Reforming private and public urban transport pricing

Stef Proost

Economics – KULeuven

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Road congestion in Paris

Addressed with cheap public transport which gave us ...

Metro in Paris at peak hours

Main message

- In many metropolitan areas and in peak periods, PT has a larger market share than private road transport and its pricing is suboptimal
- Public Transport has an important role to play in urban areas, but
  - Cheap PT cannot substitute road pricing
  - Road pricing AND reform of PT pricing are necessary
- Difficult political message, decentralisation of pricing to city level may help

Outline

- First principles of pricing of road and PT
- Some numerical evidence
  - Stockholm
  - Paris
- Getting political support for a pricing reform
- Conclusions

First principles road pricing

$$\textit{Road toll}_{t} = \text{marginal external cost of a car}$$

$$= \text{marginal external congestion cost} + \text{other external costs}$$

$$= \sum_{\text{all road users}} \text{cost of additional delay due to extra vehicle}$$

$$+ \text{ environmental and accident costs generated by this vehicle}$$

First principles PT pricing + frequency

bus fare = marginal cost of an additional bus user

= marginal external cost of an additional bus user

= additional time cost for other users due to mounting and alighting of an extra passenger

+ additional crowding discomfort costs of an additional bus user.

OPTIMAL FREQUENCY

Benefits of an extra bus = Saved waiting cost + Saved discomfort cost

Costs of an extra bus = extra congestion delay to other road users + rental cost

+ operation cost of one bus + external environmental and accident costs of a bus.

Second best pricing of PT

bus fare = marginal external cost of an additional bus user corrected for effect on the car market

= additional time cost for other users due to mounting and alighting

+ additional crowding discomfort costs of an additional bus user

- (ratio of new bus users that leave their car) x (marginal external road congestion cost - toll)

"DIVERSION RATIO" = ?0.15 to 0.35 ?

- When a reduction of fares of PT attracts 100 new passengers, 15 to 35 are ex car users
- If DIVERSION RATIO = 1, then pricing public transport is sufficient (except for deficit financing)

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- First principles of pricing of road and PT
- **Some numerical evidence**
  - **Stockholm (model of one corridor to the city but probably good cross-price elasticity information)**
  - **Paris ("full" model of the city)**
- Getting political support for a pricing reform
- Conclusions

STOCKHOLM CORRIDOR: Replace uniform bus prices by high peak bus prices, and off peak prices can decrease to 0

Scenario	Road toll Peak in €/trip	Road toll Off-Peak in €/trip	Bus fare Peak in €/trip	Bus fare Off-Peak in €/trip	Frequency Peak Bus/hour	Frequency Off-Peak Bus/hour	Deficit 1000 €/day	Welfare Gain In 1000 €/day
Reference	1.80	1.00	2.18	2.18	67	48	25.86	
Optimal Bus fare	1.80	1.00	**4.50**	**0.00**	67	48	26.54	12.58
Only change frequency	1.80	1.00	2.18	2.18	**92**	**13**	15.38	22.20
Optimal toll, bus and frequency	**4.31**	**3.32**	**4.90**	**0.97**	**84**	**20**	-2.95	36.97
Zero car toll and optimal bus fare	0	0	**4.10**	**0.00**	67	48	30.19	14.12

STOCKHOLM CORRIDOR: If all prices are optimal, higher tolls on cars and peak bus prices are not so much higher and subsidy for bus no longer needed

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STOCKHOLM CORRIDOR: How low should peak bus prices be if there would be no road tolls?

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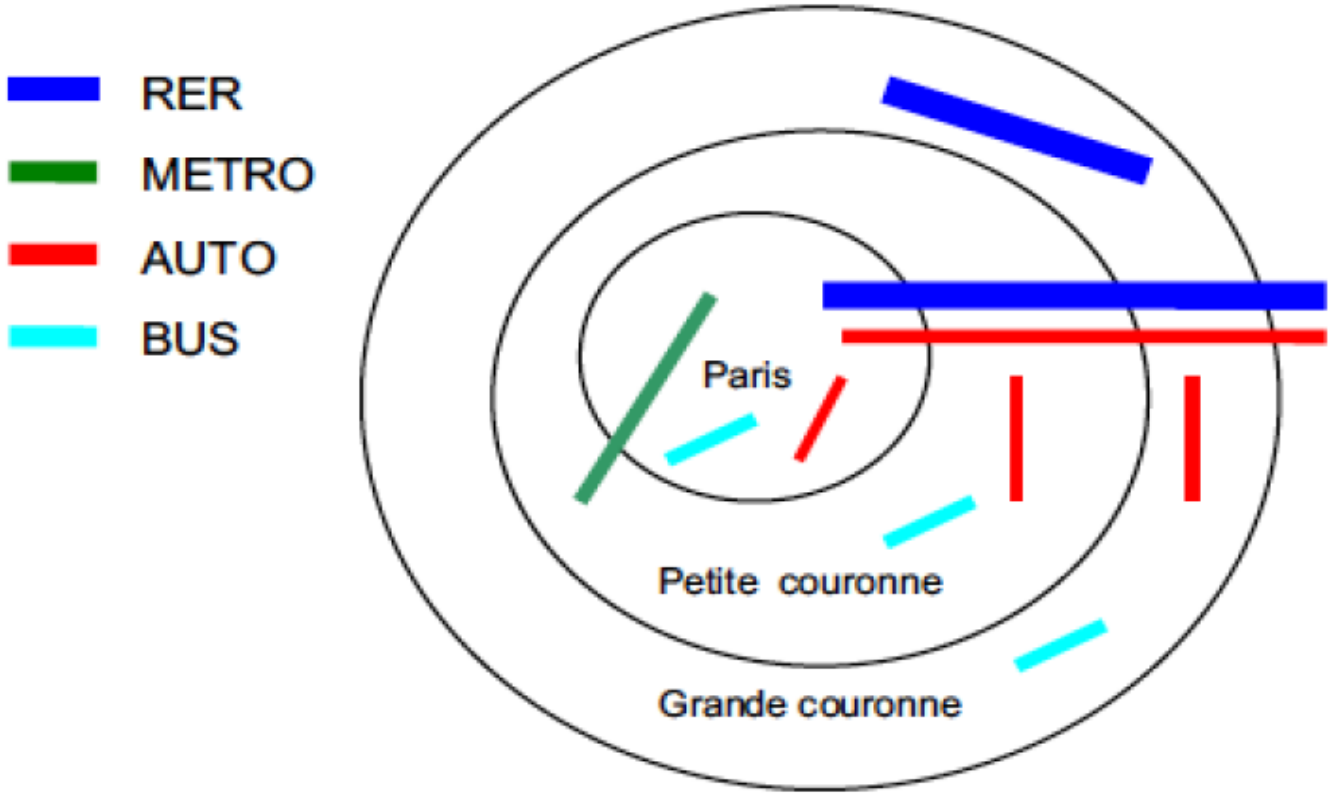
Conclude on Stockholm

- Need for higher peak bus prices whether road tolls are low or high

Paris: no road pricing – low PT prices

Figure 1 Model representation of Paris



4 categories of travellers: rich/ poor and working/not working, living in 4 zones
Calibrated to traffic survey

Do we need to complement the introduction of zonal road pricing of 3 Euro by an increase or a decrease of the PT fares?

- An INCREASE in PT peak fares generates more welfare than a PT fare decrease.
- Why? PT peak prices are already too low and not covering marginal operation costs so adding more users with low PT fares reduces welfare
- An increase in PT charges works better but hurts mainly the POORER households when net toll revenues are redistributed uniformly.
- When a double weighting is given to the utility change for the poor , the total efficiency of a PT price increase is still higher for society as a whole

Other elements

- Paris introduced flat monthly pass so that price becomes virtually zero ?
- London shows the nice example with peak/off peak differentiations and differentiations by zone
- Bottleneck congestion representation means steering finely departure times
  - Pricing pays off much more – in limit generalised price does not increase (one substitutes queuing by tolling)
  - For road but also for Public Transport
- Pricing improves locational efficiency
  - Supply of public transport relocates economic activity but net gain ("wider economic benefits") not clear

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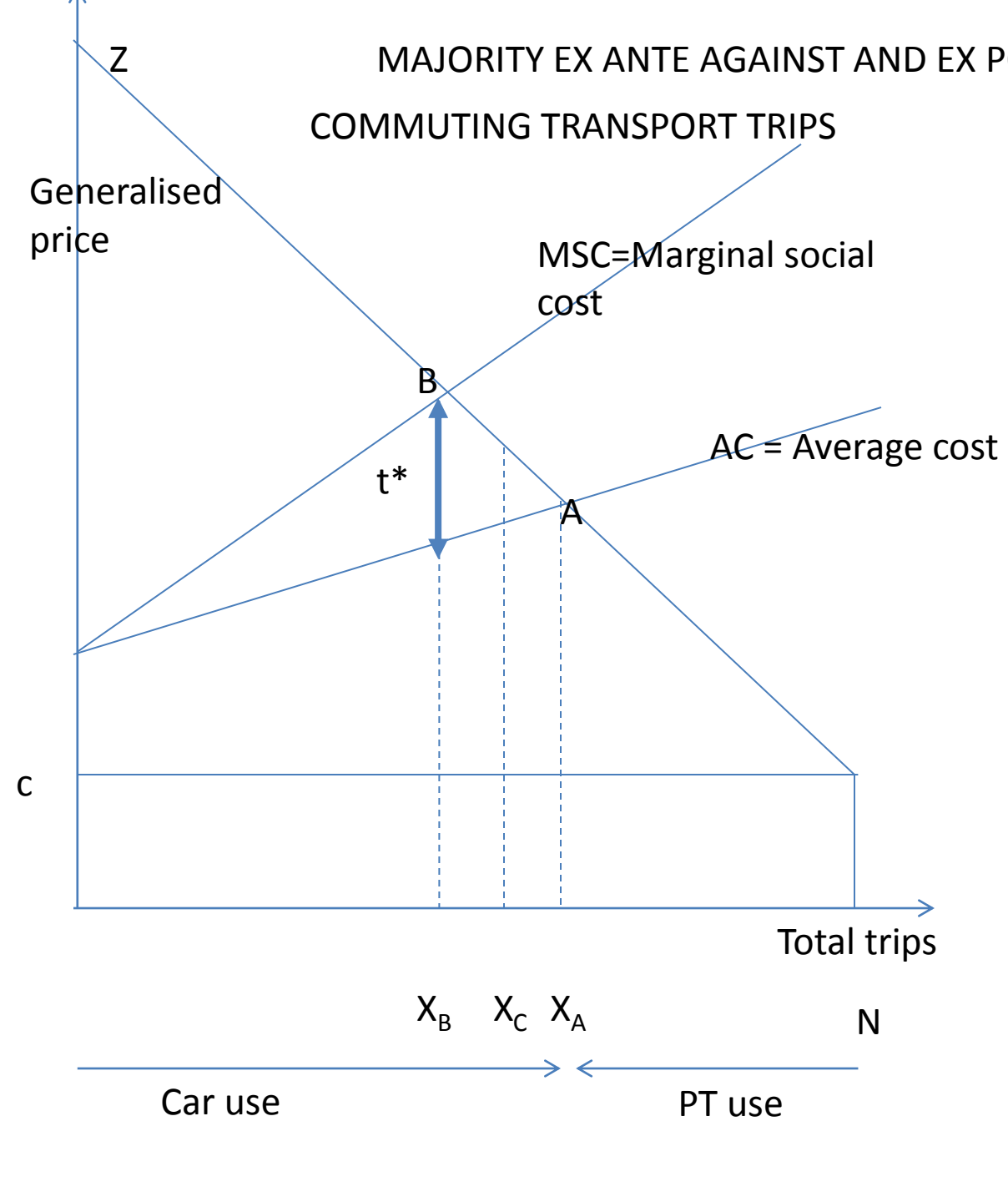
  - Paris ("full" model of the city)
  - Other elements
- **Getting political support for a pricing reform**
  - **Step 1: simple majority voting – fixed total demand**
  - Step 2: simple majority voting – price-elastic PT demand
  - Step 3: why not decentralise pricing and investment decisions?
- Conclusions

Reforming transport pricing is difficult – why?-

- When a total welfare gain exists, one can , in theory, via compensation make everybody better off via redistribution policies BUT
- Information asymetry: values of time and schedule delay costs are individual-specific:
  - everybody claims compensation…
  - low income may be poor indicator of welfare loss
- Political mechanism decides


MAJORITY EX ANTE AGAINST AND EX POST IN FAVOUR
COMMUTING TRANSPORT TRIPS
Z
Generalised price
MSC=Marginal social cost
B
AC = Average cost
t*
A
c
Total trips
X_B
X_C
X_A
N
Car use
PT use

Where is the majority?

- Road pricing is a typical reform problem
  - Majority ex ante against but ex post in favour
    - because there is an expected loss for most car drivers – they don't know how easy it is to adapt..
  - A referendum will not give a majority for an experiment
    - Because ex ante there is a loss for most drivers
    - Stockholm and London did not have a referendum before the test
- Promise to redistribute revenues to PT users via lower PT prices is efficient and may help to find a majority
  - IF total number of trips is price-inelastic

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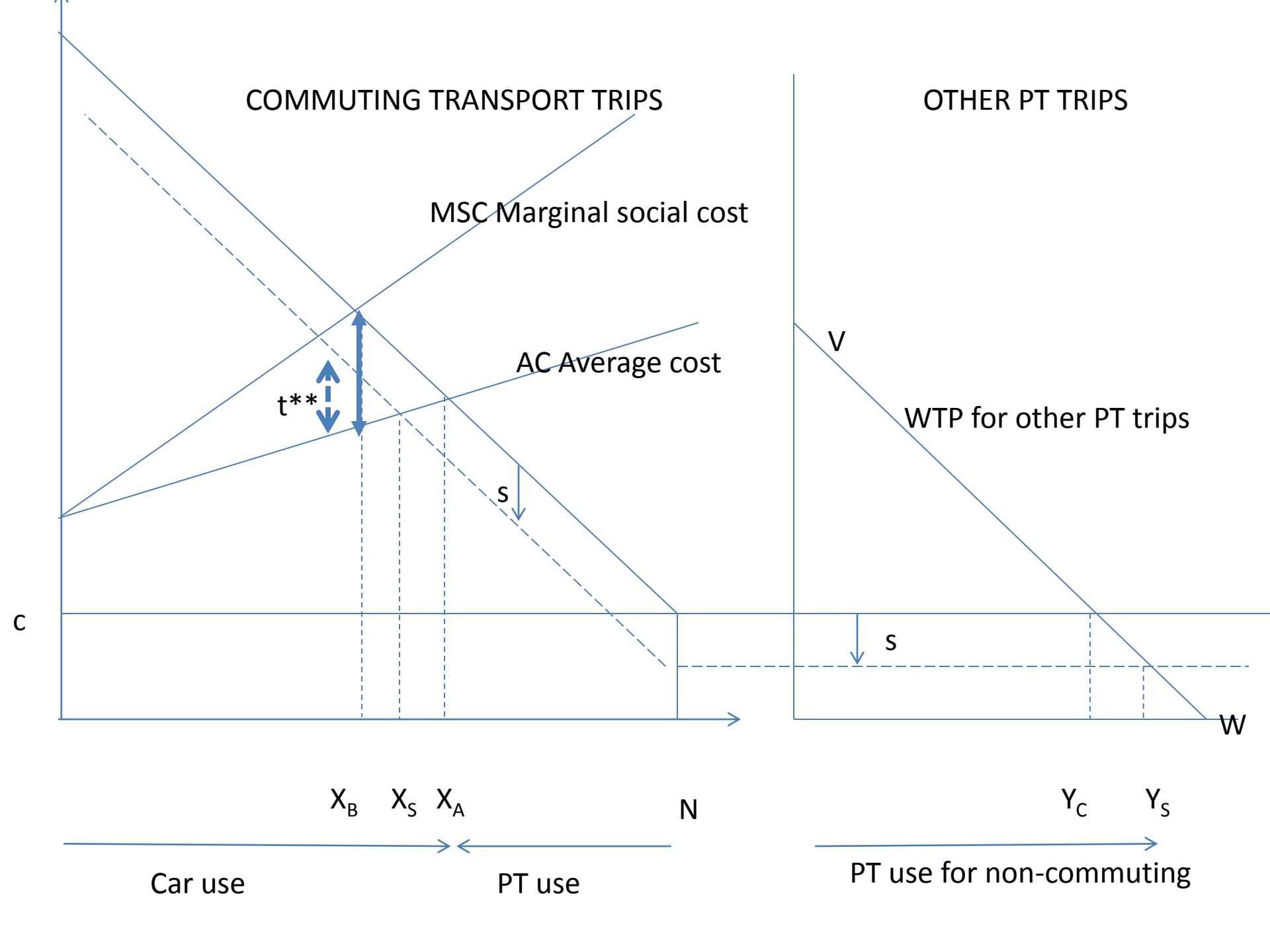
What happens with PT subsidies when public transport trips are price-elastic and diversion ratio (number of car users attracted) is small?

- Subsidy to PT attracts much more users – but this is costly to accomodate
- Once the PT prices are low, it is difficult to find a majority for the grand reform that is needed as both car users and PT users will object higher peak prices.


COMMUTING TRANSPORT TRIPS
OTHER PT TRIPS
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Y_C
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Car use
PT use
PT use for non-commuting

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Decentralise pricing to the metropolitan level?

- Opportunity is there as fuel consumption (traditional tax base) is disappearing in 10 years, in 20 years?
- Who can set prices?
  - Federal government – but constitutionally it is difficult to state that city A pays a different charge than city B
  - So differentiation of charges has to come from decentralised decision making

Advantages and problems of decentralised pricing

- Costs of PT system will become clear
- Use of city roads and PT system by outsiders forces the cities to charge at least the marginal cost and even more
  - otherwise the inhabitants are subsidizing the outsiders
  - RISK of too large charges on road and PT
  - Can be solved by a federal constraint that forces cities to invest all charge revenues into operation or infrastructure extension – this together with non-discrimination between inhabitants and outsiders guarantees optimal pricing and investment

Conclusions

- Most cities have poor pricing of road transport AND of public transport (large market share)
- Low public transport prices only won't solve the road congestion issue
- Peak pricing of road and PT users is needed
- Obviously difficult political message
- Making cities responsible for pricing can make it easier