the derivative, dR/dM is negative like the elasticity E_{RM}, which is equal to 1-2/3 = -1/3: the risk of existing vulnerable road users will be reduced by a new entry. It is likely that the first term of (8) is absolutely greater than the second term, which means that P_M^* is negative. Pedestrians and bicyclists should be paid to use the urban road transport system!

4.1. Empirical illustration of the present situation in urban traffic

Besides the accident costs a+b+c and the risk-elasticities, the absolute risk level per kilometre is required for calculating accident externality charges. The current fatality risks in Swedish urban road traffic are as follows:

$r = 7 \cdot 10^{-9}$
$R = 5 \cdot 10^{-8}$
$R' = 10^{-8}$

We can then express P_Q^* and P_M^* according to (6) and (8) above in euros per car-km and walk/bike-km, respectively:

$$P_Q^* = 2635 \cdot 10^3 \cdot (7 \cdot 10^{-9} \cdot 0.2 + 10^{-8} \cdot 0.5) + 835 \cdot 10^3 \cdot 7 \cdot 10^{-9} \approx 0.02 \text{ €/car-km}$$

$$P_M^* = 2635 \cdot 10^3 \cdot 5 \cdot 10^{-8} \cdot (-0.33) + 835 \cdot 10^3 \cdot 5 \cdot 10^{-8} \approx -0.001 \text{ €/car-km}$$

In order to take all kinds of accident into account, these figures should be raised by a factor of three. Then the order of magnitude of the complete P_Q^* can be illustrated by mentioning that a petrol tax component = 0.75 € per litre would, on average, be justified by reference to the accident costs in urban traffic in Sweden.

As was anticipated, a negative accident externality charge comes out for the vulnerable road users. It happens to be quite minute: it is so low that it is not worth bothering about in practice, which is a convenient conclusion, bearing in mind that the idea of paying pedestrians and cyclists for moving about in the urban road network would be difficult to popularise. The free offer of sidewalks and bicycle lanes to pedestrians and cyclists could be viewed as a subsidy in kind.

The most critical assumption for the calculation above is the inclusion of the emotional cost **b**. As mentioned, the common procedure is simply to ignore it. In that case P_M^* would increase in absolute terms, i.e. change from –0.001 € to –0.004 € per kilometre. The value of P_Q^* would also be affected quite appreciably by leaving the b-component out of consideration: P_Q^* would decrease from 0.020 € to 0.015 € per car-km.

5. COUNTERFACTUAL ANALYSIS OF URBAN DEVELOPMENT WITH OPTIMAL ROAD PRICING AND REGULATION

Now we shall go back fifty years in time, and try to define a starting-point for a counterfactual analysis of what could have happened, if optimal road pricing had been introduced from the start of what became the era of car expansion. Could urban transport and land-use development have taken a different turn?

The focus will be entirely on accident externality charges because, in an optimal road pricing scheme, this component will be at its highest from the very start of introducing cars onto the urban road network, quite the contrary to congestion tolls.

5.1. The transport revolutions and urban development

The industrial revolution in the 19th century included two inventions of great importance for *long-distance* transport -- the steam engine and the railway. During the second half of the 19th century, the replacement of sailing ships by steamships and horse-drawn vehicles by railway trains brought about a large advance in international and interregional trade. The new goods transport networks were large-scale systems for relatively long hauls of large shipments between seaports and between inland freight terminals. The remaining short hauls necessary for complete door-to-door transport were, at the turn of the previous century, still carried out by handcart and horse-drawn wagon. Therefore, the manufacturing industries and wholesale trade were concentrated around the large seaports and rail junctions in order to minimise feeder transport by horse-drawn wagon.

A large niche thus remained to be taken up, for almost a century: the motorisation of the relatively short, first and last links of the door-to-door goods transport chain. Not until the 1910s were these missing links forthcoming in the form of trucks and lorries. This revolutionised the logistics of goods transport by making door-to-door transport possible without change of mode. The location of production plants and trading premises became much more flexible. In the end, the urban environment was greatly improved as a result of, first, the disappearance of draught-animals from the streets of the city and, secondly, the relocation of factories and warehouses from their original situations close to port and railway terminals in the central city, to industrial parks on the outskirts. The relocation of the old ports to "outport" sites, where deeper water and plenty of back-up land for cargo handling exist, has also helped to relieve the central city of heavy traffic.

Personal transport technology development has, in turn, had a profound impact on urban development in the 20th century, when mass motoring made its indelible mark on urban life. This is, however, quite different from the goods transport revolution. The motorisation of individual personal transport had already started in the USA before the First World War, and in Europe not really until after the Second World War. Therefore, urbanisation took quite different shapes in the USA and in Europe. In the 1950s, the "automobile society" was well-established in North America, where a new development, "urban sprawl" was in full swing. Urbanisation in Europe in the first half of the 20th century, on the other hand, was linked to the gradual extension of commuter railway lines and the metro system. Like pearls on a string, new suburbs were developed along the new lines to give built-up areas the typical star shape.

By the middle of the last century, the large majority of western Europe's inhabitants lived in urban areas, with only some ten per cent of the population being employed for agricultural food production. This number has now fallen to three per cent. Most production and distribution of other goods and services does not require large land areas, but rather people living at close quarters as workers and customers. Ironically enough, when affordable cars for ordinary people at last appeared in Europe, the most natural market for it -- a relatively sparse, largely rural population -- was no longer in place.

In reality, however, urbanisation did not put a check on motoring. Urban dwellers were in fact even quicker than the rural population to adopt motorised, individual transport. As is exemplified by the development of Stockholm in Figure 3, the continued population growth in the second half of the last century has been concentrated on the outskirts of the metropolitan area, and has implied that the built-up area is filling up the empty spaces between the branches of the star.

Figure 2. **Stockholm county and the Swedish capital**

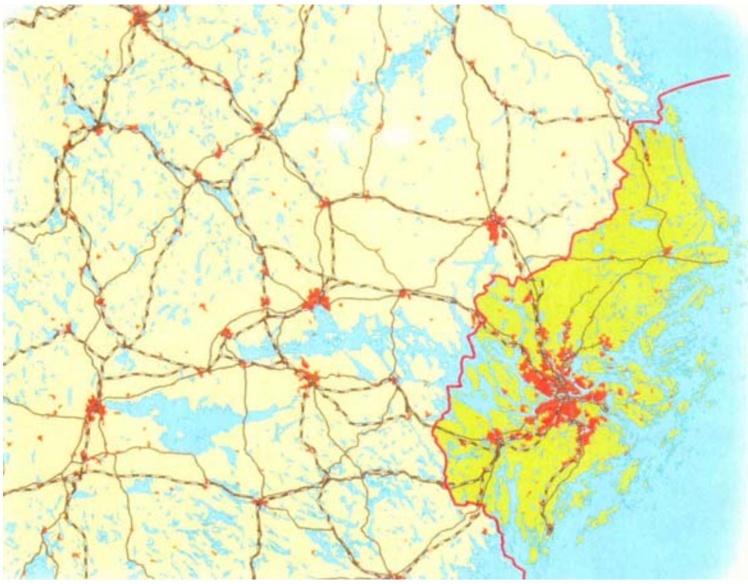
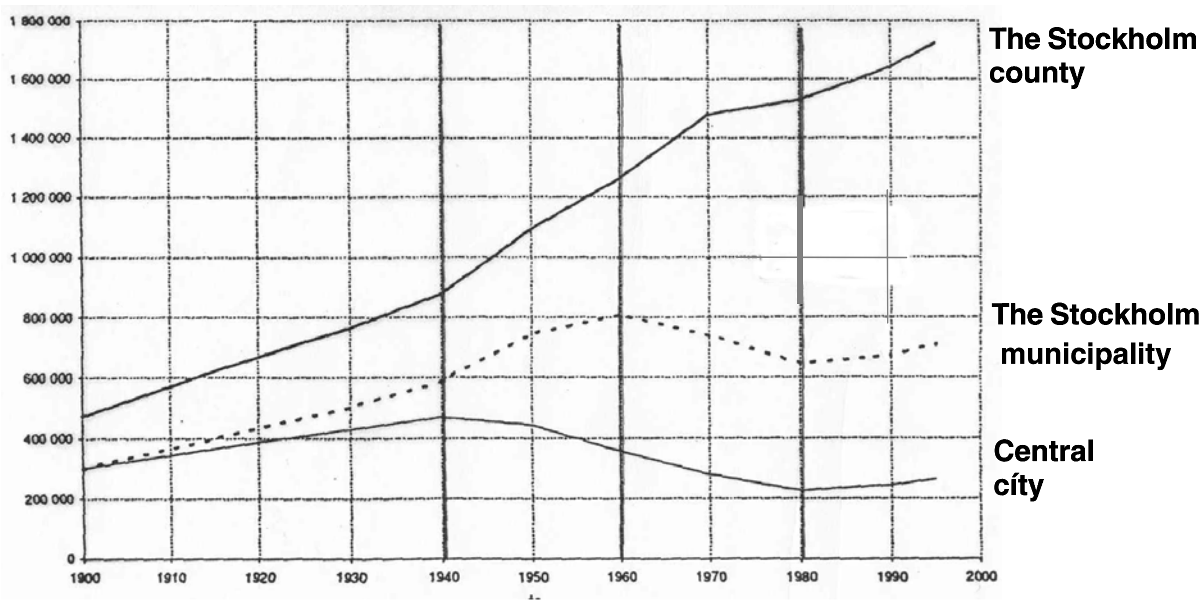
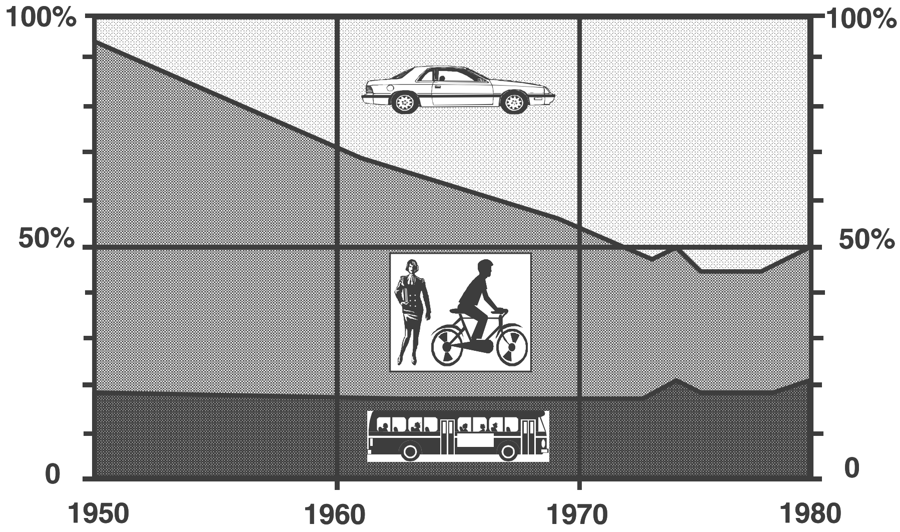


Figure 3. **Population growth in metropolitan Stockholm during the 20th century**



It was primarily individual transport by foot and bicycle that was replaced by car transport. The car share in the market for travel to work in urban areas in Sweden rose from 5 per cent to nearly 50 per cent in two decades, 1950-70.

Figure 4. **Urban modal split development for work trips in Sweden during the car expansion decades** (Transportrådet, 1985)



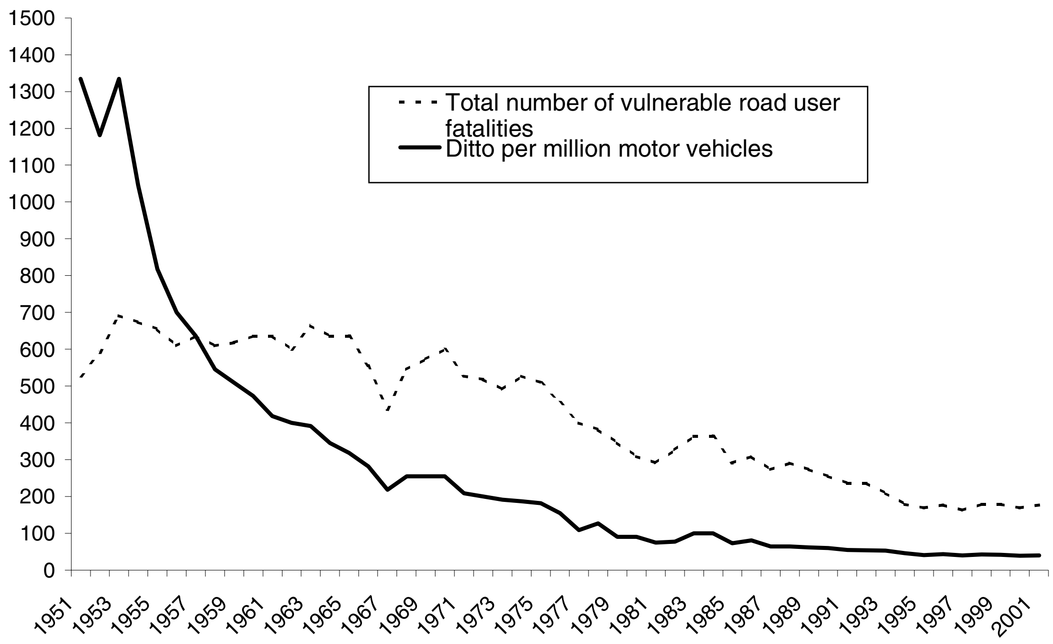
This picture of the modal split development has emerged in a growing urban area. Population density in the central city thinned out during 1940-80, and total urban population growth was accommodated by a large expansion of the built-up area. In the 1950s and 1960s, car ownership sky-rocketed. The total number of cars in Sweden increased from 0.25 million in 1950 to 2.29 million in 1970.

5.2. Traffic accident escalation

During the second half of the last century, about 50 000 persons were killed in road accidents in Sweden. A peak of 1 307 road users killed was reached in 1970. In the beginning and at the end of this period, the number of fatalities were about the same -- just below 600 per year, on average. The proportion of motorists and vulnerable ("unprotected") road users killed has changed dramatically in fifty years, from about 100:500 to 400:200. A significant feature is that most motorist fatalities occur in non-urban areas, while a large majority of vulnerable road-user fatalities occur in urban areas. Figure 5 shows the total number of vulnerable road users killed in Swedish traffic during the fifty years, 1951-2001, as well as this number divided by the total number of cars + lorries + buses. As seen, total fatalities had already reached a peak in 1953, then decreased by about ten fatalities per year up to 1994, and have since levelled off.

The number of motor vehicles on the roads has increased by a factor of ten. This means that, for the drivers of motor vehicles fifty years ago, the risk of killing a vulnerable road user, R', was no less than 30 times higher than today.

Figure 5. **Number of vulnerable road users killed in traffic, 1951-2001**



5.3. Accident externality charges in 1950

In the middle of the last century, when cars started to appear in the streets of towns and cities, the price-relevant cost structure was very different compared to the present situation. The accident costs were very dominant. In an assumed road pricing scheme, truly cost-based accident externality charges would have been a strong deterrent for motorised individual transport by private car. Applying formula (6) above to the urban traffic conditions in the middle of the last century, quite a dramatic result appears. As seen in the formula, there are three decisive factors for the level of the accident externality charges:

- the accident costs, a + b + c
- the risk elasticities, E_{rQ} and E_{RQ}
- the absolute risk levels, r and R'.

It can be assumed, on the one hand, that the accident costs (a, b and c) were a third of today's values in real terms, because real GNP per capita has increased threefold in the meantime. On the other hand, the level of charges is to be related to the purchasing power of an average income, which also was only a third of an average income today. Therefore, the present-day values of a + b + c are relevant for considering the effect on car travel demand of optimal road pricing.

The risk-elasticity values could very well have been the same as today. This leaves us with the risk values r = A/Q and R' = X/Q which would have made a great difference. As was just mentioned, it is the denominator, Q, which around 1950 was only a tenth of the present-day figure, which makes most of the difference. The numerator of the former ratio, A, was in fact slightly lower in the beginning than at the end of the period of time considered, while the numerator of the latter ratio, X, was nearly three times greater in the beginning.

Using the same parameter values in formula (6) as in the previous calculation of accident externality charges in present-day urban traffic conditions, except for the value of R', which is now raised by a factor of 30, the result is an accident externality charge of 0.33 € per car-km, on account of the risk for fatal accidents. Multiplying this figure by three to include all accidents, the final result is:

$\mathbf{P^*_{1950}}$ **=** 1 € per car-km

Some more cautious assumptions, which would work to lower this figure, could be, first, to assume $E_{rQ} = 0$, that is, to let the better-established view on the non-urban risk elasticity concerning car accidents also apply to the urban traffic conditions ruling in the beginning of the car expansion era. Secondly, the emotional cost component, b, could be disregarded in the second term of formula (6). These two modifications would lower P^*_{1950} to 0.85 € per car-km.

6. CONCLUSIONS

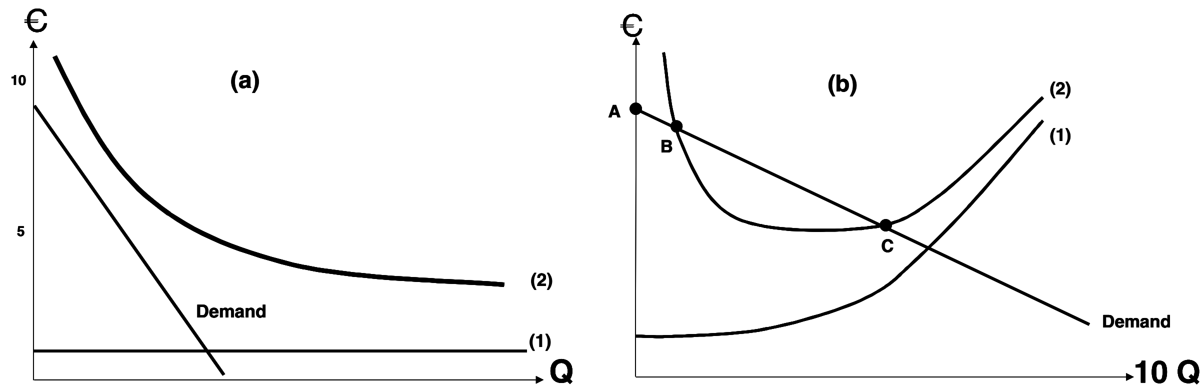
The range of figures above, 0.85–1€ per car-km, seems prohibitively high. A road-pricing scheme raising the average price of urban car traffic to that level would certainly have discouraged car use in urban areas. Only in non-urban areas would car traffic have started to grow, because there the conflicts with vulnerable road users are much less frequent.

However, when P^*_Q as a function of the traffic volume is steeply falling (or sharply rising), an average value of P^*_Q tells only half the story. The falling shape of P^*_Q is wholly due to the main component of the charge, i.e. (a + b +c) R' E_{RQ} and, in this product, just the factor R' = X/Q. According to the accident function taken as the starting-point in subsection 3.2.1, the number of accidents, X, is proportional to the square root of Q, given the volume of vulnerable road-user traffic. This means that R' is inversely proportional to the square root of Q. This relationship takes the shape of the falling cost curve (2) in Figure 6(a) below, which represents the price-relevant cost of motor traffic along a minor street or lane where plenty of walkers and cyclists move about.

The most likely position of the corresponding motor traffic demand curve would have been such that the two curves would not intersect at all. Demand would be zero in optimum. The logical consequence would be to prohibit all motor traffic in the street concerned. This could have meant that the urban motor traffic was concentrated on a limited number of "motor roads", and that the lion's share of the road network would be reserved for pedestrians and cyclists, and in some cases for tramways and bus lines (See Figure 7). The sparse motor roads with their limited total capacity would not suffice to hold anything more than some commercial traffic for goods and passengers (taxis).

The price-relevant marginal cost and demand curves of such a "motor road" are illustrated in Figure 6(b). Compared to the diagram of 6(a), the motor road demand curve is the result of adding up a number of latent demand curves for streets and lanes where motor traffic is prohibited. The price-relevant marginal cost curve in the diagram of 6(b) is initially falling, and rises again as the capacity limit is approached. This complicates the problem of finding the optimal price: the car traffic demand curve for the motor road can have two points of intersection with the marginal cost curve.

Figure 6. **Accident externality charges and other decreasing system-external costs on top of congestion tolls and polluter payments, (a) of minor street and (b) of urban "motor road"**

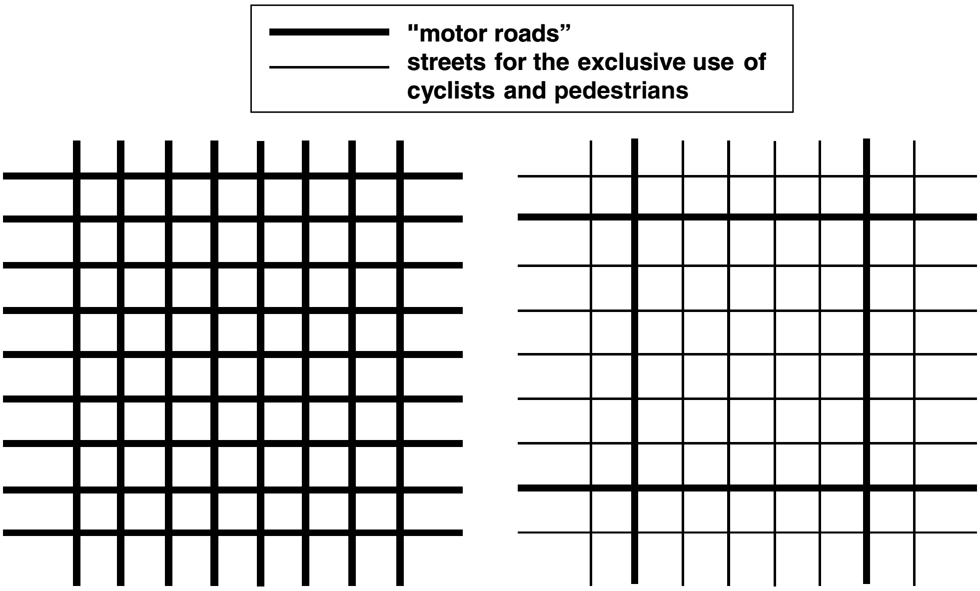


If car traffic demand is fairly elastic, the demand curve may well intersect the total marginal cost from below the first time (intersection point B), and a second time from above (intersection point C). Point B corresponds to a minimum of the net benefit and point C to a maximum. There a substantial congestion toll should apply, while the accident externality charge would be more modest. However, a third point of interest is the starting point A, where the net benefit is zero. Although point C corresponds to a maximum, it may still represent a negative net benefit, in which case the corner solution A is to be preferred. Complete freedom from motor vehicle traffic may also turn out to be the true optimum in such a case, and the resulting motor road network could be rather coarsely meshed.

It can again be noted that high prices for urban car traffic would not only apply where congestion builds up. On the contrary, the potentially highest "prices" would be charged on the links in the urban road network, where car traffic is relatively low and pedestrians and bicyclists are plentiful, because motor traffic would be prohibited there in most cases.

If, in addition, underpriced road space for parking was absent, and if local politicians and town planners refrained from forcing house-owners and landlords to provide parking space at their premises and instead left the land use to be determined by market forces, long-term parking in the central city would be prohibitively expensive for private car users.

Figure 7. **Schematic contrast pair as regards the size of urban "environmental areas"**



Source: Buchanan (1963).

It is also interesting to go back some decades in the debate on urban development and consider how town planners and transport economists at the beginning of the car era in Europe, under the impression of accelerating car traffic growth, started to question what they saw happening: were the urban transport systems evolving, and was the concomitant city development really in accordance with the preferences of the citizens? The Buchanan Report (*Traffic in Towns*, Ministry of Transport, 1963), and the Smeed Report (*Road Pricing: The Economic and Technical Possibilities*, Ministry of Transport, 1964) were two influential contributions to the discussion. In the latter, the economist's viewpoint was forcefully brought home: as long as substantial transport costs remain external to the primary decisionmaker -- the private car traveller -- the best use of available resources is not made: the solution is to make the individual car traveller aware of the congestion cost caused to fellow car travellers through road pricing. The former report naturally assumed an alternative perspective: a town planner's viewpoint is to maintain that the town-dweller's higher quality of life is the superior goal. The primary goal conflict is that the mobility afforded by private car travel greatly contributes to the quality of life, while much car traffic close to living, working and leisure-time areas degrades the quality of urban life. The basic trade-off in city planning is therefore between the size of "environmental areas", free of fast and dangerous motor-vehicle traffic, and the density and capacity of the motor road network.

Transport economists insisted that road space rationing should be performed by pricing. Had they at that time been aware of the nature of the accident cost structure, economists and planners could have worked hand in hand instead of talking at cross-purposes, and town and city development could have taken quite a different turn. At long last, we now see road pricing applied in the city core. The question remains, which traffic pricing and regulation policies are appropriate for the rest of the urban area?

To go further, it is necessary to combine the planner's and the economist's viewpoints. The dramatic consequences suggested by this counterfactual analysis would be unlikely to recur today if the logic of the accident externality charges theory were to be followed out. However, a number of interesting new possibilities for urban transport and environmental policy could emerge by regarding road pricing and traffic regulation, including traffic-calming measures, as complementary rather than alternative approaches.

NOTES

1. Compare the "Reflections on the Economics of Traffic Congestion", by Michael Thomson (1998); he was the Secretary of the Smeed Committee, which submitted their pioneering report on "Road Pricing: The Economic and Technical Possibilities" in 1964.

2. For a more detailed account, see Jansson and Lindberg, 1997.

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Sustainable Transport Pricing: From Theory Towards Application

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SUMMARY

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1. SETTING THE STAGE

Transport in Europe is confronted with increasing problems. Transport accounts elaborated within the EU research project UNITE[1], for example, show adverse impacts of transport on human health and the environment, but also increasing costs caused by infrastructure extension plans and remaining congestion problems[2]. There is a wide consensus in research, politics and in the public that the ongoing development is not sustainable in the long term and additional policy measures are needed.

What is the contribution of pricing to a sustainable transport policy? This paper aims to give an overview of recent applied research work in the field of transport pricing. Bearing in mind the considerable efforts of research and policy in the last years[3], this paper does not claim to give a complete overview. Its aim is rather to highlight some of the many relevant issues from a policy perspective: What should a theoretically well-based pricing policy look like? How can it be -- and how has it been -- implemented in the real world[4]? The focus will be mainly on the Alpine crossings, an example of a region with a high relevance of transport problems and pricing issues.

2. PRICING PRINCIPLES: THEORY AND APPLICATION

2.1. Pricing approaches[5]

Not surprisingly, the above-mentioned efforts in research and policy activities to increase the role of pricing in transport lead to different and partly contradictory results and conclusions. One reason for this can be seen in the different functions of prices:

- The price mechanism supports an efficient allocation of scarce goods (static efficiency). Congestion pricing is often mentioned as an efficient means to allocate scarce network capacity.
- Prices set dynamic incentives to change behavioural patterns, to develop new technologies, etc. (dynamic efficiency); they can, *inter alia*, reduce the adverse impacts of transport on the environment and human health.
- Pricing generates revenues that can be used for financing purposes.

The ongoing debate partly reflects the different weights that are given to these different price functions. Basically, two main approaches can be distinguished in the ongoing discussion:

– The predominant approach in the recent research work at the European level is based on neoclassical micro- and welfare economics and gives therefore special emphasis to efficiency aspects. The advocates of this approach suggest the introduction of a pricing strategy in transport (all modes) that is oriented at short-run social marginal costs.

– Opponents of this "mainstream approach" criticize the strong focus put on (static) efficiency considerations. They especially highlight the cost recovery requirements to be met by revenues from pricing. In the sense of departures from neoclassical welfare theory, the emphasis is put on "sustainable dynamic schemes of pricing and investment under institutional constraints"[6].

In the following two sections we give an overview of these two approaches with a focus on the dominating short-run social marginal cost pricing (SMCP) approach.

2.2. Social marginal cost pricing (SMCP)

The intention to transfer the basic microeconomic pricing principle of short-run marginal cost pricing (i.e. to introduce a pricing scheme where prices are set equal to the additional costs of an additional kilometre travelled or trip made) is not new but rather re-emerged in the mid-nineties in the political and academic discussion.[7]

The striking point of this approach is -- at least as long as implementation issues are neglected -- the theoretically well-founded proof that short-run SMCP leads to an efficient use of the existing capacity of transport infrastructure. If combined with sound cost-benefit analysis as decision tools for the infrastructure extension, welfare-maximising solutions result in the longer term as well. Also among the advocates of SMCP it is well recognised that these arguments are only valid under assumptions that are far from being met in the real world (e.g. perfect information, perfect markets in the non-transport sectors, etc.).

Against this background, the focus of the recent research work in transport pricing has not been so much on theory[8] but on ways to overcome the considerable difficulties connected with an implementation of SMCP in transport. Below we discuss some of these areas of research.

2.2.1. Calculation of price-relevant costs and resulting price signals

SMCP needs comprehensive marginal cost information. The "price-relevant costs" can be arranged in three groups, i.e. producer costs, user costs and transport system external costs. For each cost category, difficulties can be found in the cost calculation[9] but also in the resulting price signals. Some illustrative examples follow.

– Producer costs (or marginal infrastructure costs):

- Difficulties to estimate the additional wear and tear costs[10];
- Counter-intuitive price signals because the marginal reinvestment costs are higher for roads with a rather poor road strength. Thus, the price for road users would be higher if they travel on the secondary road network (lower quality of pavement) than on the main road network.

– User costs:

- Difficulties in the calculation of congestion costs;
- Seemingly illogical price signals: the worse the traffic situation, the more users have to pay; or: the better the quality (low congestion) the lower the price[11].

– Transport system external costs:

- Large differences in results prevail especially for bottom-up approaches (e.g. impact-pathway approach). They reflect the specific differences in the characteristics of the case study areas. This makes generalisation and transferability very difficult[12].

- Information about the impacts on cultural and historical values, forest damage, the recreational value of nature, fauna and biodiversity is still insufficient.

- In the case of traffic *noise*, above a very low level, marginal costs hardly increase with rising traffic volumes. Therefore, a pricing scheme based on SMCP would result in very low prices along/around noisy transport infrastructure with high traffic volumes. It is obvious that such a pricing scheme would not solve the noise problem for those concerned. At least, it would lead to a channelling of transport flows.

- A similar situation exists for accident costs, where other factors than traffic volume have a higher influence on the number of traffic accidents. Econometric analysis even shows that where the accident risk decreases with an increase in transport volume, the marginal external accident costs would be negative. It is hardly imaginable that any transport policymaker would propose the strict consequence, namely, to subsidise the marginal additional user of the relevant part of the road network. Rather, the insight has grown that other approaches are needed than a pricing scheme oriented at marginal external accident costs per kilometre travelled[13].

2.2.2. Level of differentiation of pricing schemes

The considerable variations of several marginal cost types according to location, time, vehicle category, etc., demand a strongly differentiated pricing strategy to "realise" the potential welfare gains of SMCP. The limits with regard to implementation are well known: implementation costs and acceptability problems.

2.2.3. The issue of cost recovery

In its pure interpretation, cost recovery is not explicitly treated but understood as a residual variable of SMCP. There are studies suggesting that SMCP generates enough revenues to cover the total costs of the transport sector as a whole -- other studies contradict this[14]. The reasons are surpluses in certain parts of the network[15] and the revenues from the inclusion of transport system external costs in the pricing scheme.

Even if cost recovery is assumed, the question remains: how relevant is cost recovery for the transport sector as a whole? It implies serious distributional effects because those who pay the charges do not necessarily profit from the use of the revenues generated by the charges. In the debate about the implementation of urban road pricing schemes, one insight is confirmed in almost every study:

for the acceptability of such schemes it is crucial that the revenues remain in the urban area; other solutions are hardly considered as fair. Thus, there are limits to using the revenues from urban congestion pricing "elsewhere" in the transport system.

If cost recovery is not assumed, funds collected outside the transport sector would be needed to cover the transport sector deficit. Issues like intersector distortions and the costs of public funds become relevant topics.

2.2.4. Organisational and institutional issues

The prevailing organisational and institutional structures in transport policy are, in most cases, not suitable for the implementation of SMCP[16]. Often, distributional conflicts occur between federal, regional and local authorities as well as difficult interfaces between the management bodies of public and private transport.

2.2.5. Conclusion on SMCP

Taking into account the difficulties summarised above, the analysis and derivation of second-best solutions has become the focus of research and is the challenge for the future. Second-best:

– because of the need to "average" cost figures for imperfect pricing instruments;
– because of cost recovery requirements;
– and in order to overcome organisational, institutional and acceptability barriers.

Most probably, this new focus will bring SMCP in transport closer to alternative pricing strategies as presented in the next section.

2.3. An alternative pricing approach

The re-emergence of SMCP in transport is not taken without contradiction, neither in the academic nor in the political world. Especially in Germany, alternatives have been developed. The report of the Scientific Advisory Council on Transport at the Federal Ministry of Transport, Construction and Housing outlines an alternative approach. One central difference refers to the treatment of cost recovery: cost recovery ratios should not be a residual variable of a pricing scheme. Pricing in transport should rather be designed in such a way that well-defined cost recovery goals are achieved, and this due to different reasons:

– Transport infrastructure is considered as a "club good": it should be fully paid by those who use it (club members). Taxpayers should only contribute if there is a special interest by the general public in the provision of the specific infrastructure or service (e.g. promotion of regional economic development).

– If the users have to pay the full costs -- minus public contributions in the case of a special public interest -- there is no incentive to overemphasize the need for new infrastructure. In the case of SMCP, such an incentive exists in situations where the extension leads to lower user prices (e.g. because of lower congestion and lower maintenance costs). The low user prices will not cover the total costs of the extension. The burden is transferred to taxpayers or to users of other, congested parts of the network.

– Pricing schemes oriented at cost recovery can make private sector involvement in the financing of new transport infrastructure easier[17].

– Inter- and intramodal competition in transport does not require that a certain pricing principle is defined for the different transport sectors and modes. Fair competition rather requires the same conditions for all transport providers (no discrimination) and harmonized cost recovery ratios for all transport infrastructure in all Member States.

– High prices in urban areas caused by congestion pricing under SMCP can have undesirable impacts on land use by accelerating urban sprawl.

At first sight, the differences between this pricing approach and short-run social marginal cost pricing seem large. However, if this approach is seen as a kind of second-best solution for an "SMCP world", the divergence is much smaller.

2.4. Implementation of pricing approaches

There is an enormous gap between theory and reality: short-run SMCP may be dominant in the present discussion in the academic world, but it is certainly not in the political world[18]. The pricing systems:

– rarely rely on SMCP which is viewed as too complicated;
– rely mainly on financial concerns and are based on long-run marginal costs or on average costs.

An example: Pricing the Alpine crossings

The Thematic Network, "ALP-NET", has brought together many thoughts and concerns of the last years with regard to trans-alpine transport. The workshop on pricing in September 2002 came to a number of conclusions[19]. Some of them illustrate that pricing policy is more and more seen as the result of a political process and less as a purely economic efficiency issue:

- *"Multiple objectives - multiple instruments*

In Alpine transport policy, there are multiple objectives and a variety of instruments. Objectives have to be set in a political process. Pricing and financing mechanisms are effective tools but they will not solve all problems. A comprehensive Alpine transport policy needs to include pricing and financing instruments, but should not be limited to those. Additional complementary measures will be necessary.

- *The role of social marginal cost pricing*

The pure SMCP concept cannot be realistically implemented. However, adhering to its core principles, it is recommended to develop more differentiated, mileage- or load-related and comprehensive pricing schemes across Europe. Economists alone cannot set right price levels for infrastructure use. The level of road and rail charges has rather to be set according to policy goals, distributional questions and financing needs.

- *Harmonization of pricing systems*

In order to avoid distortions, pricing systems in the Alps should be harmonized, following the principles of territoriality and non-discrimination. The cost calculation principles should be harmonized, still leaving a range for the overall price levels. No consensus was reached on the question of setting upper or lower limits to pricing."

Obviously, there is a low socio-political acceptability of SMCP[20]: against this background, it is not surprising that pricing solutions explicitly oriented at social marginal costs can hardly be found in transport. Rather, some examples exist where elements of both pricing approaches can be found, again suggesting that the differences between the two approaches are probably not as large when it comes to implementation under real world conditions[21]:

- In the case of rail transport, infrastructure access charging schemes explicitly oriented at social marginal costs -- however permitting non-discriminatory mark-ups to improve cost recovery -- are required by the railway directive of the European Commission[22]. In Switzerland, the relevant law demands that the infrastructure access charges should cover at least the marginal costs but can be amended by charging elements taking into account different total costs of the network, environmental and scarcity aspects.

- The well-known urban toll rings around the three Norwegian cities of Oslo, Bergen and Trondheim have primarily been introduced to generate revenues for transport infrastructure extensions and improvements in public transport. This purpose certainly does not correspond with the core idea of SMCP, but they also reduced traffic volume and therefore congestion which touches on congestion pricing, a major issue of SMCP.

- For Central London, the introduction of a congestion charging scheme is under discussion[23]. Whereas the idea of congestion pricing corresponds with a core concern of SMCP, the design of the scheme only very roughly transforms SMCP. From 7.00 a.m. to 6.30 p.m., a standard charge of £5 will be imposed for entering the very heart of central London. It is obvious that this standard rate cannot take into account speed-flow relationships on different roads during different time periods.

- The Swiss MRHVT (Mileage Related Heavy Vehicle Tax)[24] is distance-dependent which meets one of the basic requirements of SMCP. The fee rate distinguishes between more or less polluting trucks (EURO I, II and III) but there is no further differentiation (time, location). The rate of the fee was not derived from marginal but rather from average social cost estimates. Looking at the uncertainties in social cost estimation and the wide range of available estimates, the rate may even be a possible "average" value for social *marginal* costs.

These examples can be considered as first steps in the direction of a social marginal cost-based pricing in transport. Extensions and further differentiation in the long run are not out of the question, although the transaction costs connected with a next step should not be underestimated (new political effort, new technological equipment in-/outside the vehicles, new administrative procedures, etc.).

Advocates of SMCP have well realised that only a stepwise implementation path is appropriate to overcome the many and substantial constraints for a successful implementation of "their approach". The ongoing EU research project, MC ICAM[25], examines optimal implementation paths from a situation with low pricing of transportation to a socially optimal pricing situation. Implementation paths are understood as a sequence of second-best optima, which arise as the set of constraints on pricing changes over time (typically, the number of constraints and/or their "tightness" can be expected to decrease during the course of an implementation path). The following motivations for implementation paths reflect the types of constraints considered[26]:

- to gain public acceptance over time;
- to teach the public to understand increasingly complex pricing schedules;
- to reflect that capacity, too, cannot be optimised instantaneously;
- to help the regulator get used to pricing -- i.e. set up toll collection agencies, acquire experience in automated billing, etc. -- in a small-scale project or using a simple pricing schedule;
- to reflect that the degree of policy co-ordination between vertically or horizontally ordered governments will change (typically increase) over time;
- to reflect that practical and/or technical considerations may prevent simultaneous implementation across modes.

According to Verhoef, three archetypes of implementation paths can be identified and may serve as a guideline for evaluation within MC ICAM:

- Stepwise expansion over sub-markets (e.g. increase the number of priced links of a network over time);
- Stepwise convergence to optimal prices over all sub-markets simultaneously (e.g. all links of a network get prices, which move to optimal levels in a discrete number of steps);
- Stepwise (further) differentiation of second-best prices (e.g. increase in the degree of differentiation of prices within a mode over time).

If everything cannot be done at once, the question is where to start. Priorities are often set as follows[27]:

- Road transport: introduction of road pricing in congested areas, reform of the charging system for commercial vehicles and especially heavy goods vehicles (including taking into account the external costs).
- Rail transport: adjustment of infrastructure access charges in a non-discriminatory way, prices at or -- to comply with cost recovery constraints -- above social marginal costs only together with the pricing reform in road transport.

Looking at the development in policy, there is a concern among economists that adjustments (mostly liberalisation) in rail transport are realised whereas the inclusion of external costs in the pricing schemes is foreseen only in a next phase. In particular, it is feared that the market conditions of competition between road and rail transport would worsen for the latter.

3. IMPACTS OF SMCP: RESULTS FROM SELECTED STUDIES

3.1. Effects on prices and transport volumes

In the tables below we have summarised some of the recently published results for marginal costs, illustrating the wide range of values given in the literature.

Table 1 makes clear how difficult it is to answer the very relevant question for policymakers: How would the prices change? Obviously, the answer depends on two points:

- the reference case, i.e. the existing pricing and subsidisation schemes in transport;
- the choice of the concrete values for the cost estimates.

Looking at the range of values, it is clear that, from a scientific point of view, it is very difficult to make a robust suggestion for the latter. The choice is, to some degree, arbitrary -- and this will not change even if large research efforts may somewhat reduce the range of uncertainty. This should be kept in mind when studies are evaluated which calculate in detail the impacts of new pricing strategies in transport. The "price set" assumed strongly influences the results. Nevertheless, we present some results of such exercises below.

Table 1. **Selected marginal cost estimates, in € / 1 000 p-km**

Road passenger transport: Marginal noise costs		
Specification	**Value**	**Source**
European urban average	21.3	Infras and IWW (2000)
European urban average	7.5	ECMT (1998)
European inter-urban average	0.17	Infras and IWW (2000)
European rural average	2.9	ECMT (1998)
Stuttgart, daytime and night-time	10.4 - 31.3	UNITE, case study, in Nash and Johnson (2002)[28]
Berlin, daytime and night-time	3.3 - 10.1	UNITE, case study, in Nash and Johnson (2002)[29]

Within the research project, PETS[30], a number of case studies have been carried out to assess the price changes and the changes in transport volumes connected with an implementation of SMCP. The issue of uncertainty has been taken into account by defining low and high social marginal cost estimates.

Whereas interurban passenger transport seems to be generally overpriced -- if started from the social marginal cost rates as assumed by PETS -- this is not the case for freight transport[31]. In one of the PETS freight case studies, "Transalpine Freight"[32], the price changes resulting from an introduction of SMCP for the two modes of road and rail freight transport differ between the transalpine corridors in Italy, France, Switzerland and Austria.

Table 2 shows the results for the most important crossings.

Table 2. **Changes in prices for freight transport, unconstrained marginal cost pricing scenario, in €/passage and in relative terms compared to the base case (i.e. business as usual, BAU) (1995 prices, 2010 values)**

Corridor	Cost estimate	€ / passage	Price change compared to BAU
Ventimiglia	low	27.6	-44%
	high	90.0	+82%
Mont Blanc	low	39.6	-76%
	high	128.9	-23%
Gotthard	low	37.2	-76%
	high	121.2	-21%
Gr. St. Bernard	low	26.3	-86%
	high	85.5	-55%
Brenner	low	36.5	-75%
	high	118.7	-19%
Schoberpass	low	28.4	-36%
	high	92.5	107%

- The values reflect the somewhat arbitrary choice of the "right price" for infrastructure usage mentioned above: both the low and the high values can be supported with available social cost estimates.

- The large differences in the price changes between the corridors reflect the different pricing schemes in force at present: whereas in some of the corridors considerable charges are levied (e.g. Gotthard and Brenner) this is not the case for others (e.g. Ventimiglia).

What are the impacts on transport and traffic volumes? These effects are summarised as modal split changes in Figure 1 below.

The changes do not only depend on the price changes of but also on two further points:

- A part of transalpine freight transport is long-distance transport. Thus, the impacts on transport volume also depend on the pricing strategy outside the transalpine crossings. The case study assumes that in the "rest of Europe" social marginal cost pricing is introduced too. The result is that infrastructure user charges should be lowered if the low marginal cost estimates are assumed (-36.8 per cent) and increased (doubled!) if the high values are used.

- Social marginal cost pricing also affects the rail freight transport prices. Only in the case of the low cost estimate would infrastructure user charges decrease compared to the base case.

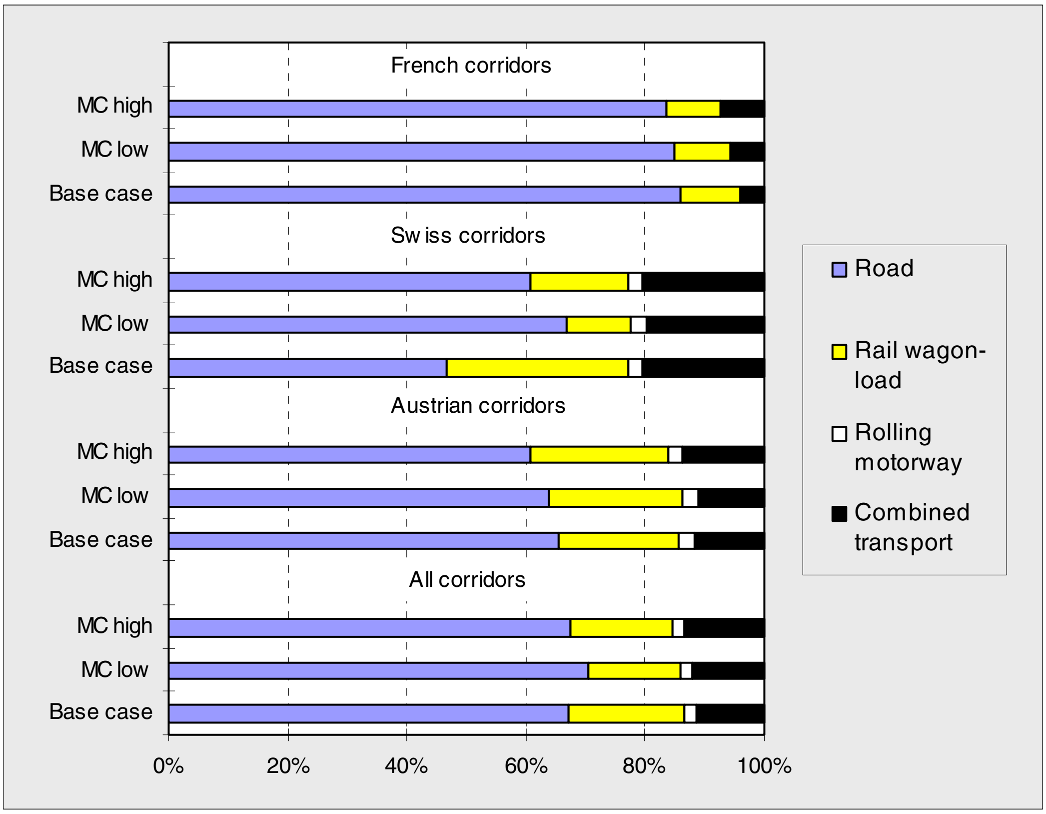
The main findings of the analysis of a change to SMCP in transalpine freight transport in the PETS case study can be summarised as follows:

– The current pricing schemes in transalpine freight transport do not reflect short-run marginal social costs, neither in road nor in rail transport. In the case of road freight, the need for action is a priority at the European level (i.e. outside the Alpine area) and for the transalpine corridors with low existing charges and tolls.

– The marginal cost pricing scenario does not lead to a substantial increase in rail transport. The cost estimates derived from the literature and additional calculations within PETS are not high enough to change the prices in a way that induces road transport to switch extensively to rail transport.

– Switzerland cannot hold its high share of rail transport if SMCP is introduced. In the case of the low cost estimates, the road transport volume on the Swiss corridors almost doubles, whereas it decreases on the French and Austrian corridors. First of all, traffic from the Brenner and the Mont Blanc divert back to the Gotthard if Switzerland gives up its rail-friendly transport pricing policy.

Figure 1. **Change in modal split, unconstrained social marginal cost pricing**



The results calculated suggest that pricing based on economic efficiency objectives alone will not save rail, if it starts from the price-relevant cost rates assessed in PETS. Substantially higher productivity gains than assumed in the case study are needed if rail wants to increase its market share under a social marginal cost pricing scheme.

- This finding is confirmed by the EU research project, STEMM[33], where the potential impacts of different policy instruments on modal split have been estimated for transalpine freight transport[34]. A successful liberalization of the rail freight market and more appropriate pricing schemes in road freight transport proved to be the most effective instruments to make freight switch from road to rail.

  Such improvements are especially needed if, as suggested by representatives of the alternative pricing approach, rail should bear its total infrastructure costs in the long term. Calculations within PETS suggest that rail freight transport would largely cease to exist if it had to achieve total cost recovery.

- Further scenarios calculated within the PETS case study show that, with additional pricing measures in favour of rail, a change in the modal split in favour of rail can be achieved. There might be reasons for such additional measures:

  - In the case of plausible capacity constraints in the road network, it might be cheaper to increase the rail share of total transalpine freight transport than to extend the road infrastructure[35].

  - The external cost estimates underestimate the real external costs of transport, because a range of Alpine-specific cost factors (e.g. impact on bio-diversity, impact on the shelter function of Alpine forests) had to be neglected in the assessment, due to the limited knowledge and data availability.

  - SMCP scenarios may entail, compared to the current situation, significantly higher road transport volumes in the case of marginal cost pricing than the public are prepared to tolerate, given the sensitive Alpine environment and sustainability considerations. Or, to paraphrase: if the Alps, as a sensitive area, should be preserved as an intact living space and habitat, a pricing scheme should be oriented more at certain politically defined sustainability objectives rather than on SMCP, where Alpine-specific issues are not treated adequately.

3.2. The welfare impacts of changes in transport pricing

According to theory, efficiency or welfare gains are the central arguments in favour of a change to social marginal cost pricing in transport. The open question is how large these welfare gains might be. Within the UNITE project, comprehensive General Equilibrium Analysis has been carried out with Computable General Equilibrium models (CGE models) to assess the welfare, distributional and economic impacts of different pricing scenarios for Belgium and Switzerland[36].

In an Alpine context, the results for Switzerland are of particular interest. In the case study, the effects of the various pricing scenarios with elements of both pricing approaches of Chapter 2 are analysed.

The results suggest the following evidence:

- The simulations for Switzerland predict a limited increase of total welfare for SMCP in transport (+0.17 per cent and +0.18 per cent for the two "pure" SMCP scenarios). These limited welfare gains should be kept in mind when an implementation of SMCP is considered: the analysis assumed "perfect instruments" (i.e. no transaction costs) whereas we mentioned before that sophisticated instruments and differentiated price signals will result in high transaction costs.

- The more flexibly the budget constraint is implemented, the higher the welfare level. Thus, cross-subsidization between modes can increase the efficiency of a pricing strategy containing revenue requirements.

- A scenario was simulated where marginal social cost pricing -- and thus an internalisation of external costs -- is implemented first or even solely in road transport and where the situation for rail transport remains unchanged. This "road-first" scenario slightly increases welfare.

- There are significant welfare implications in the treatment of foreign traffic and its contribution to revenues.

- For road transport, SMCP results in an increase in traffic volume, for rail a decrease! These impacts are not in line with the official goals of the Swiss transport policy, confirmed in several public votes: neither a reduction of the adverse environmental impacts of transport would result, nor an increase of the share of rail transport on modal split.

- The impacts on the Swiss economy -- measured as changes in GDP induced by the pricing schemes -- are more or less neutral or negative. Thus, we do not find economic arguments advocating a change of the existing charging and taxation scheme in the direction of any of the transport pricing scenarios described in this modelling case study. Only in a small number of sectors does the impact on the gross production value (or "turnover") exceed +/-1 per cent.

Again, we stress that these conclusions are valid for the analysis carried out in this case study for Switzerland. They strongly depend on the assumptions made in the modelling work and especially on the cost bases chosen to define the transport prices. Simple generalisation is not possible, as a comparison with the results of a similar analysis for Belgium shows[37]. The higher congestion level in Belgium compared to Switzerland and other marginal cost estimates as a pricing basis result in higher welfare gains for SMCP[38].

Our main conclusion from the CGE modelling exercises refers not that much to efficiency implications (which is strongly influenced by the assumptions for the social marginal cost rates and the reference situation in a country); in our view, the studies first of all disclose politically highly relevant distributional effects of changes in the existing pricing schemes.

3.3. The case of the Swiss Mileage-related Heavy Vehicle Tax

The new MRHVT (Mileage-related Heavy Vehicle Tax) in Switzerland came into force on 1st January 2001 and replaced the existing flat rate. However, at the same time, the weight limit of 28 tonnes was partially abandoned, which increased logistical efficiency and the attractivity of the Swiss transit routes and thereby compensated to some degree the higher costs of the MRHVT. The following effects have been observed so far[39]:

- *Traffic on Swiss territory*: While traffic increased between 1997 and 2000, with average growth rates of about 5 to 6 per cent, the corresponding period in 2001 saw a clear 4 per cent decrease in traffic. In the first year after its introduction, the MRHVT has therefore not only counteracted the trend towards growth in road haulage traffic, it has even produced a slight decrease in kilometre performance across the whole of Switzerland.

– *Traffic on the Alpine crossings*: After a steady increase in the years before, the transit of lorries was reduced by 3 per cent in 2001[40].

– *Use of Rolling Highway*: Since the introduction of the MRHVT, a slight increase has been recognised, but it is quite difficult to detect the extent to which the increased number of transported vehicles is due to the MRHVT.

– *Fleet composition*: The transport industry has adapted the fleet composition to the MRHVT tariff: high-emission trucks have been replaced by new low-emission vehicles. Also, the vehicle sizes have been adapted to the goods that are regularly transported (e.g. a carrier buys special, low-weight trucks if he runs a business transporting paper towels). This process was noticeable well before the start date of the MRHVT. In Switzerland in 2000, truck sales were booming.

To conclude, this example shows that modern pricing systems can be effective with regard to dynamic as well as to static efficiency; however, the effect for the Alpine crossings is limited so far since the weight limits were abandoned. Furthermore, the tax level is not yet at its final position and the lower tax levels in the surrounding countries as well as the poor railway performance are limitations for the modal-split effect.

4. CONCLUSIONS

The recent discussion about pricing in transport has been dominated by a re-emergence of the microeconomic pricing principle of short-run social marginal cost pricing (SMCP). As long as the discussion concentrated on theory, the simplicity of the approach was a strong argument. However, the "splendour of simplicity" is more and more replaced by complexity and criticisms, as implementation issues become the focus of attention:

– The strong focus on short-run efficiency and welfare gains set by economists is just one viewpoint in transport policy and not the most important one among politicians. So far, fairness or equity considerations (who covers deficits, who gets surpluses?) and financial constraints (cost recovery, the need for private sector involvement) have played a more important role.

– Though a large number of studies have come up with the proof that the basis for SMCP, i.e. social marginal costs, can be estimated, the available set of cost estimates is neither complete (all modes, all relevant cost types) nor robust enough (large uncertainties) to claim that the welfare optimising prices are known. The prices will be the result of a political decision process, and this process will primarily be governed by genuine and controversial interests and only very partly by evidence from research. Therefore, even a further narrowing of the range of plausible cost estimates will not lead to political consensus on price levels.

– Finally, public concerns about the environmental impacts of transport will only decrease if a policy proves to be effective and not solely efficient. In the case of transalpine freight transport, for example, the inhabitants would hardly accept a solution where the modal split changes in favour of road transport -- even if they were told that this solution is efficient.

Against this background, there are few advocates of SMCP who do not conclude that "pure marginal social cost pricing has to be modified to take all these issues into account[41]." Modification means that second-best issues become the centre of research interest.

Our conclusion is that it is time to merge both pricing approaches because a political path favouring exclusively one approach is unlikely. A number of recommendations, common to "promoters" and "opponents" of SMCP, can be suggested:

– **More differentiation, appropriate incentives**: Both approaches accept that transaction costs will limit the possibilities for differentiation. The assessment of external costs, as carried out in the context of the SMCP discussion, provides important inputs to determine which differentiations should have priority. A number of studies and real-world experiences have shown that pricing is a powerful means to induce changes in traffic behaviour.

– **Territoriality principle**: Both approaches are in favour of less charges and taxes based on the country-of-origin principle and more infrastructure usage-related charges.

– **Inclusion of external costs in the charging and taxation scheme**: Both approaches concur, even if advocates of SMCP propose to include these costs in infrastructure charging schemes, whereas representatives of the alternative approach suggest a strict separation of infrastructure user charges and taxes for the internalisation of external effects.

– **Cost recovery issues**: Advocates of SMCP have recognised the high importance of financial constraints: second-best approaches should address exactly this issue (multi-part tariffs, Ramsey pricing).

  Important points to be addressed in further research should be:

  - For which units (sub sectors, parts of a network) should cost recovery ratios be defined in a second-best world?

  - Should cost recovery requirements be defined -- as proposed by representatives of the alternative pricing approach -- mode-specifically or is an integrated (intermodal) view more appropriate under certain circumstances (e.g. in the sense of a "least-cost-planning approach" for a defined transport corridor)? The issue of cross-financing would then again become relevant.

– **Optimal use of the existing infrastructure**: This key concern of SMCP especially for urban areas (congestion pricing) is recognised by representatives of the alternative pricing approach. Peak-load pricing is seen as one possibility. Land-use planning instruments and improvements in alternative transport modes help to prevent undesirable effects on land use caused by urban road pricing schemes. For urban areas, where infrastructure extensions are often strongly limited, SMCP may remain the dominant approach. In an interurban context, where infrastructure improvements and extensions are a major issue, this will most probably not be the case.

– **Treatment of sensitive areas:** The appropriateness of the SMCP approach is limited because the impact-pathway approach used to derive marginal cost estimates cannot be applied, due to knowledge and data gaps (e.g. impacts on bio-diversity, monetarisation of these impacts). As long as this is the case -- a change is not within sight -- pricing should be used as a means to achieve politically-defined sustainability goals. One cannot imagine that advocates of SMCP would propose to simply neglect impacts of transport that are a major public concern but which cannot be expressed in monetary terms.

– **Need for packaging:** The alternative pricing approach emphasizes this need because different goals cannot be achieved with one instrument (effectiveness): the SMCP approach sees a case for packaging of second-best instruments in order to "replicate the full set of incentives given by hypothetical first-best pricing as closely as possible[42]." A pragmatic interpretation of this theoretical statement may bring the two approaches quite closely together.

And finally, we would like to quote the last of the ALP-NET recommendations[43]:

Science in general and economics in particular cannot provide sound answers to all questions of policymakers. Many decisions have to be taken politically rather than based on pure economic theory. On the other hand, this does not mean that economics has nothing to contribute to real-world pricing systems. In any case, today's knowledge is good enough to start acting immediately!

NOTES

1. UNITE, Unification of accounts and marginal costs for transport efficiency, http://www.its.leeds.ac.uk/research/index.html

2. For Germany and Switzerland, see Link *et al*. (2002).

3. See, e.g., ECMT (1998), or, for a recent scientific input, e.g. the Special Issue on Road Pricing in *Transport Policy*, 2002 (9/3).

   At the level of the European Commission, this increasing relevance of economic instruments can be traced back in three major publications on transport policy, i.e. the 1995 Green Paper, "Towards Fair and Efficient Pricing in Europe", the 1998 White Paper, "Fair Payment for Infrastructure Use", the White Paper "European transport policy for 2010: Time to decide" of 2001.

   In view of this need for policy action, a huge number of research projects have been launched within the European Framework RTD Programmes to provide scientific inputs for concrete policy formulations -- QUITS, ExterneE, PETS, EUROTOLL, TRENEN, CAPRI, OPTIMA, FISCUS, PATS, AFFORD, PRIMA, DESIRE, UNITE, MC-ICAM and IMPRINT-EUROPE being only some of them. For short summaries of these projects see, for example, the Inception Report of ALP NET (Ecoplan with contributions from partners and members, 2001). Furthermore, the EC

High-Level Group on Transport Infrastructure Charging has evaluated results from the several research projects and tried to formulate commonly-agreed priorities for future policy strategies.

4. For a more extensive overview, see Suter (2002), which partly served as a basis for this paper.

5. This chapter was greatly inspired by the work carried out within the 5th Framework Thematic Network project, IMPRINT-EUROPE, and especially the overview contained in Nash and Matthews (2001). IMPRINT-EUROPE, Implementing Pricing Reform in Transport -- Effective Use of Research on Pricing in Europe, http://www.imprint-eu.org

6. Rothengatter (2001), p. 3.

7. However, in the two White Papers following the Green Paper, the statements made about pricing in transport leave much more room for interpretation as to whether the Commission still considers short-run social marginal cost pricing as the only pricing approach to be implemented in all the different sub-sectors of the transport sector.

8. The application of the theory of social marginal cost pricing in transport has, for example, been analysed in detail within the EU research project, PETS [Pricing European Transport System, see Jansson and Lindberg (1997)] and the different publications of CAPRI (Concerted Action on Transport Pricing Research Integration).

9. For an overview of the state of the art see, for example, van den Bossche *et al.* (2000) or Lindberg (2002).

10. See, for example, the results for different European countries given in DIW *et al.* (1998).

11. See Nash and Matthews (2001), p. 6.

12. The problem of generalisation and transferability of marginal cost estimates is treated in detail in Deliverable 15 of UNITE, "Guidance on Adapting Marginal Cost Estimates" (forthcoming). First results have been presented at the UNITE Final Conference in Leuven, 18-19 June 2002.

13. The EC High Level Group on Transport Infrastructure Charging supports, for example, the principle that "charging transport users for the costs of the accidents they cause should, as far as possible, be implemented through extension and refinement of the existing insurance system (Goodwin, 2001, p. 27)."

14. Roy (2000) suggests overall surpluses for France, Germany and the United Kingdom; Maibach *et al.* (1999) and Wickart *et al.* (2002) find overall deficits for Switzerland. Different marginal cost estimates used as a pricing basis and different road congestion situations are two important reasons for the different results. Nevertheless, because marginal cost estimates still differ so much, cost recovery ratios are strongly influenced by the choice of specific values by the study authors.

15. Typically, urban areas are mentioned where congestion pricing in road transport generates higher revenues than needed to cover total infrastructure costs.

16. See Vickerman (2000) and AFFORD, Acceptability of Fiscal and Financial Measures and Organisational Requirements for Demand Management, http://data.vatt.fi/afford/

17. For a recent general overview, see Debande (2002).

18. According to an overview carried out within UNITE, see Quinet (2001).

19. Ecoplan (2002), Trans-Alpine Crossing -- Pricing & Financing. The conclusions are, of course, not binding for the European Commission or any of the other participating organisations.

20. See Herry (2002), Barriers to interurban transport pricing and AFFORD/Milne *et al*., 2001.

21. For a recent overview, see also Perkins, S. (2002).

22. Directive 2001/14/EC of the European Parliament and of the Council of 26 February 2001 on the allocation of railway infrastructure capacity and the levying of charges for the use of railway infrastructure and safety certification.

23. For an overview of the scheme see, for example, Dix (2002).

24. A detailed discussion of to what extent the MRHVT complies with SMCP is given in Suter and Walter (2001). For a detailed description of the MRHVT, see Federal Office for Spatial Development (2002).

25. MC ICAM. Marginal Cost Pricing in Transport -- Integrated Conceptual and Applied Model Analysis, http://data.vatt.fi/mcicam/index.html

26. Verhoef (2001), p. 14.

27. See, for example, Goodwin (2001) and Nash and Mathews (2001).

28. The original value is given in € / vehicle-kilometre. We use an average German load factor for cars of 1.44 to calculate the figure in € / passenger-kilometre [*Source*: Infras and IWW (2000), p. 167].

29. The original value is given in € / vehicle-kilometre. We use a German European load factor for cars of 1.44 to calculate the figure in € / passenger-kilometre [*Source*: Infras and IWW (2000), p. 167].

30. PETS, Pricing European Transport Systems, http://www.cordis.lu/transport/src/pets.htm

31. We focus on freight. For passengers, see Suter (2002), where the conclusion is: in general, it seems that public transport profits from SMCP if rather high cost estimates are assumed. However, the change in modal split is rather limited because of the strong dominance of road transport in the reference case. Only in the urban case study is a significant change in modal split in favour of public transport assessed.

32. Suter *et al*. (1999).

33. STEMM, Strategic European Multimodal Modelling, http://www.cordis.lu/transport/src/stemm.htm

34. See Ecoplan and MDStransmodal (1998).

35. In this context it should be noted that the PETS case study did not take into account congestion. However, one can assume that the results would not change dramatically because congestion is first of all an issue for passenger transport (peak loads on a limited number of days, e.g. Easter or at the beginning of school holidays) or connected with extraordinary events (e.g. closure of the Gotthard and Mont Blanc tunnels).

36. See Mayeres *et al.* (2002) and Wickart *et al.* (2002). See also Proost *et al.* (2002).

37. See Mayeres and Proost (2002).

38. A partial equilibrium analysis, carried out for several urban areas in Germany and England, is -- as expected with regard to the relevance of congestion -- more in line with the results for Belgium than for Switzerland (see Mayeres *et al.,* 2002).

39. Based on interim reports of the DESIRE project; see also Balmer (2002).

40. The period where the Gotthard Tunnel was closed is eliminated in these data.

41. Nash and Matthews (2001), p. 8.

42. Verhoef (2001), p. 13.

43. Ecoplan (2002).

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SUMMARY OF THE DISCUSSIONS

Summary of Discussions

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INTRODUCTION

The 16th ECMT International Symposium, on the theme *50 Years of Transport Research: Experience Gained and Major Challenges Ahead*, took place on 29-31 October 2003 in Budapest, Hungary. This was a particularly significant Symposium in that 2003 was the Jubilee Year of the ECMT, marking the 50^{th} anniversary of the founding of the Conference.

This Symposium provided an excellent opportunity for experts in transport economics to meet together, air their views and share their invaluable experience with others. As in the past, the ECMT Symposium was attended by high-level representatives of government bodies, universities, research institutes, enterprises and national and international organisations and groups. A total of 305 delegates attended the Symposium.

The three main areas of discussion were all highly topical: Transport and Economic Growth; Competition and Regulation; and Sustainability of Transport.

The rapporteurs presented 22 papers, or a total of 517 pages of printed text, at the Symposium. The format in the panels was for two or three papers to be presented in succession which were then followed by discussions. During the panel debates, 68 questions or short comments were taken from the floor and from other panel members. A judicious balance was struck between the time spent on the presentation of papers by the rapporteurs and the time given over to discussions.

Gyula Gaál, Political State Secretary at the Hungarian Ministry of Economy and Transport, extended a warm welcome to the delegates participating in the Symposium, which he said would provide an overview of the research into transport economics that the ECMT had conducted over the last 50 years. He was glad that Hungary had the opportunity to host this major international ECMT event, which was being held in a country of Central and eastern Europe for the first time. He added that he had every confidence that the presentations and discussions at the Budapest Symposium would prove to be a genuinely inspiring professional experience for all participants.

Jakob Presečnik, the Slovenian Minister of Transport (this year's ECMT Chairman) underlined the long and rich tradition of inland transport research conducted by the ECMT. The results of its research activities, the round tables and three-yearly symposia helped to shape national transport policies and to promote their co-ordination and harmonization at the international level.

Research data clearly showed that over the past thirty years the volume of freight transported by road between Western and eastern Europe had increased by a factor of 3, and that the volume of passenger traffic had increased by a factor of 2.5.

The rate of growth of transport had outstripped that of GDP, but this situation was reversed when the economy was in a period of stagnation or decline. The quality of transport had improved over the last decades while transport prices had fallen. At the same time, the increase in transport growth had not furthered the objective of improving environmental protection and attaining sustainable mobility.

Competition alone was not enough to foster a sustainable balance between transport by car and public transport or between transport by road and rail. The development of the transport sector needed several new tools; technology, development and economic regulation, to name a few. The Symposium provided an excellent opportunity to promote understanding of the inland transport field and its activities.

General Secretary, *Jack Short,* emphasized the importance of the Symposium, where researchers, policymakers and experts from enterprises had come together to share their experience and knowledge and discuss present and future tasks and aims. The ECMT, established 50 years ago, now had 43 member countries, six associate member countries and one observer country. At its very first Symposium, forty years ago, the main topics had been concerned with investment, while issues such as modal split and environmental protection were somewhat less in evidence. Nowadays, several new issues had arisen, such as economy-wide structural change, globalisation and, as regards the railways, the divergence between political aspirations and reality. Equally, in order to influence car use, especially in urban areas, and promote environmentally friendly public transport, people would have to pay more for transport; but would they accept this? At the same time, one could not simply ignore the fact that some transport data were weak on quality and poor in quantity, especially forecasts based on costs and price data. In other words, after half a century of experience, several major new challenges lay ahead.

After the Opening Session, the Symposium was divided into four half-day sessions. The first session was devoted to transport and economic growth, the second discussed competition and regulation and the third addressed the sustainability of transport, through the roles of modal split and pricing. The fourth half-day session took place as a final round table which summed up experience to date and discussed future perspectives.

Topic 1. Transport and economic growth: Which interdependencies?

Part 1. Relations between transport infrastructure and the economy

Chairman: **W. Rothengatter (D)**

Rapporteurs: **R. Izquierdo (E)**
L. Ruppert (H)
J. Burnewicz (PL)
P. Hilferink (NL)

Rafael Izquierdo, author of a paper entitled, Economic Impacts of Infrastructure Investment: The Spanish Infrastructure Plan, 2000-2010, addressed infrastructure as an instrument of economic strategy. The report underlined the fact that the European economy needs higher levels of infrastructure/public investment in order to remain competitive. The problem is how to increase public investment without jeopardising the strict budgetary discipline imposed by EMU criteria. The Keynesian model has had to give way to a new economic model, based on the supply economy and the positive impact of policies such as privatisation, public sector liberalisation and the injection of more private capital into infrastructure.

This notwithstanding, intervention in aggregate demand and the use of the public deficit as a means of expanding the economy seemed to be likely options. Mr. Izquierdo pointed out that the ECMT Round Table 119 on *Transport and Economic Development* (2001) concluded that a *de facto* relationship existed between transport infrastructure and economic development, although that relationship was not as close as some politicians were wont to claim.

The report analysed the effect of infrastructure investment in Spain using a macroeconometric model (MOISEES), which is based on economic theory and exhibits a high level of aggregation. It takes account of multivariable vector-autoregressive (VAR) models, which can be used to measure the short-, medium- and long-term impacts of investment in infrastructure for different scenarios and variables, which are treated as endogenous variables. The HERMIN Spain model not only analyses existing relations between economic parameters but also assesses the impact of EU aid. With these methods the short-term macroeconomic impacts of infrastructure investment by sector and the effects on the economic cycle could be assessed.

The effects generated during the period in which infrastructure is in use were analysed from the standpoints of the impact on private-sector productivity, long-term macroeconomic impact and regional effects.

The report concludes that transport infrastructure investment is a major instrument of economic policy. The models and real-time effects demonstrate that public investment has high multiplier effects. Although such investment can increase employment, transport demand, transport service level and quality, GDP, etc., on the other hand, too much public investment can lead to higher interest rates and a public budget deficit. A well-planned transport infrastructure programme -- based on a robust forecast -- with carefully managed public capital is the form of investment which makes the greatest contribution to productivity growth and hence economic competitiveness.

The report presented by the next speaker, *Laszlo Ruppert,* gave an account of infrastructure and economic growth in the transition period, illustrating this with some Hungarian examples. He underlined that in the last half-century, between 1950-2000, world GDP had increased by more than sixfold while world trade (export goods) had increased by a factor of more than twenty, based on a strong and efficient transport network. During the same period, passenger transport performance increased by a factor of twelve and goods transport by a factor of five in Hungary. Fifty years ago, rail had been the unchallenged leader of the transport market. It had accounted for 94 per cent of passenger and 84 per cent of goods transport in 1950. Nowadays, the modal share of rail stood at 11 per cent of passenger transport and about 27 per cent of freight transport. In the mid-20th century, there were 66 000 road motor vehicles in Hungary; 40 years later the figure was 2.4 million; and at year-end 2002, more than 3.1 million. Between 1990 and 2000, the stock of cars in Hungary increased by 23.5 per cent, as opposed to 15.9 per cent in the EU-15 countries.

While Hungary's GDP rose by 7 per cent between 1990 and 2000, passenger traffic performance was one per cent lower at the end of the same period than it had been at the beginning of the transition period. Rail and bus/coach performance (expressed in passenger-kilometres) declined, while car and air traffic increased by 10 and 59 per cent, respectively.

The change was far more radical in the freight transport sector. The total volume of freight transport (expressed in tonne-kms) fell by 18 per cent between 1990 and 2000. Air and road freight alone increased over that period (with road transport gaining 20 per cent), whereas rail -- the big loser -- lost 53 per cent of its freight traffic. The Hungarian motorway system is only about 40 per cent as dense as the EU's, but its growth rate (of 47.3 per cent) is now higher than the average for the EU-15 area (25.5 per cent).

A study of the multiplier effect of investment in local (up to 20 km) motorway infrastructure on the M5 motorway in Hungary, shows that exports increased tenfold and the number of unemployed within this region fell by eight per cent in the two years following the opening of the new section of motorway.

Practical experience in Hungary therefore shows that transport infrastructure investment can reduce imbalances in regional development and enhance interactions between various parts of the country and its neighbours.

During the discussion some participants taking the floor supported the report's view that well-chosen and planned transport infrastructure investment has a positive effect on the growth of the economy. Others insisted on the importance of using a larger base for calculation. Some participants considered that, for comparisons to be fair, the effects of investment in other sectors (such as education or environmental protection) should be analysed alongside the effects of investment in transport. What would happen to GDP if investors financed the development of other sectors instead of transport?

The next rapporteur, *Jan Burnewicz,* advocated a transport system model which is more compatible with the European macroeconomic environment. In his introduction he stressed that, in view of the importance and complexity of the role played by transport in the economic and social life of countries, the first need was to determine to what extent the transport sector in fact meets the desires and expectations of society. Subjectivity was the risk in any case study. The perspectives could also diverge widely. In developing countries, for instance, researchers focus on the marginal weakness or lack of infrastructure, while in wealthy countries, transport systems attract attention due to their impact on the environment, safety, the beauty of the landscape or to other "soft" factors or parameters of transport investment. On the other hand, a general assessment of the transport system may be so abstract that it is of no political, economic or social utility. One needed to bear in mind, too, that the demands and desires of transport users are often unrealistic, either because they are not technically feasible or because they are too expensive.

The long-term statistical data show that economic growth runs parallel to transport growth. However, there is no one hard-and-fast rule that governs the relationship between the two. For instance, in Ireland, an annual growth rate of 8.2 per cent per year in GDP over the period 1990 to 2000 was accompanied by a decline of 3.2 per cent annually in freight transport (in tonne-kms). The opposite was true for Italy, where GDP rose by 1.4 per cent per year, but freight transport increased by 1.5 per cent per year over the same period. One of the main messages Mr. Burnewicz had for the Symposium was this: "*Strong acceleration in macroeconomic growth will enable the link between the transport sector and the economy as a whole to be completely severed. However, this strategy will fail if administrative instruments or economic, fiscal and financial measures are used to lower the volume of transport flows.*"

An important point is that decoupling transport and macroeconomic growth cannot be based on the argument that increased traffic levels are not matched by infrastructure capacity. Furthermore, the decoupling strategy must be compatible with spatial changes in Europe as a result of enlargement. The report points out the discrepancy between infrastructure development and traffic growth. Over the ten-year period from 1990 to 2000, the intensity of freight traffic on one kilometre of road network within the EU-15 area increased by 40 per cent, while the intensity of rail traffic increased by only 4 per cent and in some countries decreased by 5 to 37 per cent. This happened in spite of the fact that EU transport policy has given priority to investment in railways. The report mentioned that some European transport modes, especially rail, are weaker than their global competitors. It pointed out that macroeconomic disparities within the EU-15 area would become greater in the enlarged European Union. For instance, the average price in Euro/t-km is 0.23 in Denmark; 0.10 in France; 0.20 in the United Kingdom; and 0.08 in Poland. The same indicator for Greece is 12 to 13 times lower than for Belgium or Luxembourg. Reducing the current disparities between European regions requires higher levels of investment in those that are less developed.

The same topic -- the correlation between freight transport growth and economic growth -- was continued by *Pieter Hilferink*. His report looked at transport as a part of the economy, analysed past developments and discussed future perspectives and scenarios. The statistical data for GDP, industrial production, passenger transport and goods transport showed that in the last twenty years (from 1980 to 1999) there had been a significant change in the correlation of these parameters. Within the EU-15 area, GDP had grown at a faster rate than goods transport until 1993, but after that the dynamic growth in freight transport outstripped the growth in GDP and industrial production. Furthermore, from 1995 on, the rate of growth in goods transport outstripped that of passenger transport.

It is evident that the correlation between goods transport and GDP differs from one country to another (depending on economic and spatial structure and the organisation of transport). The countries at either extreme were Finland, which has the highest ratio of transport to GDP, and Austria, which has the lowest ratio. The report showed how economic structure influenced goods transport and GDP in different countries (such as France, Germany, the Netherlands, Spain, Poland and Romania). According to NEA data, technology leads to the use of smaller, lighter materials and the application of advanced technologies. The influence on the transport/GDP correlation is twofold.

Looking to the future, an NEA forecast for the European Commission suggests that transport volumes (in tonnes) will increase by from 76 per cent to 80 per cent over the period 1995 to 2020, depending on the scenario. Calculated in tonne-kilometres, growth will exceed 80 per cent. The growth in goods transport will be higher than in passenger transport, but some 10 to 20 per cent lower (measured in tonnes) than GDP growth. Measured in tonne-kilometres, the growth in goods transport will be about the same as GDP growth. As regards modal split, it is expected that the growth in the modal share of road transport can be halted and it should remain at its present level in the EU-15 area. However, in Central and eastern Europe, where the process of economic restructuring is still on-going, the shift in the share of rail to road transport will not be halted at its current level. A further point was that the use of policy instruments on an international scale to decouple goods transport -- especially long-distance freight transport -- from economic growth is only in the very early stages. The effect of new pricing systems, the production chain, the internalisation of external costs, etc., on the growth of the total volume of goods transport would probably be limited. Mr. Hilferink added that, given the subsidiarity principle, it was doubtful whether Europe would be able to contribute here.

During the *panel discussion* some participants supported the idea of reducing the share of road transport and promoting rail, especially because of environmental protection and land-use problems. Others pointed out that new types of road motor vehicle (Euro-4, Euro-5) produce less noise and about twenty times less air pollution than Euro-1 vehicles. Market demand from consumers made it unlikely that the growth in road transport could be stopped. Several suggestions were made regarding the introduction of various taxes (environmental taxes, higher road charges, etc.), including the possibility of collecting resources from the road sector in order to fund rail transport. One interesting question raised was whether or not the Central and Eastern European Countries would follow the western European model on modal split.

The majority thinking, summarised by the Chairman, *W. Rothengatter*, was that the newly associated countries would not be able to maintain the market share of their railways at the same level as in the pre-transition period before structural changes.

Topic 1. Transport and economic growth: Which interdependencies?

Part 2. Decoupling transport from economic activity

Chairman: **W. Rothengatter (D)**

Rapporteurs: **H. Meersman/E. Van de Voorde (B)**
S. Rommerskirchen (CH)
P. Goodwin (UK)

"Decoupling freight transport and economic activity: realism or Utopia?" was the question put to the Symposium by *E. Van de Voorde and H. Meersman.* The globalisation of the economy, the global market and the liberalisation of international trade are catalysts for the growth of industrial output and world trade and hence for freight transport. The highly dynamic growth in freight transport could cause serious capacity, traffic safety and environmental problems in road haulage. The report explored whether decoupling was at all feasible in the context of freight transport within ECMT countries. The relationship between economic activity and demand for freight transport shows that within the EU-15 area, freight transport (t-km) increased by 32.2 per cent over the period 1991-2000, i.e. at a higher rate than GDP. The growth in road transport has overtaken that of economic activity, especially in Belgium, Germany, France, Italy and the Netherlands. During this period, the nature of goods produced has changed. High specific gravity and low value-added bulk transport has declined, while the transport of high value-added, semi-finished or finished products has increased, which has clearly benefited the road haulage sector.

Bearing in mind that two-thirds of road freight transport involves distances of under fifty kilometres, it would clearly be very difficult to change its market share. At the same time, the transport sector accounts for 4.2 per cent of the total jobs market in the EU-15 area. Furthermore, transport indirectly creates other jobs in the supply chain network and in related industries. Unfortunately, when transport growth parallels economic growth it creates several negative side–effects, such as traffic congestion, environmental pollution, etc. The main questions are: how can we increase economic activity while reducing transport demand? Why are goods conveyed from one location to another? A study by the rapporteurs showed how transport and economic forecasts diverge from reality. They found that models underestimated reality in all cases. GDP, in particular, had a greater impact on freight transport in the 1990s than it did in the 1980s, while changes in industrial production became far less influential. The relationship between freight transport and economic growth clearly varies a great deal from one country to another.

The change in the relationship between freight transport demand and economic activity which began in the early 1990s, can be put down to deregulation, privatisation and the liberalisation of the transport market, lower freight rates, technical developments, new stock and logistic policies and, last but not least, the opening up of the eastern European market.

A study on international logistics developments had identified a number of important developments which had an influence on freight flows: the globalisation of the production process; growing competitiveness in international trade; supply chain management strategies; time-based competition; the development of IT systems, EDI and global e-commerce.

Further globalisation, the growing importance of the Western European service industry and EU enlargement, along with closer relations with eastern Europe, will probably generate additional growth.

It should be quite clear that decoupling can only be interpreted as an attempt to break the automatism whereby absolute growth in freight transport is always greater than economic growth and whereby the market share of road haulage, in particular, continues to rise. “However, decoupling demand for freight transport entirely from economic activity and international trade is utopian.”

Stefan Rommerskirchen continued the theme with a paper entitled “Decoupling -- What for? What does it mean?”. He pointed out that the decoupling of economic and transport growth had been the subject of intense debate in recent years. What had sparked interest in decoupling in the 1990s was the negative side-effects of transport (capacity limits, emissions, safety problems, etc.). It was then that the possibility of breaking the link between economic growth and transport growth, especially freight transport growth, was first discussed. The same period saw the publication of some research papers on this issue (such as the German Federal Government’s “decoupling strategy”), but the debate was given a new political dimension with the publication of the White Paper, *European Transport Policy for 2010: Time to decide*. The White Paper states, “greater efforts [will be needed] in order gradually to break the link between transport growth and economic growth…”. An interesting question raised was whether economic growth should be measured in terms of GNP or GDP or whether the value-added of manufacturing industry provided a better indicator because of its closer links with transport.

By the same token, what unit should be used to measure transport growth: volume or vehicle fleet? Based on a study by Prognos AG, “European Transport Report 2002”, the report compares

GDP growth with freight transport performance intensity in the EU-15 area and some Central eastern European countries. The study found that the intensity of road freight transport performance rose from 156 t-km/€1 000 GDP in 1980 to 206 t-km/€1 000 GDP in 2001 within the EU-15 area.

During the same period, the intensity of rail transport performance declined by 34 per cent. As well as past trends for all-mode transport performance intensities, the report gives forecasts to 2015 for all-mode transport performance intensity in the EU-15 area and five CEECs. The report concludes: "*If decoupling is to be successful, it must result from a change in our attitudes, from our role as the originators of movements of people and goods and, above all, from our real behaviour with regard to mobility*."

As one might expect, participants at the Symposium were interested in knowing more about the method of congestion charging used in London, the subject presented by *Phil Goodwin*. After a short introduction, the rapporteur described the calculation method for congestion charges in detail. Widespread congestion is a common daily experience. The typical argument (from business interests) was that the construction of new roads reduced congestion and that what prevented congestion was also good for the economy. In contrast, "environmentalists" argued against road-building projects. More recent views hold that (in some circumstances) road construction can be bad for economy, while traffic restraint can be good for it. In the case of congestion charging, the argument is that increasing transport prices and reducing traffic may be the optimal solution for improving economic efficiency.

The "total cost of congestion" -- a concept which has been influential in transport for some forty years now -- has been estimated at about £20 billion per year in the UK. It would be better to shift the focus from the "*total* economic cost of congestion" to "the economic value of the savings in congestion that could be achieved with congestion charging". According to the Mayor of London, the benefits for central London could be about £100 million per year using this method of calculation. Other calculations (GoL, TfL) estimated the net benefit at £95 million to £160 million, while the overall economic benefit was an estimated £125 million to £210 million. The Adam Smith Institute suggests that the direct costs and prices are less than half the costs of congestion to businesses. Estimated "environmental values" would add an extra 10 to 20 per cent to the congestion benefits, but some researchers suggest that the figure would be 30 to 100 per cent. (The modest 20 per cent figure gives an extra £20 million benefit in central London.)

During the discussions that followed the presentations in Part 2 of the Session, most of the questions and comments related to congestion charges and decoupling. The paper on the London charging scheme had been written before any practical experience with the scheme had been gained. Mr. Goodwin was able to give some information on the initial experience in reply to questions.

London introduced the charging scheme on 27.02.2003 (£5 flat charge per day per vehicle). There had been several positive experiences. The scheme was working; the number of vehicles entering the central area was lower than expected (thus, income was also lower); higher average speeds had been possible in the central area. The pricing level in central parking areas had fallen while the price of parking spaces in the outer city area was higher. One comment made was that the future of cities could be totally different from what we knew at present. The question is: do we move towards the American model? Central London and Rome could be "empty" but what about induced and extended congestion?

It is important that the public accept the theory behind charging systems, and the need to reinvest the income from them back into city transport, mainly public transport. The total cost of congestion can never be zero because that would be prohibitively expensive; there is a conflict between the economic optimum and the demand of customers.

There was then a long discussion on whether decoupling is or is not realistic, but all parties agreed that this was a topic which needed more research and that in order to bring about decoupling -- as related to economic and transport growth alike -- economic tools should be used as well as technical improvements (IT systems, logistics, e-commerce) in order to influence human behaviour.

Topic 2. Competition and regulation: Substitutes or complements

Part 1. Regulatory approaches?

Chairman: **R. Vickerman (UK)**

Rapporteurs: **U. Blum (D)**
M. Ponti (I)
J. M. Viegas (P)
A. Smyth (UK)

Ulrich Blum emphasized in his report that the theory of economics recognised two main systems of co-ordination which are manifested through public choice or through the market principle. The market can be regulated or it can be fully competitive (in practice it is often a mix of these two forms). The transport sector had changed from being a strongly regulated sector to a competitive environment. This transition had brought about many problems and failures in privatisation and deregulation. Competition, according to the rapporteur, is an open process, which produces results which would otherwise remain unknown. The paper classifies regulation according to the structure or conduct that it addresses: market structure (market access, market organisation and cartelisation); market conduct (surveillance of pricing, product placements, surveillance of co-ordination among suppliers, and of obstruction); and market performance (price regulation and quantity and quality regulation).

The historical background of the arguments justifying non-market allocation was outlined: transportation and the emergence of the nation state; natural monopoly; public good and essential services. Greater competition on the market and the shift toward deregulation theory could be traced back to the "Chicago revolution" and the renaissance of free market economics. At the same time, it is true that infrastructure is not a naturally competitive activity because of sunk costs. The unbundling of activities -- horizontal separation -- and the establishment of a different institutional structure is therefore essential. Mr. Blum concludes that competition requires rules on a meta level in the market and institutions which regulate arbitration procedures. Standards need to be defined, especially with respect to interfaces between networks.

The next speaker, *Marco Ponti,* examined the traditional "social choice" and "state regulation" approaches. According to Mr. Ponti, state intervention is needed not only to achieve "autonomous" welfare goals but also if the market fails to deliver productive or allocative efficiency. In the transport sector there are several areas in which state intervention is needed to deal with natural monopolies, externalities, safety issues, etc. Furthermore, planning -- land use, infrastructure planning and landscape control -- are the main areas in which a more direct public role has to remain dominant. Conversely, in areas of low-density land use, public transport subsidies are generally needed.

The main areas for transport policy action in market competition and state regulation are as follows:

- Liberalisation: transport sector in general (long-distance rail and bus services; intercontinental air services);

- Regulation: infrastructure operation/building (PPP); unstable markets in services (local transport); efficient charging and access rules (competitive tendering for concessions, slot allocation);

- Planning: direct public intervention: infrastructure design and location (EU common transport policy, TEN-T, etc.); environmental and social values (Kyoto standards, safety and security); land use/transport policies (urban sprawl containment).

Public regulation has to "simulate" pressures in the transport market. A range of regulatory policies exists, including: regulated privatisation of assets → competitive tendering of operations → tariff regulation → yardstick competition (also known as the "tournament" method, a form of "simulated market"). The report gives some examples of regulatory problems within the transport sector, such as: congestion charges and access rationing; the "minimum efficient dimension" issue; financial issues, investment regulation, etc.

Mr. Ponti concluded that public regulation of transport services and infrastructure is a highly complex task, basically still in its infancy. The task of reconstructing proper market rules poses a much bigger challenge than the "destructive" phase. There was an ideological difference between liberal values and pure "laissez-faire" theory. Furthermore, public regulation is not a purely technical issue: in reality, the choices embedded in regulation represent different visions of economic democracy and social priorities.

According to *José Manuel Viegas,* for virtually any type of economic activity today, there are technical regulations relating to safety and environmental protection goals and economic regulations which set limits on the economic behaviour of a company or organisation. He pointed out that competition was not a goal in itself. The economic efficiency of transport activities may sometimes come second in the concerns of governments after a universal, guaranteed stable supply. So, a careful balance has to be struck between regulation to stimulate efficiency gains and the required availability, stability and predictability of transport supply.

The increasing sophistication of competition and regulation poses five main challenges for the public sector: restructuring to promote competition, keeping competitors' behaviour in check, maintaining small market services and access, managing concessions and ensuring safety and environmental protection. It is interesting to note that there are two main risks of capture for the regulator: capture by operators and capture by users. In the first case, operators will try to gain special advantage from political circumstances to improve their terms of operation or reward and, in the second, users may create pressure to impose demands not covered in contracts -- hence the need for as clear a definition as possible of the scope of the regulator's powers.

It should be borne in mind that the extent of regulation preferable depends largely on the size of the market and the potential number of suppliers; the existence of alternative forms of transport; the sophistication of the services on offer; and the level of technical competence and sophistication of the regulatory agency, which should be commensurate with the complexity of the supply requirements. There are some risks of excessive competition, as well as: "*instability in general; duplication of services by different operators, over-capacity and cherry-picking of services*" (leaving low-density areas without services). The report contains detailed information on managing competition for the market using tenders and contracts.

Mr. Viegas's main conclusions were that the availability, stability and predictability of transport system performance are at least as important as its efficiency. Authorities and public operators need to learn from private operators and market players.

Austin Smyth's paper provided an in-depth analysis of the elements of competition and regulation and the relationship between public sector control, private sector ownership and the need for regulation. Selected cases illustrated patterns of regulation and competition in various transport markets and sub-sectors. The paper points out that there are two main types of approach to competition: the Anglo-Saxon model and its continental European counterpart.

Overall, the only difficulty as regards competition, regulation and efficiency is the way the effects of externalities are taken into account. Competition can be a powerful force in transport, provided that a perfect pricing system -- one which reflects the true social costs of the operators -- prevails. The paper outlines the differences between the four main types of competition: perfect competition, monopolistic competition, oligopoly and monopoly. The regulation of competition includes a wide range of mechanisms used for reducing or counteracting market failure. The main policy instruments are: competition policy, standards, entry controls, price controls, rate of return regulation, tax concessions/rebates and subsidies. It is important that regulatory bodies demonstrate the following: well-defined objectives, integrity, independence from the public body with ultimate responsibility for determining and resourcing the system, understanding of the market, effective control mechanisms and sufficient resources.

The fact remains that transport is one of the most regulated sectors in any economy. More recently, UK governments have tended to withdraw from direct control of transport with the introduction of wide-ranging privatisation. After the first wave of privatisations, there now appears to be increasing enthusiasm for competition for the market rather than competition within the market. A key part of the report was the section on competition for the market *versus* competition in the market and the emergence of competitive tendering as the preferred option for local transport, while providing for adequate public passenger transport and public service contracts.

A number of lessons have been learned from the experience of, and the challenges faced by, the countries of central and eastern Europe. Although the reform of public transport there has been relatively slow with respect to local and urban transport, five forms of market organisation can be identified:

- the hitherto largely universal, fully regulated public sector model;
- the so-called Scandinavian model, essentially based on a mixture of minimum subsidy and minimum cost contracts at a route level;
- the French model, based on network management contracts with additional contractual incentives;
- the so-called Adelaide model, intermediate contracts, where operators have some freedom to develop services; and
- the largely deregulated model, which accounts for the vast majority of bus services in Great Britain, outside London.

The report concluded that transparency and consistency are essential for giving private companies the confidence to make long-term investments. Ideally, the regulatory authorities should be set specific, measurable aims. Without clearly-defined, measurable targets, it becomes a matter of debate whether regulation is working well or not.

During the panel discussion, there were several questions about the different methods of competition within the public transport sector. The threat of regulation is not enough; active monitoring by the authority (state, local municipality) is very important. Feedback and continuous observation of the market are precisely what make for a well-designed regulatory system. More research is needed to define social benefit in relation to costs. More flexible requirements, public services (level, quality and quantity) are specified by the authority but it is by no means certain that this is what the real market -- the clients -- need.

Topic 2: Competition and regulation: Substitutes or complements

Part 2. The market contribution?

Chairman: **R. Vickerman (UK)**

Rapporteurs: **S. Barrett (IRL)**
G.A. Giannopoulos (GR)
A. Bonnafous (F)

Sean Barrett's paper looked at why the transport market had been neglected for some fifty years, since about 1930, and why transport economics had returned to the market in the last two decades -- in the period from the Keynesian revolution to the Chicago revolution.

Considering the consumer welfare gains it generated, deregulation in four transport sectors in the USA would appear to be a very effective tool for improving services and reducing expenditure of the state budget. The following are some key and highly pertinent examples from the US transport sector:

- Airlines: average fares are 33 per cent lower in real terms since deregulation, and service frequency improved significantly;

- Truckload trucking: average rates per vehicle-mile have declined by 75 per cent in real terms since deregulation;

- Railroads: average rates per tonne-mile have declined by more than 50 per cent in real terms since deregulation and average transit time has fallen by at least 20 per cent.

Like the USA, Ireland can also point to similar positive examples. After deregulation of the Irish air sector, one new-entrant airline claims reductions of as much as 85 per cent off the fares charged by traditional European national airlines. Although the population of the Republic of Ireland is less than four million, more people fly between Ireland and the UK than between the UK and France, Germany and Italy. Following the deregulation of the taxi sector, entry costs decreased, the number of taxis increased and the average waiting time fell; 25 per cent of passengers had to queue up for less than five minutes in comparison with 48 per cent before deregulation. The ISOTOPE report contrasted bus costs per vehicle-km in 1996 (euros): closed markets 3.02; controlled markets 2.26; deregulated markets 1.44.

The issue addressed by *George A. Giannopoulos* was competition (*vs.* regulation) in transport: a mixed blessing or Utopia? The paper reviews the issues of liberalisation and free competition. It draws a distinction between technology-based "long-term cycles" and policy-based "short-term cycles", such as were seen in the 1970s, the age of energy consciousness and environmental consciousness; the 1980s, the age of regulatory reform; and the 1990s, the age of liberalisation and infrastructure issues. The current transport policy cycle focuses primarily on the following areas: strong privatisation moves; full liberalisation; and heavy and increasing reliance on technology, interconnection and interoperability of networks, placing the user "in the middle of it all". The paper quotes Bishop and Thomson: "*Economists are now generally agreed that simply changing the ownership of assets is not sufficient, and indeed is not even necessary to improve efficiency. What is important is the threat of competition and, therefore, market condition and perhaps the regulator regime*." According to the results of a survey comparing the relative efficiency of 55 companies in different economic sectors, public companies were more efficient in 10 per cent of cases, results showed no difference or were ambiguous in 30 per cent of cases and private companies were more efficient in 60 per cent of cases.

The rapporteur's main recommendations were: formulating and establishing more distinct limits and rules for market liberalisation and privatisation in the transport sector; putting more emphasis on, and pushing for, integrated and interrelated transport services; creating pan-European institutions and organisations, which reflect the new face of a multinational, intermodal, technology-driven and borderless European transport system; establishing and implementing a commonly agreed framework for financing transport infrastructure; making the "user" part of the "solution"; and creating the necessary organisational and business structures to use the full advantages of Information Society Technologies (IST) within the transport sector.

Alain Bonnafous pointed out that the last decade had seen an increase in the use of "Public-Private Partnerships" (PPPs). According to the World Bank report for the period 1990-2000, 2 500 projects had involved private operators, of which 676 were in the transport sector. This trend was increasing, despite the fact that a large number of the projects had not been clear-cut financial successes.

There are sound reasons for the more widespread use of the PPP method of finance: it gives private operators the opportunity to manage the construction and operation of a given project more efficiently; the involvement of private operators makes the implementation of the user-pays principle more acceptable; the excessive level of public debt. Furthermore, PPPs started to become attractive at a time when the financial rate of return on projects was at an historic low.

The paper identifies three types of project, in decreasing order of rate of return: high rate of return projects (over 12 per cent); medium rate of return projects (from 8 to 12 per cent) and low rate of return projects (less than 8 per cent). It draws a distinction between the "public" option, where it is assumed that the operator in charge of the project will probably not make a profit, and the "private" option, which allows for the operator to make a profit.

Using a mathematical model, M. Bonnafous shows the parameters which influence the subsidy rate required to improve the internal rate of return (IRR). The social rate of return was calculated for a programme of 17 toll motorway projects, in order of implementation. The results show that the social loss is minimal if priority is given to investments with low rates of return.

During the panel discussion, some participants stressed the importance of fair competition rules. Private operators do not offer complex, integrated services because they are more costly. As regards liberalisation, the whole of the transport sector, including suppliers and subcontractors, could be reviewed. The trend has changed, it seems, and now suppliers are putting pressure on the procurement agency. In parallel with liberalisation, more transparency (regulations, pricing and subsidy) is needed. The big private companies had an enormous influence on regulation. One of the main questions raised was: what do we want to increase -- access or mobility? (see low-price airlines). There is no single solution for market liberalisation and much more concrete research is needed in these fields in Europe.

Topic 3. Sustainability of transport: The roles of modal split and pricing

Part 1. The role of modal split

Chairman: **S. Proost (B)**

Rapporteurs: **G. Aberle (D)**
A. Musso (I)
M. Beuthe (B)
H. Knoflacher (A)
A. Monzón (E)

The first speaker in this session, *Gerd Aberle,* addressed the issue of sustainability in transport policy. Mobility is a social challenge, with opportunities and risks. Sustainability has been a key concept for social and transport policy since the United Nations' Conference in Rio de Janeiro in 1992. However, a great deal of mobility nowadays is forced mobility and this is an increasing trend in the passenger sector as well as the freight sector. There are two main strategies for countering rapid growth in mobility: first, to decouple transport growth from overall economic growth, and then to shift mobility demand to modes of transport with comparatively less negative impacts on the environment. (In the passenger transport sector, this implies a shift to different forms of public transport -- buses and trains -- and, in the freight sector, a shift to rail, inland waterway and combined transport.) Yet the trends in the modal split in particular have been the same since 1998, and all available forecasts suggest that the past modal trends are unlikely to change significantly over the next 10 to 15 years in the EU-15 area. The main parameters which influence the choice of transport mode and modal split are: flexibility, reliability, infrastructure network, information networks and a customer-oriented cost policy.

The report reviews in depth the capacity of the individual modes to meet logistics requirements, opportunities for combined transport and -- in terms of the implications for the sustainability debate -- specific emission trends. There has been huge progress from Euro 0 vehicles to Euro III-type diesel engines: four times less HC, six times or less CO emissions and much higher standards are to be introduced as of 2009 by the Euro V standard.

It seems that policy's freedom to influence modal split is limited. High taxes or restrictive bans and regulations could hamper freight traffic but at the risk of lower economic growth. Among the methods proposed were: providing transport infrastructure of a high standard; establishing the necessary conditions for non-discriminatory competition within and between modes; using the same method of calculation to charge infrastructure costs to all transport modes, while still allowing for the possibility of an appropriate contribution from the public purse towards the cost of infrastructure investment; issuing regulations establishing norms in respect of harmful emissions, noise pollution and vehicle characteristics.

Continuing the topic on modal split, *Antonio Musso*'s report provided an overview of the freight traffic sector. It focused closely on the freight transport market in the Alpine regions and the roles of the different modes and gave some successful examples of best practice. In the EU-15 area, total freight transport was 3 078 billion t-km in 2000, of which more than 1 300 billion were carried by road and 1 270 billion by sea (intra-EU), while freight transport by rail amounted to no more than 250 billion t-km. The modal share of rail in freight traffic through the Alps, a highly environmentally sensitive region, declined from 44 per cent to 32 per cent over the period 1991 to 2001.

The main causes of this decline were: rail's poor reliability and poor service quality; its lack of interoperability (five different traction systems, fourteen signalling systems, etc.); structural weakness at intermodal terminals; lack of a well-functioning reservation system for potential slots across national borders, together with the priority given to passenger trains; lack of integrated commercial services throughout the international logistic chain.

A number of different case studies were reviewed. A key finding of the survey carried out for the IQ project was that an efficient high-performance shuttle train service needs a minimum haulage distance of 500 km and a minimum volume of 20 000 TEU per year. Some successful examples were Kombiverkehr in Germany, with the movement of 2 million TEUs in 2000; the RTC between Verona and Munich and the new Italy-Spain ro-ro routes.

Michel Beuthe's report pointed out that the dynamic growth in road haulage traffic was a major source of congestion, pollution and road accidents. If authorities and policymakers wish to influence this growth, more data, relevant information on transport demand and the elasticity of the demand will be needed. However, there are few research findings available in this field, probably because data is lacking. The author presented the findings of selected research studies on the elasticity of categories of freight and transport modes. It was found that the elasticity of demand for rail exhibited greater sensitivity to cost variations than demand for other modes. Pricing and taxation policies aimed at promoting modal shift could prove effective under certain conditions. Six qualitative factors in modal choice were analysed: frequency of services; door-to-door transport time; reliability of transport; carrier's flexibility; costs and losses. The calculation is based on the UTA multi-criteria model, which derives the manager's decisionmaking process from the order of preference assigned to the different transport alternatives proposed.

Modal split in the passenger transport sector was analysed by *Herman Knoflacher*. He drew a distinction between "modal choice", "modal split" and "mobility shares". "Trip" was proposed as a more appropriate unit than "kilometres", as it allowed for the fact that every journey started and ended with at least one pedestrian trip. From this standpoint, the average number of trips per person per day has not changed with increasing car use. Cars cannot be considered a sustainable mode. When viewed as a whole -- car transport, public transport and non-motorised transport -- the trajectory of the modal split curve is away from sustainable modes and towards unsustainable modes. To counter this trend, it is often argued that pricing is not enough. If transport is to be more sustainable, we need to change people's behaviour. Currently, modal split is an indicator with a car bias. As long as such structures exist, it is probably impossible to change the trend. City planners have designed city structures with a view to optimising car traffic; traffic engineers use pricing as a tool to restrict travel. Fair pricing means that people have to pay for infrastructure and the consequences of their behaviour. The report analysed several new aspects of human behaviour.

The paper concludes that sustainable transport could be defined as transport systems which are highly efficient within the limits of ecological, social and economic capacity. Pricing is defined as a set of measures which can be used to encourage transport system users to behave in a sustainable way. Today, it is ineffective and unfair to users, who are forced by existing structures to use their cars . These structures are optimised for individual situations and not for the system.

The next rapporteur, *Andrés Monzón,* supported the view that mobility trends were not following a sustainable trend. In spite of the efforts which had been made, the situation was growing worse day by day in both urban and intercity transport. One of the key issues was to influence the behaviour of car users and to encourage people to opt for public transport more than car transport. Shifting demand to public transport required 20-60 per cent of metropolitan support or patronage.

The author gave two examples of integration and improved co-ordination of private and public transport. The first was the High-Occupancy Vehicle (HOV) lane scheme in Madrid. The concept of lanes reserved for high-occupancy vehicles started in San Francisco in 1973, when private vehicles with a minimum of two occupants were allowed to use bus lanes. HOV schemes were first introduced in Madrid in 1995 over a total lane length of 16 kilometres, the longest in Europe. The scheme is one of a number of "demand-side management strategies" and its slogan was "fill the empty seats". The Madrid HOV lane is located in the north-western sector of the Madrid region. The factors taken into consideration in the selection process were this sector's consistent population growth, high environmental standards, lower housing density, higher motorisation rates and higher income levels than in the rest of the region. Thanks to the HOV lane, while the total number of passengers increased by 63.3 per cent between 1991 and 2001, the number of vehicles increased by "only" 40.5 per cent during the same period. The other key factor in people's use of this lane was time savings, especially in peak hours, when travel times could be cut by almost 50 per cent.

The second scheme was the extension of Line 9 of the Madrid Metro. The extension of Line 9 started in 1999. The impact on modal split highlights the rapid impact of the new line, which attracts 70 per cent of PT demand and which, together with bus services, has reduced car patronage by 6 per cent since its implementation.

Topic 3. Sustainability of transport: The roles of modal split and pricing

Part 2. The role of pricing

Chairman: **S. Proost (B)**

Rapporteurs: **E. Quinet (F)**
J. O. Jansson (S)
F. Walter (CH)

Emile Quinet used the phrase "sustainable development" in a broader sense, to mean development which takes full account of any impacts on the environment. In order to achieve sustainable development in the transport sector, charging seems to be the natural solution. From the economic standpoint, it is prices which govern the markets in which economic agents make their decisions and prices which determine supply and demand. From a policy standpoint, in the transport sector governments have to take the place of the market in setting prices which, in this particular case, are basically infrastructure and environmental costs. The debate on infrastructure charging dates back some 200 years, but had regained momentum in the last third of the 20th century.

The implementation of charging raises several questions. Which is the best pricing option: basically, marginal cost or average cost? Once an option is chosen, the next step is to put a figure on the costs generated by the type of traffic being targeted by charging. This is really difficult because of the uncertainty of the calculations, especially the calculations for non-market goods, such as greenhouse-gas emissions, noise, etc.

Furthermore, transport goods are often paid for indirectly. In the case of road charging, for instance, users pay a tax on petroleum products, tolls, parking fees, vehicle tax, special taxes on car licences, etc. However, these charges do not exactly match the costs of the infrastructure. Mr. Quinet gave an in-depth review of studies in price elasticity. Freight traffic appears to be relatively inelastic with respect to the price of transport. Cross-elasticities are much lower than direct elasticities. The idea that charging can affect modal split should be reviewed, as there are few repercussions to be expected in this area. Prices are important but are not the sole factor in determining transport volumes. Most determinants of transport demand are to be found outside the transport sector. These include economic growth, spatial planning, technological change and human behaviour.

The next rapporteur, *Felix Walter,* addressed the topic: what is the contribution of pricing to a sustainable transport policy? How can it be implemented? According to the author, social marginal cost pricing (SMCP) is a tool which leads to the efficient use of existing transport infrastructure capacity. The information required to calculate the "price-relevant costs" includes producer costs (marginal costs of infrastructure), user costs and external costs.

The paper also outlines an alternative pricing approach -- cost recovery ratios -- which was developed in Germany. In the real world, implementation of the pricing system is very important from the standpoint of harmonisation. The question is where to start introducing charges. The priorities are often road transport (road pricing in congested areas, HGVs, etc.) and rail transport, with the adjustment of infrastructure access charges. Information on the positive effects of the Swiss Mileage-related Heavy Vehicle Tax (MRHVT) system was available.

Jan Owen Jansson posed the question "If we knew 50 years ago what we know today about the price-relevant costs of urban traffic, could urban development have taken a different turn?" According to his paper, the total costs of the unwanted by-products of road traffic is 4.4 per cent in OECD countries and 4.2 per cent in Sweden. (Although the overall total is fairly similar, the breakdown by type of costs shows differences, for example, congestion costs are 2.0 per cent at OECD level and 0.4 per cent in Sweden.) In order to calculate the price-relevant marginal cost of road services in general, three elements must be taken into consideration: producer marginal cost, user average cost and transport system-external cost. One of the main problems is to calculate system-internal and system-external costs.

The author outlines methods of calculating costs, such as the costs of noise and barrier effects, accidents and accident externality charges. The report shows how developments in transport have influenced urban development, including trends in urban modal split for work trips in Sweden during the era of car expansion.

When empirical data are used to calculate the total system-external cost in an urban area, the range of figures €0.85-€1.0 per vehicle-km, seems prohibitively high, but the highest "prices" would potentially be charged on links in the urban road network, where car traffic is relatively low and pedestrians and cyclists are plentiful because motor traffic would be prohibited there.

The *panel discussion* stressed that there was a wide range of tools available for transport regulation. Successful examples show that, in real life, a mix of policies can be utilised (spatial planning, influencing behaviour, etc.) but that charging should play a greater role. There was a lengthy discussion on whether or not the income from clients of the transport sector is clearly and fairly distributed. The aims of pricing were: a reduction in traffic, improved efficiency and profitability. Some participants opposed cross-financing (of rail by the road sector) but the audience agreed that multiple measures are needed in order to reduce the growth of road freight traffic. High road charges influence transit and export-import costs and have a negative impact on trade. Probably the price system can be influenced by the geographic size of a country. Road pricing penalises peripheral countries because their trade is dependent on comparatively higher traffic.

Final Round Table: Experience to date and future outlook

Chairman: **U. Karlström (S)**

Panel members: **W. Brög (D)**
M. Browne (UK)
Y. Crozet (F)
R. Maggi (CH)
E. Molnar (USA)
J. Oosterhaven (NL)
J. Palfalvi (H)
M. Wachs (USA)

After introducing the panel members, *Urban Karlström* opened the final Round Table discussions by summarising the main messages of the sessions. The members of the panel, experts from the research and business communities and policymakers, had an opportunity to deliver their viewpoints on the three topics of the Symposium: Growth, Competition and Regulation and Sustainability. After these short lectures, the panel members and the audience addressed questions and observations to the speakers.

FINAL CONCLUSIONS

General conclusions

- The ECMT has had a strong tradition of transport research for the last 50 years. The findings of its research activities could be helpful in harmonising national and international transport, as well as transport policies.

- From the areas of investment and construction in its early days, the focus of the ECMT's transport research topics had shifted to other areas, such as modal split, environmental protection and the social impact of transport, regulation and competition.

Transport and economic growth

- Of all public investment, investment in transport infrastructure makes one of the greatest contributions to productivity growth and hence to economic competitiveness. Nevertheless, transport investment is not an automatic tool for economic growth. It is closely related to other local or national parameters, such as level of education, development of telecommunications and other business and social factors.

- The demand for transport investment can differ markedly from one country to another, depending in particular on their geographic location (peripheral or transit country), but mainly on their level of economic and infrastructure development. That is why researchers focus on marginal weakness or lack of infrastructure in developing countries, while in developed countries the focus on transport systems tends to be due rather to their impact on the environment, safety and land use.

- Improving transport does not necessarily mean building new infrastructure or more infrastructure. For instance, the London congestion charging scheme, which increased the price of transport and reduced traffic, could be an effective way of improving economic efficiency.

- Decoupling the growth of freight transport from economic growth is still considered a desirable development -- although nowadays it may be regarded as utopian. More research is needed in this field.

Competition and regulation

- Public regulation is not a purely technical issue; in reality, the choices it involves represent different visions of economic democracy and social priorities. The dominant practice today is competition under different kinds of regulation.

- An effective transport system requires the co-ordination of public choice and market need. Public service levels, often specified by the authority, are not certain to respond to market demand. More flexible formulae need to be built into the contract; not just regulation of services but monitoring of the market is needed. The stability and predictability of transport services are at least as important as their efficiency.

- Competition works best where the actors concerned would be no more efficient than public operators, in instances when it would be more expensive for the State to award a concession for public infrastructure to a private enterprise. More research on regulation is required. We need to know more about the national and international impact of regulation. When speaking of regulation, the positive potential of technology and engineering development should not be underestimated.

The role of modal split and pricing

- Forecasts show that freight traffic will increase much more than passenger traffic in the medium and long term. At the same time, it will not be possible for rail transport in the new member countries to maintain the same share of transport as before.

- The development of an attractive railway system is probably impossible without state subsidies. The question is volume. There are some good examples of cross-financing (the transfer of resources from the road sector to the rail industry), but this is a very sensitive area.

- Better co-operation between partners and better supply-chain management could open up new opportunities for revitalising the railways, as one competitive alternative among a range of increasingly complex intermodal transport solutions.

- One of the most interesting questions raised was: why do human beings need more and more mobility? There are several examples of "living cities" where car transport has been replaced by public transport or "non-motorised" modes. However, more research is needed to gain a better understanding of the reasons for mobility and human behaviour.

- Charging is the basic tool for adapting to the requirements of sustainable development. However, efficient charging has limits which stem from practical implementation problems and demand elasticity.

Concluding Remarks

Michel VIOLLAND
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CONCLUDING REMARKS

Some of the issues debated by the more than 300 participants attending the Symposium were: the link between transport growth and economic growth; possible options for deregulation of the transport sector, or more specifically, whether regulation and competition were substitutes or complements; and the link between transport and environmental sustainability.

The following is a short summary of the discussions that took place at the Symposium.

1. TRANSPORT AND ECONOMIC GROWTH: WHICH INTERDEPENDENCIES?

The first issue addressed at the Symposium was the impact of major investment in transport infrastructure on economic development.

1.1. Investment in transport infrastructure, a growth factor?

1.1.1. At the level of the economy

There is no disputing the fact that any new substantial investment in transport infrastructure has a knock-on effect that creates more aggregate demand in the economy. When aggregate demand rises, aggregate supply rises with it and, consequently, output increases. In order to keep pace with higher output, employers take on more employees, thus helping to generate a salary surplus that will, in turn, lead to additional spending. This new spending prompts a further increase in output and salaries, but also in investment to keep pace with new demand. The mechanism that has just been described is the multiplier effect of investment on which Keynes laid so much emphasis. According to this principle, new spending generates additional income which, in turn, will translate into consumer spending and investment and thereby fuel a further increase in production.

The Symposium did not dispute that this reasoning was applicable to major infrastructure projects. Nevertheless, there are a number of qualifications that warrant mention. The first is that it is by no means certain that spending on transport infrastructure is the area of expenditure which produces the greatest induced effects. Other types of spending are likely to have an equally comparable, if not an even greater, impact on output growth and therefore on job creation. This is one qualification which should always be kept in mind. Secondly, if the increase in expenditure to finance investment produces a budget deficit, then borrowing to finance that expenditure will generate competition with other borrowers, who will either be crowded out or will have to pay a higher rate for their own finance. This is one of the contradictions of the theory, which disregards the fact that a deficit leads to a rise in interest rates in the long-term. It may well be that the government budget is in balance, in which case this objection ceases to be so significant.

A last point to note is that borrowing to fund investment lays the burden of debt repayment on the shoulders of future generations: while borrowing certainly improves the situation on the employment front in the short term, it does so at the expense of a long-term improvement.

As these points raised in the course of the discussions at the Symposium show, investment in transport infrastructure in order to maintain demand calls for certain precautions to be taken. These include having a balanced budget for government expenditure at aggregate level and ensuring that investment in transport is the most appropriate use of resources.

1.1.2. At the local level

Is investment in transport infrastructure likely to promote local development? In this regard, it is essential never to lose sight of the fact that transport infrastructure cuts two ways: it can import competition as easily as it can export it. Regional industries may be weakened or falter in the new wind of competition. It is only regional industry's capacity to turn new opportunities to its advantage that will dictate whether the regional labour force can expect an improvement in its situation. Indeed, it is through its ability to mobilise capacities such as research and development and sources of finance, and to consolidate local operation through the provision of competent administrative services, that a region can reap the benefits of new transport supply. By reducing generalised transport costs, the new transport supply can enlarge the market area of local industries, but the same can be said for any point of access to the new infrastructure. For instance, it has been noted that industries are set up close to motorway access roads. So, when any major new section is brought into service, it is to be expected that it will attract industries. Here, too, these may be firms which relocate in order to take advantage of new opportunities: there will only be a net benefit if the economic gains provided by the new infrastructure take the form of an increase in productivity for the economy as a whole. Where this is not the case, one region's gains may be offset by another region's losses.

Another factor which should not be overlooked is the fact that new infrastructure generates additional mobility: this is the induced mobility phenomenon. Since governments in Europe share the objective of environmental sustainability, the wider issue which now arises is the problem of decoupling economic growth from transport growth. New infrastructure construction certainly is not conducive to decoupling the two.

1.2 Decoupling is not straightforward

1.2.1. Freight transport growth factors

In the freight transport sector, globalisation and the global economy are powerful growth factors for international trade. The interconnection of markets and information on a global scale which the Internet permits are behind that growth. Integration into the global economy is the aim for practically every country, regardless of its stage of economic development. As a result, international transport is growing faster than national transport and the trend is towards an increase in average distances travelled; another phenomenon we are currently witnessing is growth in transit traffic.

In Europe, the end of Communism and enlargement of the EU have brought about an unprecedented surge in foreign direct investment in new ECMT Member countries. This new division of labour has led to an increase in international trade. The fact is that the vast bulk of this trade is by road. It is the road freight transport sector which has benefited from these new developments in Europe. More flexible and offering higher quality services which perfectly match the expectations of freight forwarders, road freight transport has cornered this growth in trade. This trend seems to be irreversible in the short term. What is true on a Europe-wide level is also applicable at the national level, where road freight transport is winning market shares from its competitors. All of this makes talking about decoupling -- in the sense that transport might grow at a slower pace than the economy -- seem extremely difficult, not to say impossible, in a regulatory, fiscal and institutional context that remains unchanged.

Later in the course of the Symposium, possibilities for policies based on charging were discussed and are reported in section 3.2. They are based on ways of increasing transport productivity. It is worth noting that, in the CEECs, the new economic developments have led to a decline in freight transport, in which the rationalisation of production processes has been a contributing factor. At the same time, road transport has won very substantial shares of the market from its competitors. There has thus been decoupling of a sort, but perhaps not with a reduction in environmental damage overall.

It is important to note this trend in the CEECs, where, although there has been a decoupling of transport growth from economic growth in absolute terms, relative decoupling from environmental nuisances proved possible only with vehicles that had lower emissions of environmental pollutants. While it seems impossible to influence modal split in the short term, absolute decoupling could be obtained by achieving better productivity levels from transport system architecture and relative decoupling by better technology

1.2.2. Passenger transport growth factors

In the passenger transport sector, the Symposium showed that perceptions and cultural heritage were strong determinants of behaviour. The fact is that we have created an environment which encourages the use of the car, which is highly prized by society. It should therefore come as no great surprise that there has been a steady increase in car ownership and that many households own more than one car. To change these perceptions we shall first have to overcome resistance. The Symposium discussed ways of doing so through charging, taking the London congestion charging scheme as an example. The discussions on this issue are reported in greater detail in section 3 below. Before that, the Symposium discussed the interdependencies between competition and regulation.

2. COMPETITION AND REGULATION: SUBSTITUTES OR COMPLEMENTS?

2.1. Substitutes

The Symposium took note of the various examples of deregulation in the transport sector throughout the developed world. In the air transport sector, regulatory changes had enabled a reduction in fares of at least 50 per cent by enhancing competition and facilitating the entry of new companies on the market. In the freight transport sector, enhanced competition in road transport had enabled a reduction in prices of over 40 per cent in Ireland, for instance. The experts at the Symposium unanimously acknowledged that the introduction of greater competition was in the interest of consumers on the busiest routes. Moreover, it was with the interests of the end-consumer in mind that the shift towards deregulation of the basic sectors and the transport sector in particular was first initiated. It was accompanied by a diversification in supply, as each company sought to make its mark and differentiate itself from the competition. This meant that, as well as cheaper services, a greater range of services was provided. At the same time, stiffer competition on the various segments of the market pushed companies to seek productivity gains. Competing firms thus became more efficient and the economy as a whole gained by becoming more competitive.

Judging from the many examples given in the course of the Symposium, one can safely say that it is possible to reduce regulation in the economy and that, in most cases, doing so benefits the end consumer. This said, not all the experts at the Symposium agreed that this always and definitively brought gains in every situation. Furthermore, there was still a role for the public authorities in the deregulated sectors, if only to supervise them. In this regard, competition and regulation are complementary.

2.2. Complementarity

2.2.1. Less populated areas

While on busy routes there is no doubt that greater competition is positive, in less populated areas or tight markets, the trends are less convincing and debatable. In some cases, air transport between less popular destinations had been disrupted, while in others organisational gains helped to maintain services but with smaller airplanes. As regards public urban transport by bus, the overall situation in the United Kingdom had given rise to a great deal of criticism but the level of subsidy was very appreciably lower after deregulation. So, it would seem that the level of service can only be maintained with subsidies in cases where the innovative dynamic expected from deregulation has not come up to expectations.

2.2.2. Firms as the main actors

One constant feature of deregulation, which appears to have been borne out by experience, is the trend towards concentration in the sectors concerned. The price reductions conceded can sometimes amount to more than the productivity gains which can be realistically achieved and, where that happens, the sectors concerned see company failures along with a trend towards concentration. This is what prompted some of the experts at the Symposium to say that the main actor is not the market, it is the firm. From competition, we may be moving towards different forms of oligopolistic market, and it can be said that this is a trend which has been noted in many of sectors which have been subject to deregulation. This issue raises the question of the importance of regulation and, hence, of the regulator himself.

2.2.3. The role of the regulator

The regulator's tasks are both numerous and extremely important, namely: ensuring that there is no abuse of dominant position, that all consumers receive equal service, that no excess profits are extracted at the expense of end users and that asymmetries in information do not lead to a quasi-monopoly rent situation; ensuring service continuity and availability at all points; ensuring that research in technology can be amortized and that there is a reasonable return on capital; maintaining conditions in the sector close to those of the competition, etc. The Symposium reviewed some of the basic requirements in this regard. First, the regulator has to be independent and free from any political pressure. However, this is easier in theory than in practice in that a regulator has to be appointed. Should the regulator be appointed by the Prime Minister or by Parliament? To whom should the regulator be accountable? One way to ensure the independence of the regulator would be to make the term of office longer than the term of government. However, even this does not ensure total independence. The Symposium took note of the fact that in this particular area thinking clearly had to progress.

The mission of the regulator could be specified in the constitution so that no pressure could be brought to bear to influence the regulator's course of action.

It was also important to ensure that the regulator could not be subject to capture by the industry which he or she regulated. This was where asymmetries in information came into play. If the regulator did not have adequate expertise to remain aloof from the inevitable lobbying by industry, he or she would not be in a position to evaluate the situation objectively. The experts at the Symposium maintained that the regulator should not be too close to the industry he or she was responsible for regulating, so as not to be vulnerable to capture by it and to be able to apply to it lessons and experience gained in other sectors. This was the concept of "yardstick competition".

As regards the scope of the relationships between the regulator and industry, contracts should not be over too long a term, in order to prevent the sector from becoming stagnant for a long period. In addition, contracts should leave room for innovation, which stimulates progress. Agreements run the risk of hemming the parties into situations which no longer reflect the degree of technological innovation or cyclical and structural changes in the market. The regulation of a sector as international as the transport sector should be designed to do away with borders and should be technology-driven, given the progress in this area. In some instances, the participants at the Symposium highlighted the possibility of having European regulators, since borders were increasingly becoming a meaningless concept at the European level.

A last point to note is that the regulator should be able to fund his or her work from industry resources; again, so that he or she is not subject to political pressures and in order to guarantee independence.

This overall discussion on the role of the public authorities at the Symposium extended to another area of study: environmental sustainability.

3. TRANSPORT SUSTAINABILITY

3.1. The part played by modal split

Effecting a modal shift towards rail has been constantly on the European policy agenda, more specifically in the freight transport sector, for the past 30 years or more. The record is a disappointing one. In long-standing ECMT Member countries, for instance, rail's market share declined from an average of over 25 per cent of inland transport to less than 15 per cent over the period 1980 to 2000. Although the facts clearly show otherwise, politicians still sometimes persist in setting growth targets for the modal share of rail transport.

What prompts policymakers to do so is that the environmental performance of rail has been assessed as being better than that of road transport. However, this analysis is now less accurate and will become increasingly so: advances in HGV technology along with more stringent requirements for vehicle certification are such that road transport vehicles will clearly be more environmentally friendly than diesel traction engines. Where electric traction is used, the question we need to ask is: what is the source of its electrical power? If the source is thermal power, then the environmental evaluation, in terms of greenhouse gas emissions, is not necessarily in rail's favour and if the source is nuclear power, then the question of waste management arises. In view of this, the participants at the Symposium forcefully made the point that, while the environmental assessment of railway traction engines was still better than road for now, it would not necessarily be so in future.

Since the environmental assessment no longer appeared to favour one mode over another, in the future there would be steadily fewer grounds for concentrating on the modal share of rail. Specifically, it was stated in the course of the Symposium that the modal share of rail should not be an issue of concern. What emerged more clearly was the need to allocate the costs of rail services and segment the markets so that services would be supplied only for growth markets. Rail was not in the business of providing a universal service, rather, just like any other service provider in a competitive market, namely, the freight haulage market, it should be concentrating on products that brought a profit. The profitability issue was a tricky one, since given the degressive cost structure of rail, marginal cost pricing showed losses. It was therefore difficult to baldly state that only profitable services were suitable. Nevertheless, it was possible to single out the main centres of loss and withdraw from them.

While focussing on a specific modal split was not warranted, one issue remained valid and that was the effect of different transport prices on modal development. The example of roads and congestion tolls was considered at the Symposium.

3.2. The role of charging

3.2.1. The London scheme and lessons learned from it

The Symposium primarily highlighted the role that can be played by transport prices which reflect environmental and congestion costs more accurately. The congestion charging scheme recently introduced in London attracted a great deal of attention. The (£5) toll charged to enter the city centre reduced road use by private cars by approximately 15 per cent. The main winners from the scheme were bus services and bus users: more passengers could be carried and journey times were shorter. Somewhat harder to estimate was the impact on the retail trade, since it appears that there was a drop-off in the number of visitors to the central London area, although the decline could prove to be temporary. Clearly, the reduction in congestion was greater than the Government had expected, with the result that revenues from the scheme have not been as high as hoped. The main lesson to be learned from the scheme is that traffic is more price-elastic than initially thought. This holds out the possibility that transport trends can effectively be influenced through appropriate charging. Practice in so doing is lacking, although there is no shortage of theories. The main obstacle standing in the way of more widespread use of the moderating role that prices can play is public acceptance. Identifying the winners and losers of a strategy aimed at giving a greater role to incentive pricing is one of the major challenges ahead. The redistributive effects of appropriate pricing are perhaps regressive, but with an overall policy which aims at developing alternative methods, while giving due attention to a wide range of mutually dependent methods to counter such effects, gains could be made practically all across the board.

Again with regard to the London road charging scheme, the point was made that measuring congestion costs against free-flowing traffic conditions as the baseline makes no sense; there is an optimal, socially desirable level of congestion. This is what balances out the additional utility for the marginal user and the level of cost generated by that user's trip. Similarly, the revenues generated by congestion charging are the monetary expression of time savings. They cannot be double-counted as times savings and resources. It is nonetheless true that congestion charging can achieve a reduction in congestion and in environmental damage and, at the same time, generate resources. It is possible to win across the board if an integrated strategy is put in place aimed at offsetting the regressive effects on revenue distribution. This could be achieved by reinvesting the revenues earned from public transport which enables the least well-off to travel without having to use the car, which has become particularly expensive.

Would congestion charges make the attraction exerted by urban areas even stronger? If congestion charges are applied to the entire urban area, no single area is favoured and transport becomes more expensive throughout the city. This could well exert a stronger attraction, given that quality of life would also improve with city-wide congestion charging. In the case of cordon tolls, there might be reason to fear that, unless companion measures were implemented, the toll zone could eventually become gradually deserted. Housing and businesses might move to the city outskirts, where public transport has immense difficulties in providing services for substantial fringe populations.

The optimum toll charge was not explicitly discussed in the course of the Symposium, other than to state that it should be based on marginal social costs. In response to the argument that marginal social costs are difficult to evaluate and vary with time and space, the participants at the Symposium made two points: first, that the price of a good is never the same everywhere, it is subject to variation; and second, that advances in electronics would shortly enable very accurate allocation of the costs generated.

In the freight transport sector, too, one might also envisage giving a greater role to transport prices which incorporate environmental and congestion costs. However, applying these principles to an activity which spans the whole of Europe must be conducted from a perspective that is similarly European, for reasons relating to interoperability, *inter alia*, but not just for that reason. Gaining in economic efficiency by seeing that the international authorities play their full role is one of the major challenges in today's context.

3.2.2. User charges as an instrument of efficiency

If all costs are allocated to those who generate them, economic efficiency will improve, as this will prevent over-consumption of transport. This is why some of the experts at the Symposium took the view that charging the true cost was an instrument which contributed to overall economic efficiency rather than countering it. Just because external costs were not measured and allocated did not mean that they did not cause harm to the economy. By factoring these costs into the decisionmaking process of the various actors -- by making them visible -- we would gain in efficiency. This was why decoupling through charging did not run counter to economic growth, even though some experts took the more conventional view that any increase in transport prices would be detrimental to the international division of labour. Others considered that the international division of labour should not be subsidised through flawed transport pricing.

3.2.3. User charging for basic services

With recent progress in electronics and GPS technology, there was the real possibility in the near future of setting up road user charging systems which closely reflect the marginal social cost of road use on all roads. On congested infrastructure, funding could be raised for new infrastructure on the most frequented routes. Another option which could then be a possibility would be a two-part charge, with a flat charge to cover the fixed costs of infrastructure and a variable part which would cover marginal costs. In this way, road would finance its own costs. Thus, the idea that emerged in the course of the Symposium was that road could be considered as a basic utility which would self-finance its own maintenance and development. In most developed countries, road usage generated more resources than it needed to finance its own maintenance and development, but that was not the case everywhere and particularly in the new ECMT Member countries, where maintenance needs were high. Considering road as an essential basic service like water or electricity and reassigning to it the revenues it generated -- breaking with a unitary budget -- was one possible development that, in the Symposium's view, could not be dismissed. Should there be a surplus of revenue over expenditure, that surplus could be allocated where it would maximise the socioeconomic return on the capital freed up. That, at any rate, was one of the points of view expressed at the Symposium.

From this standpoint, the issue of public-private partnerships for the financing and construction of major roads was stressed. Among other things, it was pointed out at the Symposium that the increase in subsidies needed to finance the least profitable projects was not much higher for private sector participation than it was for the public sector. Adding to this the fact that the private sector is generally more cost-effective in running the operation, and therefore cheaper, it is hardly surprising that private sector participation is sought for projects with low rates of internal return. This was probably the most cost-effective solution.

4. CONCLUSIONS

The possibilities offered by electronic tolls and GPS are such that transport prices close to the environmental and socioeconomic optimum are a possibility. It is safe to assume that the economy will not suffer, even if some trade-offs should be expected for distant regions where access to the centre would cost more. Economic decoupling of transport from overall growth could then be achieved and, at the same time, the impact of this decoupling could be enhanced through the advances in technology that the appropriate standards would disseminate throughout the economy. Congestion would also be prevented, while at the same time resources required for infrastructure upkeep and development would be freed up. Separating road infrastructure from the general government budget and allocating to road -- just like any other basic service -- the resources raised from road, would seem to be one major change which should be promoted. The thread running through all of these points, as indeed through the Symposium's discussion on the functions of a modal regulator or a regulator specifically for the transport sector, was the European dimension. Deregulation clearly could not be regarded as a panacea and it was effectively through the exchange of experiences that imaginative, integrated solutions could be found.

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