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The Performance of High Speed Rail in France: From Appraisal Methodologies to Ex-Post Evaluations

Pr. Yves Crozet
University of Lyon (Institute of Political Studies)
Laboratory of Transport Economics (LET)

Contents

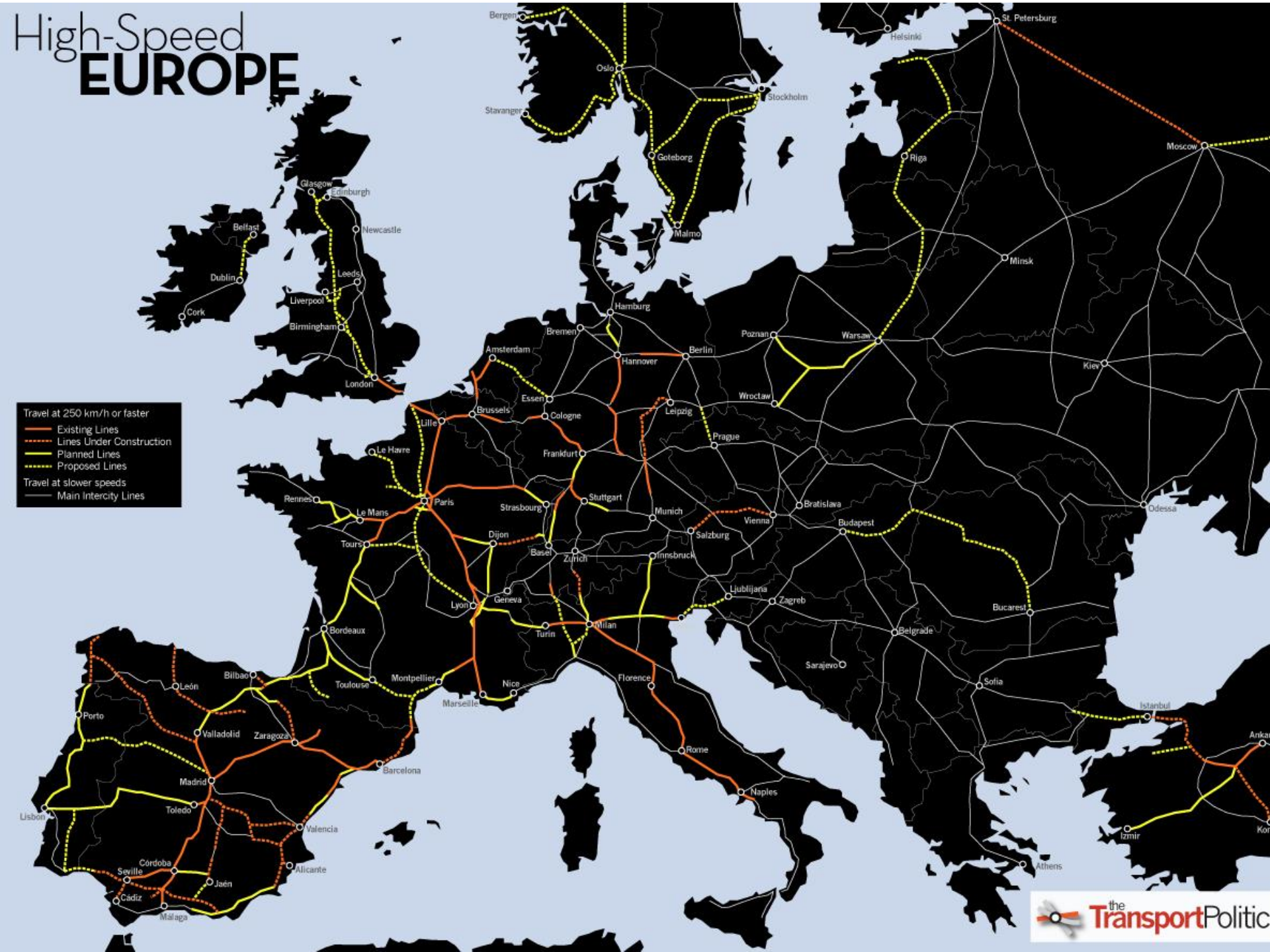
- 1) HSR "models" in Europe and in France
  - HSR in Europe: an overview
  - HSR in France: the Paris – Lyon « model »
- 2) The conditions of HSR success in France

3) Is French HSR network close to its optimal size?

European Union
White Paper goal n°4

- By 2050**, complete a European high-speed rail network.**
- Triple the **length of the existing high-speed network** by 2030 and maintain a dense railway network in all Member States.
- By 2050, **the majority of medium-distance** passenger transport should **go by rail**

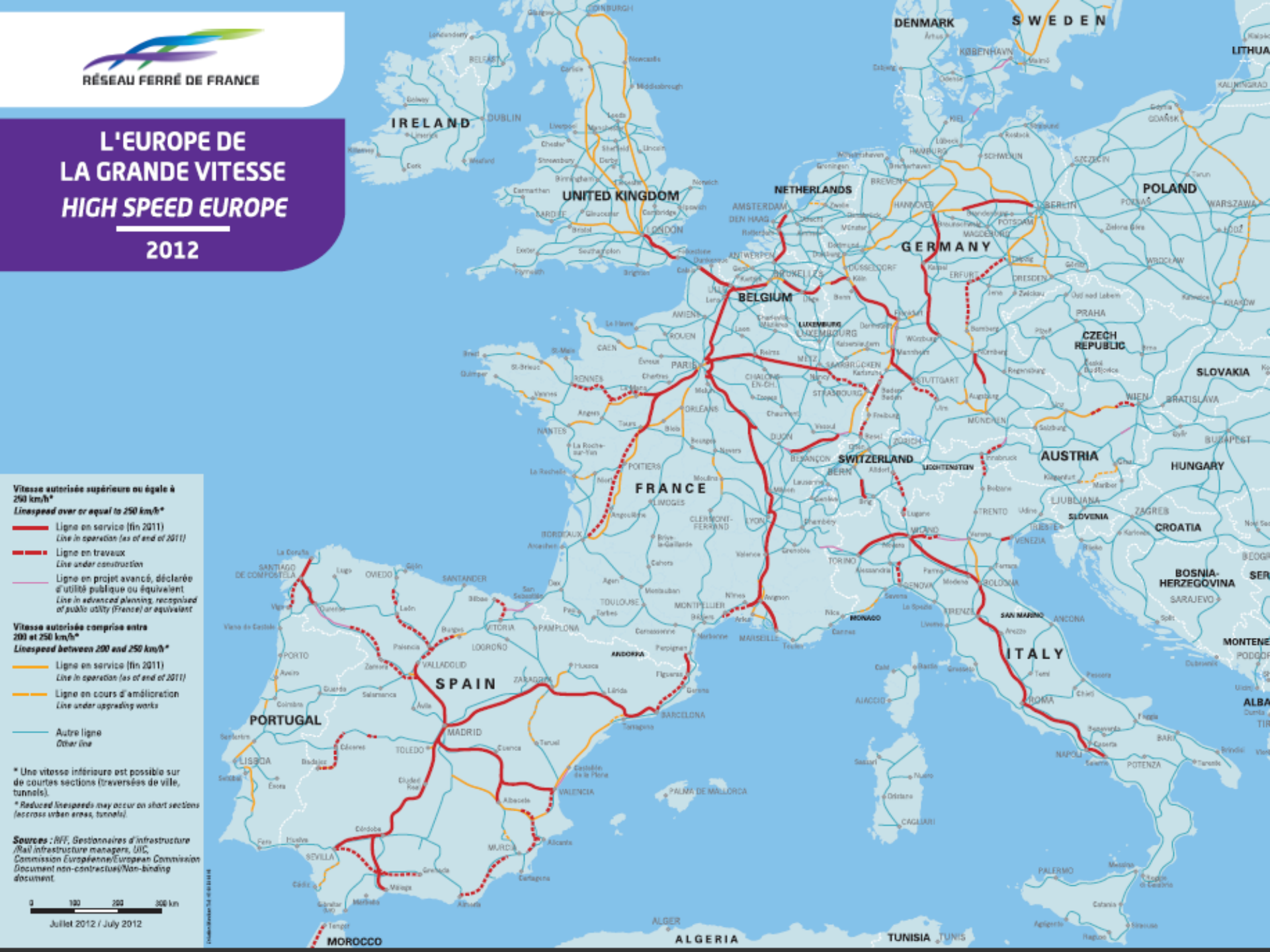
High-Speed EUROPE



RÉSEAU FERRÉ DE FRANCE

L'EUROPE DE LA GRANDE VITESSE
HIGH SPEED EUROPE

2012



Vitesse autorisée supérieure ou égale à 250 km/h*
Linespeed over or equal to 250 km/h*

- Ligne en service (fin 2011) *Line in operation (as at end of 2011)*
- Ligne en travaux *Line under construction*
- Ligne en projet avancé, déclarée d'utilité publique ou équivalent *Line in advanced planning, recognised of public utility (France) or equivalent*

Vitesse autorisée comprise entre 200 et 250 km/h*
Linespeed between 200 and 250 km/h*

- Ligne en service (fin 2011) *Line in operation (as at end of 2011)*
- Ligne en cours d'amélioration *Line under upgrading works*
- Autre ligne *Other line*

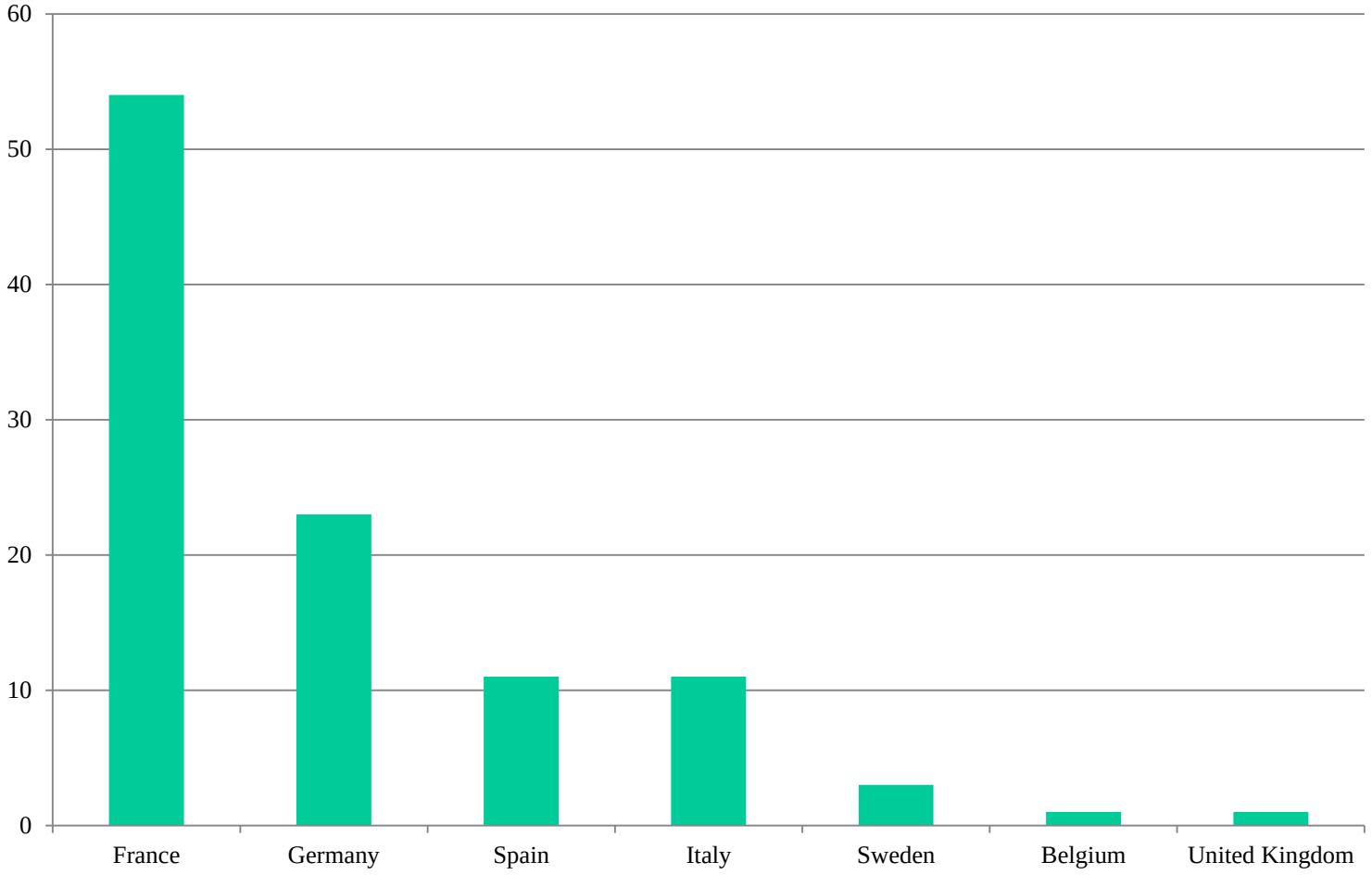
* Une vitesse inférieure est possible sur de courtes sections (traversées de ville, tunnels).
* *Reduced linespeeds may occur on short sections (across urban areas, tunnels).*

Sources : *RFF, Gestionnaires d'infrastructure /Rail infrastructure managers, UIC, Commission Européenne/European Commission*
Document non-contractuel/Non-binding document

0 100 200 300 km

Juillet 2012 / July 2012

High Speed Trains Traffics in Europe (Billion of pass.km/year)



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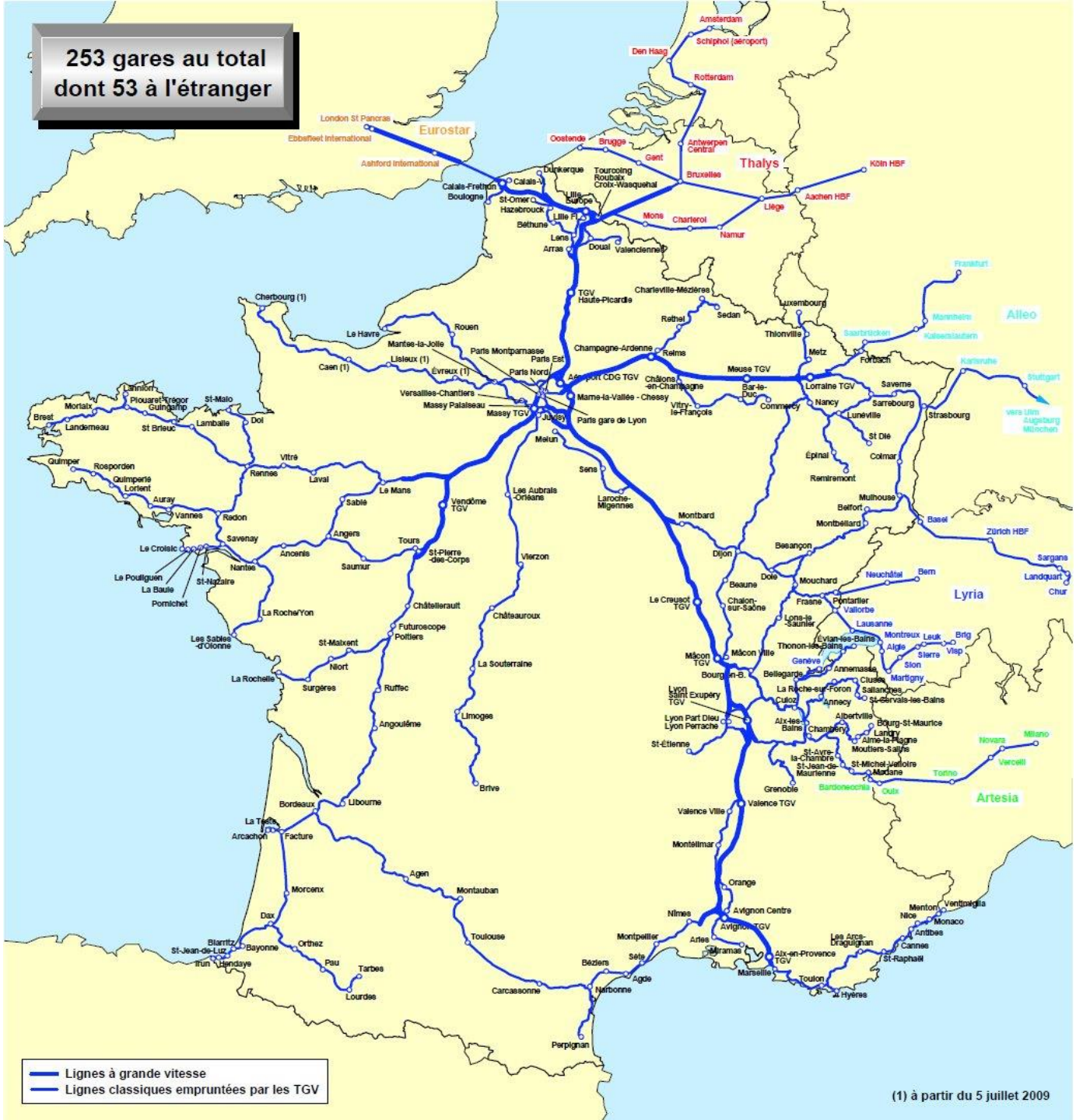
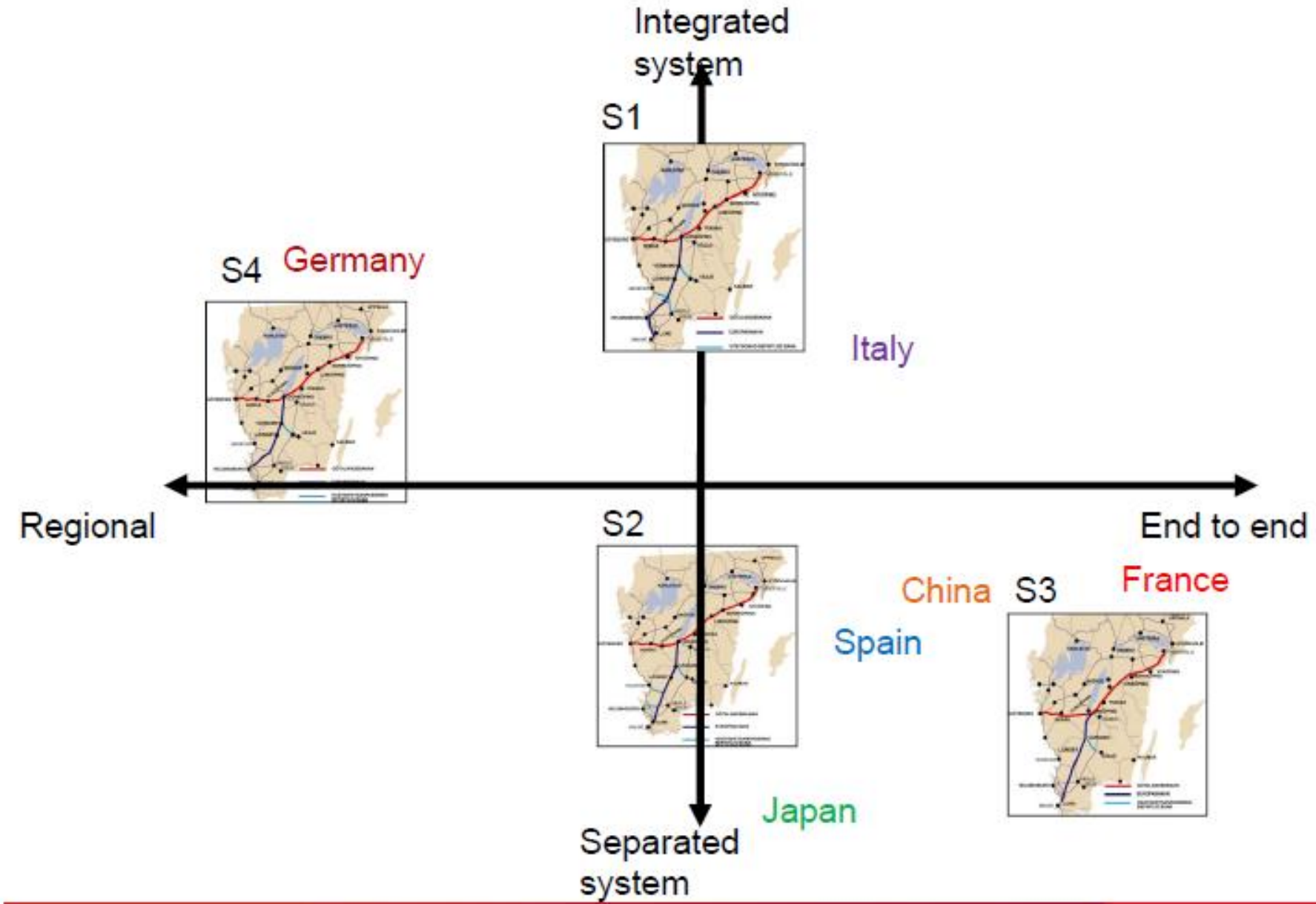

253 gares au total
dont 53 à l'étranger
Eurostar
Thalys
Alleo
Lyria
Artesia
London St Pancras
Ebbsfleet International
Ashford International
Amsterdam
Schiphol (aéroport)
Den Haag
Rotterdam
Oostende
Brugge
Gent
Anvers
Bruxelles
Köln HBF
Aachen HBF
Liège
Mons
Charleroi
Namur
Dunkerque
Tourcoing
Roubaix
Croix-Wasquehal
Calais
Calais-Fréthun
Boulogne
St-Omer
Hazebrouck
Lille Flandres
Lille Europe
Béthune
Lens
Arras
Douai
Valenciennes
TGV Haute-Picardie
Charleville-Mézières
Sedan
Rethel
Luxembourg
Thionville
Metz
Frankfurt
Mannheim
Kaiserslautern
Saarbrücken
Forbach
Karlsruhe
Stuttgart
vers Ulm Augsburg München
Champagne-Ardenne
Reims
Meuse TGV
Lorraine TGV
Saverne
Strasbourg
Lunéville
Nancy
Sarrebourg
Commercy
Bar-le-Duc
Châlons-en-Champagne
Vitry-le-François
Paris Est
Paris Nord
Paris Montparnasse
Aéroport CDG TGV
Marne-la-Vallée - Chessy
Massy TGV
Massy Palaiseau
Versailles-Chantiers
Juvisy
Paris gare de Lyon
Melun
Évreux (1)
Lisieux (1)
Caen (1)
Cherbourg (1)
Le Havre
Rouen
Mantes-la-Jolie
St Dié
Colmar
Épinal
Remiremont
Cannion
Plouaret-Trégor
Guingamp
St-Malo
Dol
Lamballe
St Brieuc
Landerneau
Brest
Mortaix
Quimper
Rosporden
Quimperlé
Lorient
Auray
Vannes
Redon
Vitré
Rennes
Laval
Le Mans
Sablé
Angers
Savenay
Le Croisic
Nantes
Ancenis
Saumur
Tours
St-Pierre-des-Corps
Vendôme TGV
Les Aubrais-Orléans
Laroche-Migennes
Sens
Montbard
Dijon
Mulhouse
Belfort
Montbéliard
Besançon
Basel
Zürich HBF
Sargans
Landquart
Chur
Neuchâtel
Bern
Dole
Mouchard
Beaune
Le Creusot TGV
Chalon-sur-Saône
Frasne
Pontarlier
Vallorbe
Lausanne
Lons-le-Saunier
Montreux
Leuk
Brig
Visp
Sierre
Sion
Evian-les-Bains
Thonon-les-Bains
Aigle
Genève
Annemasse
Bellegarde
Bourg-en-B.
Mâcon TGV
Mâcon Ville
Cluses
Martigny
La Roche-sur-Foron
Sallanches
St-Gervais-les-Bains
Annecy
Culoz
Albertville
Bourg-St-Maurice
Aix-les-Bains
Chambéry
Lyon Saint Exupéry TGV
Lyon Part Dieu
Lyon Perrache
St-Étienne
Aime-la-Plagne
Moutiers-Salins
St-Avre-la-Chambre
St-Jean-de-Maurienne
St-Michel-Valloire
Modane
Novara
Milano
Vercelli
Torino
Bardonecchia
Oulx
Grenoble
Valence TGV
Valence Ville
Montélimar
Orange
Avignon Centre
Avignon TGV
Nîmes
Arles
Miramas
Montpellier
Sète
Agde
Béziers
Narbonne
Carcassonne
Perpignan
Marseille
Aix-en-Provence TGV
Toulon
Hyères
Les Arcs-Draguignan
Cannes
Antibes
Monaco
Nice
Menton
Ventimiglia
St-Raphaël
Toulouse
Montauban
Agen
Brive
Limoges
La Souterraine
Châteauroux
Vierzon
Châtellerault
Futuroscope Poitiers
Ruffec
Angoulême
Niort
St-Maixent
Surgères
La Rochelle
Les Sables-d'Olonne
La Roche/Yon
Pornichet
La Baule
St-Nazaire
Le Pouliguen
Libourne
Bordeaux
La Teste
Arcachon
Facture
Morcenx
Dax
Orthez
Bayonne
Biarritz
St-Jean-de-Luz
Hendaye
Irun
Pau
Tarbes
Lourdes
Lignes à grande vitesse
Lignes classiques empruntées par les TGV
(1) à partir du 5 juillet 2009

A Swedish point of view



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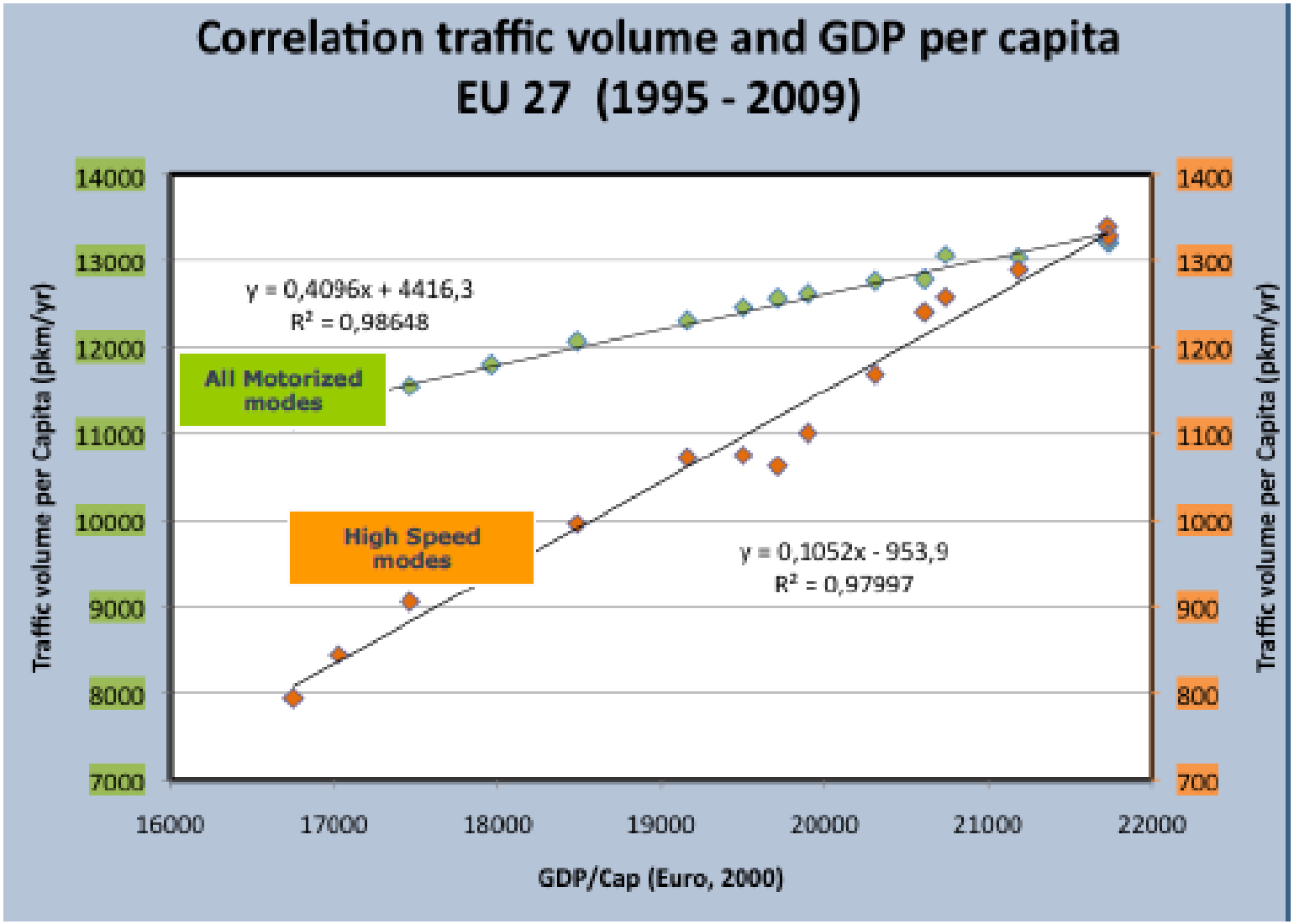
- 2) The conditions of HSR success
  - Demand side (intensity of traffic)
  - Supply side

3) Is French HSR network close to its optimal size?

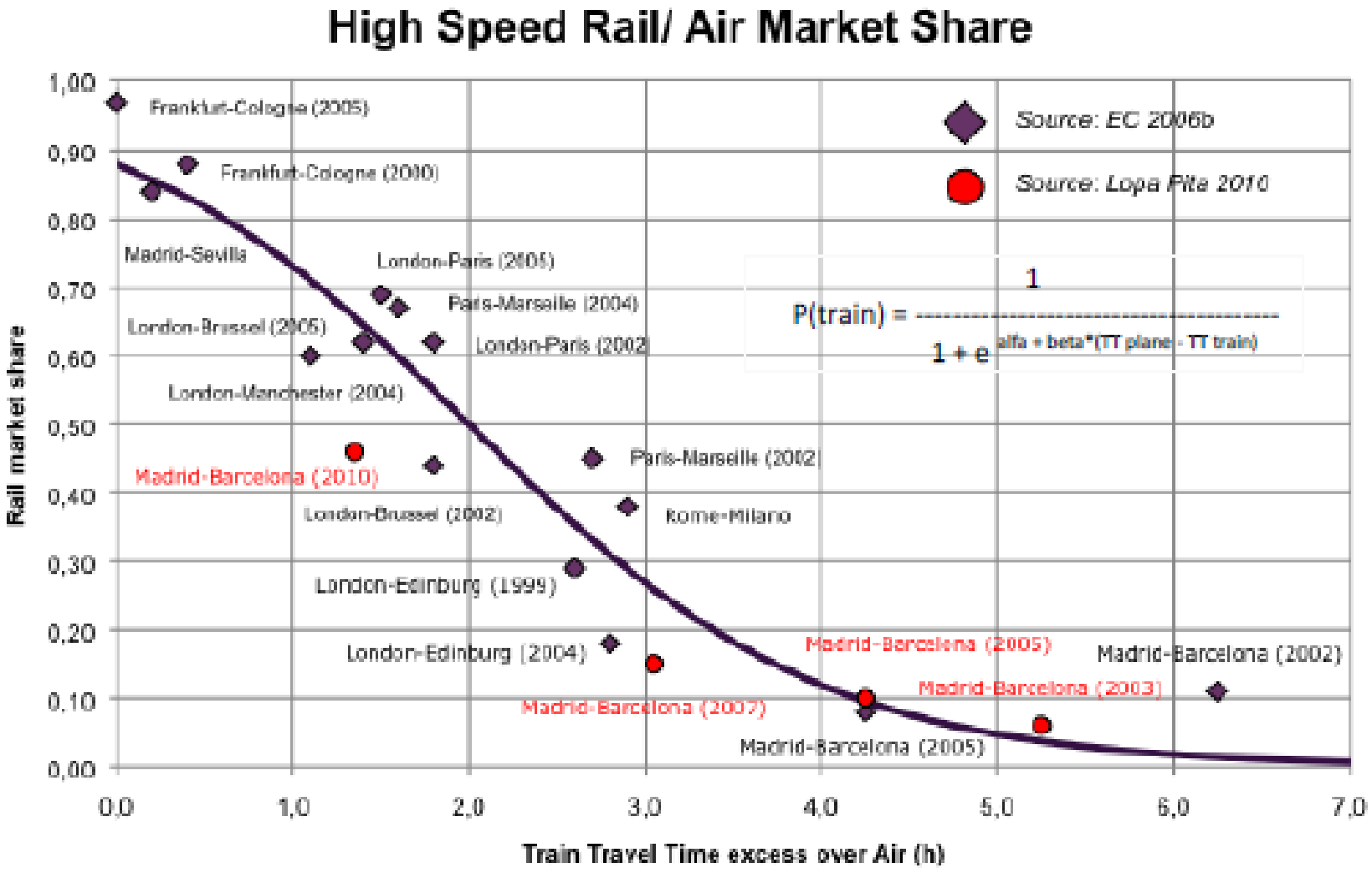
HSR: the key factor of success

- Geography: size of the cities, distance between cities (gravity model)
- Economy: level of life
- History and institutions
- Rail industry + rail operator
- Technology
- Politics….

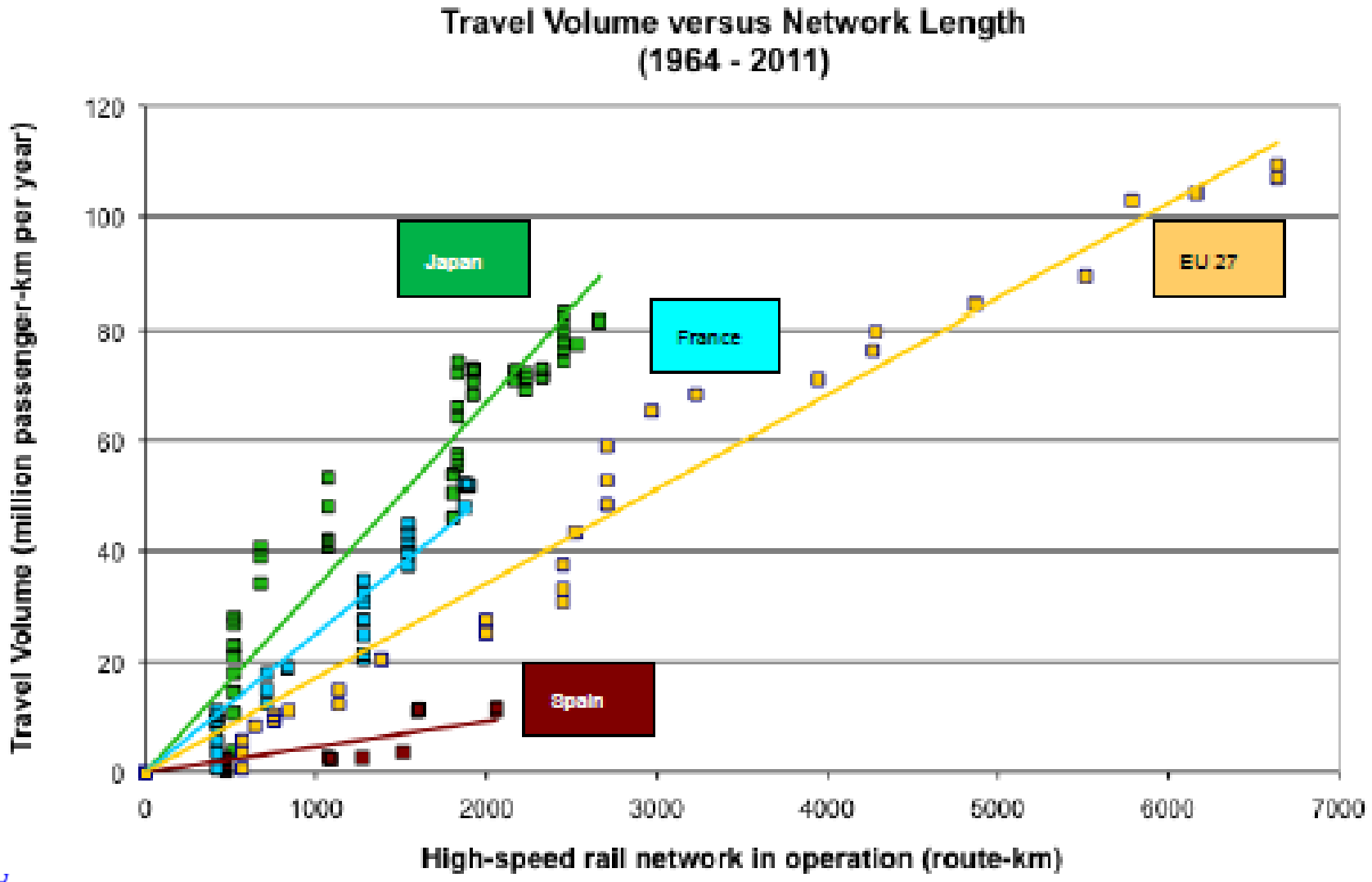
Passenger Mobility: the demand for speed



HSR market share and travel time



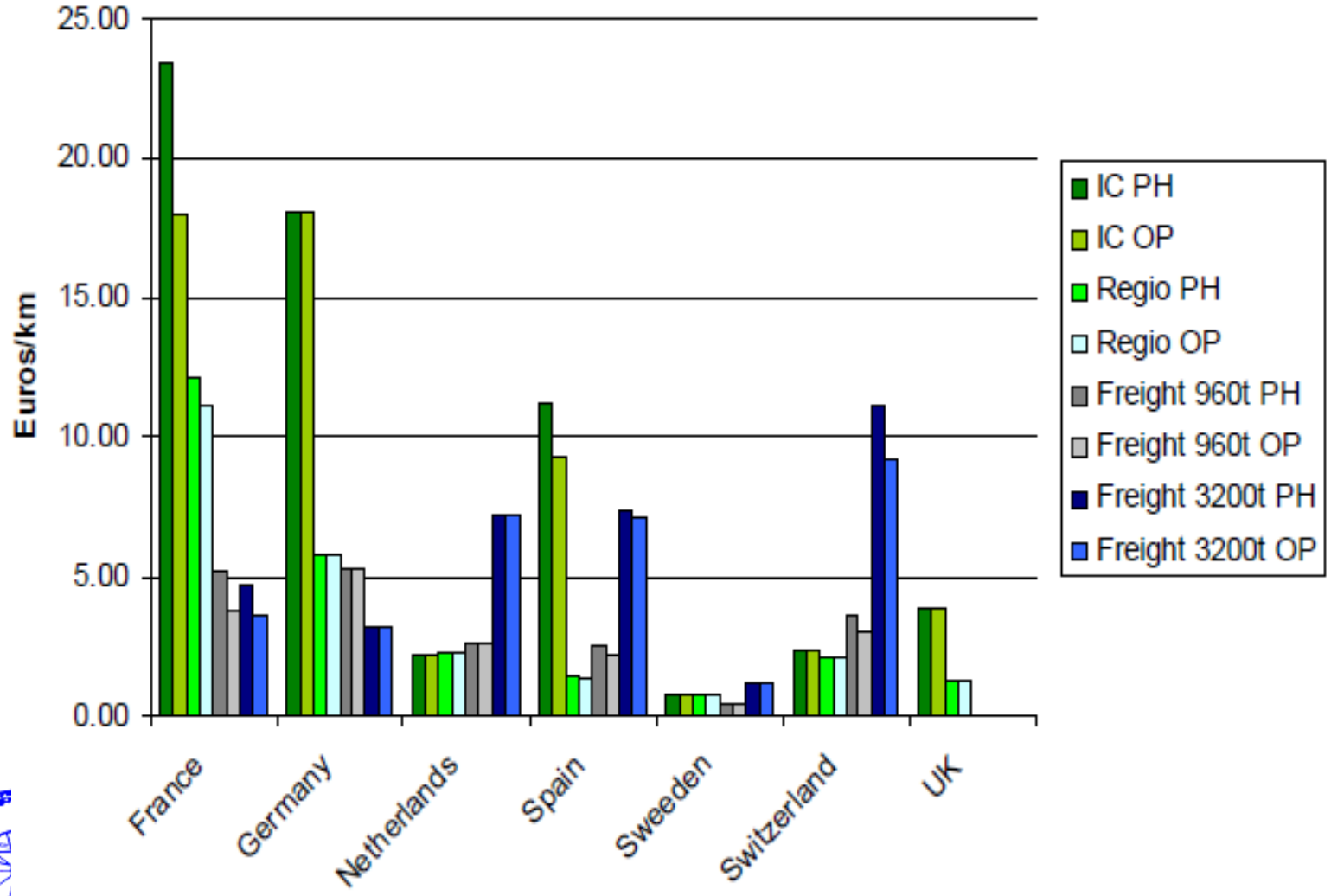
Intensity of traffic



Supply side (economic viewpoint)

- Appraisal methodologies and traffic forecasts
- Yield management of train operator => high load factor
- Yield management of Rail Access Charges (Ramsey-Boiteux pricing scheme)

Rail access charges in Europe (2010)



Contents

- 1) HSR "models" in Europe and in France
- 2) The conditions of HSR success in France
- 3) Is French HSR network close to its optimal size?
  - What do we learn from ex-post evaluations
  - The limits to the extension of HSR network

From ex-ante to ex-post evaluations
The socio-economic IRR

	Ex ante	Ex post
LN 1 (Sud Est)	28,0%	?
LN 2 (Atlantique)	23,6%	12,0%
LN3 (Nord Europe)	20,3%	5,0%
Interconnexion	18,5%	15,0%
LN4 (Rhone-Alpes)	15,4%	10,6%
LN5 (Med)	12,2%	8,1%

$$\text{NPV} = \sum_{j=t_p-t_r}^{j=t_n-t_r} \frac{-\Delta I_j + \Delta R_j - \Delta C_j + \Delta A_j}{(1+a)^j} + \frac{K_{t_n}}{(1+a)^{t_n-t_r}}$$

4 new HSR lines under construction (2011-2017)

	EAST	BPL	CNM	SEA	Total
Total cost (million euro)	2000	3300	1800	7800	14900
Length (km)	106	182	80	303	671
Cost/km (million euro)	18,9	18,1	22,5	25,7	22,2
Paid by RFF (million euros)	520	1400	0	1000	2920
Paid by central gvnmt (million)	680	950	1200	1500	4330
Paid by local gvnmt (million)	640	950	600	1500	3690
Paid by EU + Luxembourg	160	0	0	0	160

The risk of HSR for daily commuting

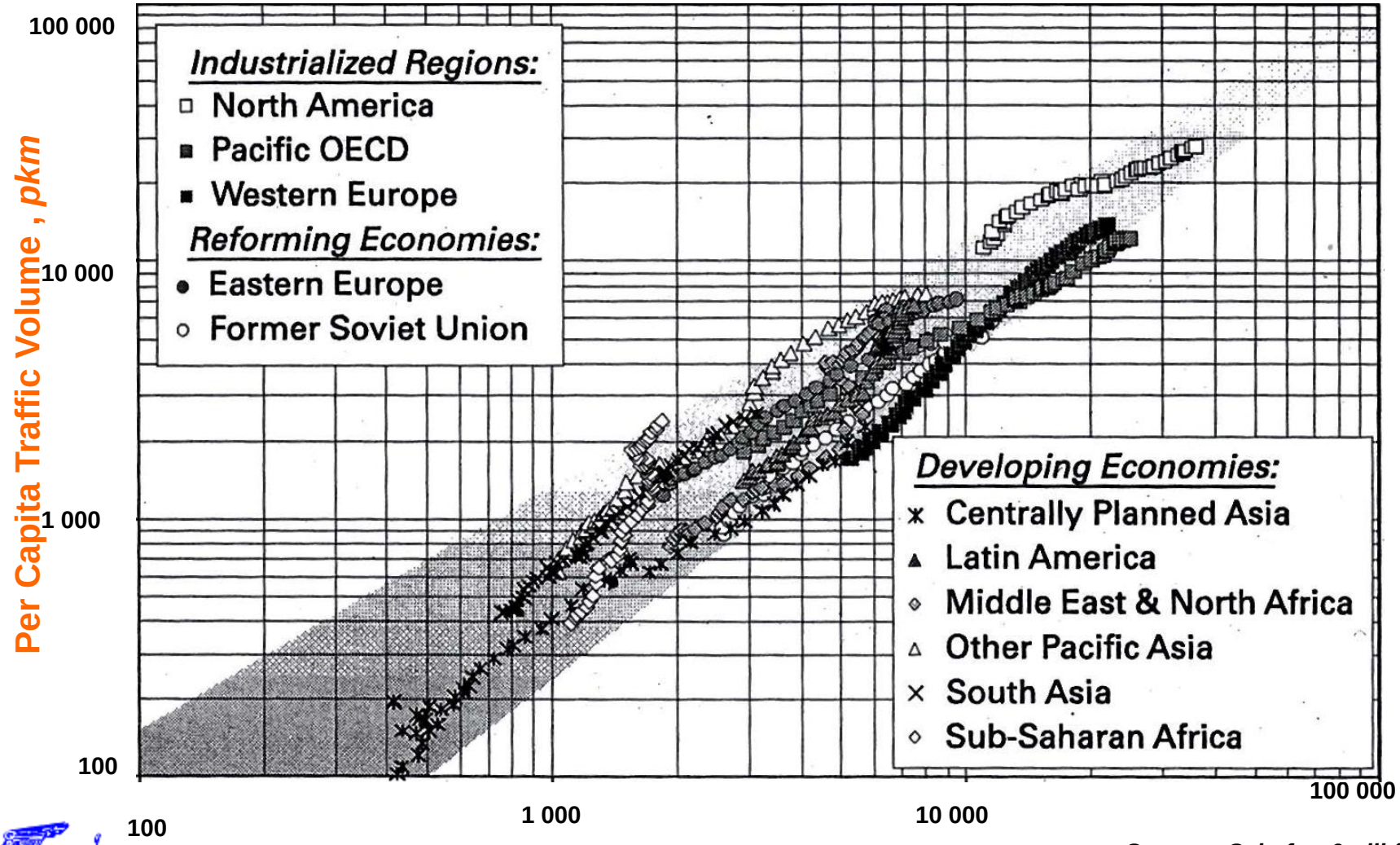
- HSR Marseille-Nice
- Public subsidies = 15 billion euros
- Between 30 and 40 euros/pass/day!

Conclusion

- HSR is a success in France from an economic point of view (ex-post CBA)
- But don’t forget that the main winners of HSR are the users, SNCF, RFF and the rail industry
- There is no observed “wider economic effects”
- HSR is part of the standard of life of developed countries (demand for speed)
- HSR is the fruit of economic growth, but few effects of HSR on economic growth

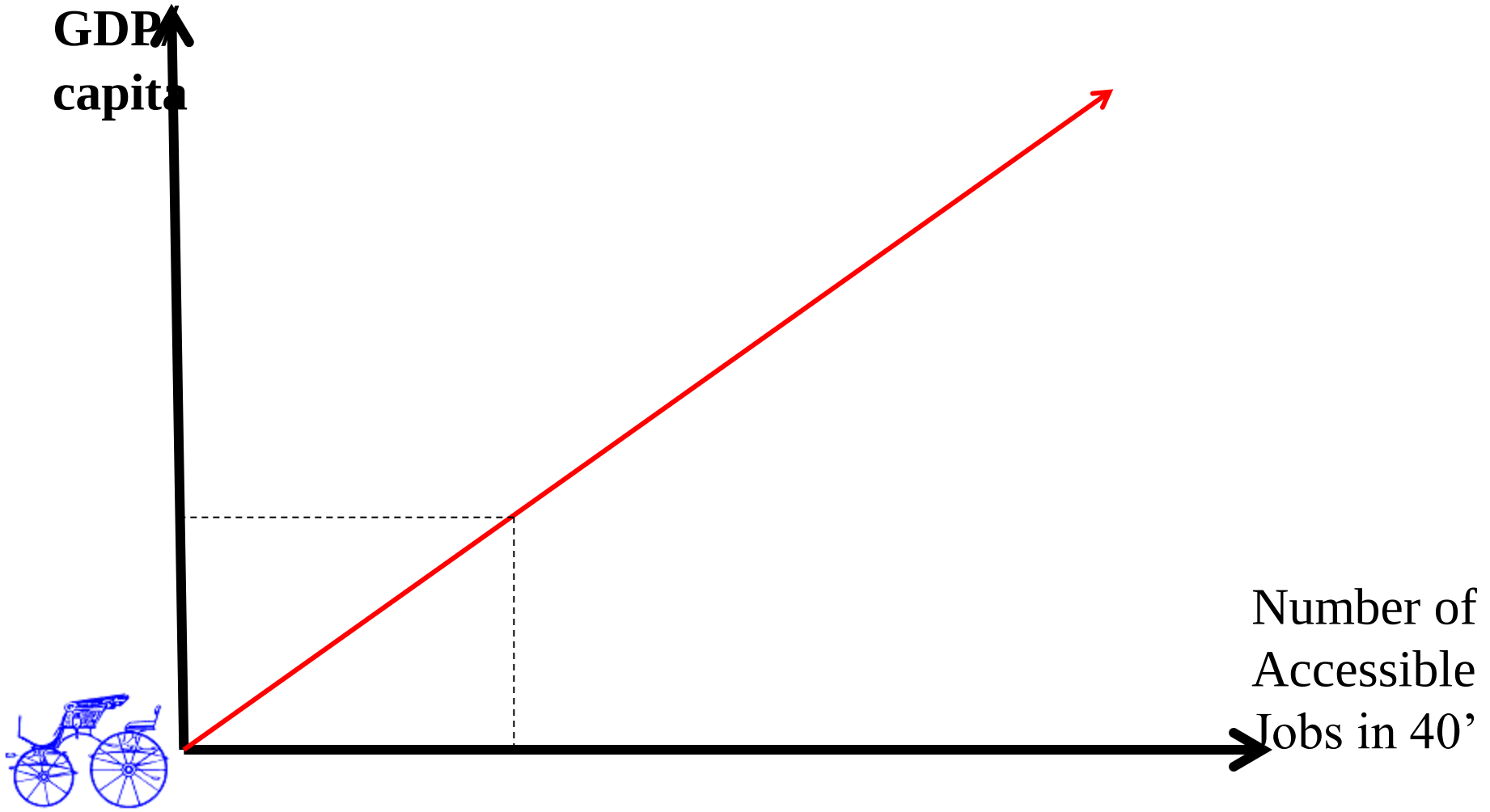
Global mobility

(data points : 1960-2000)

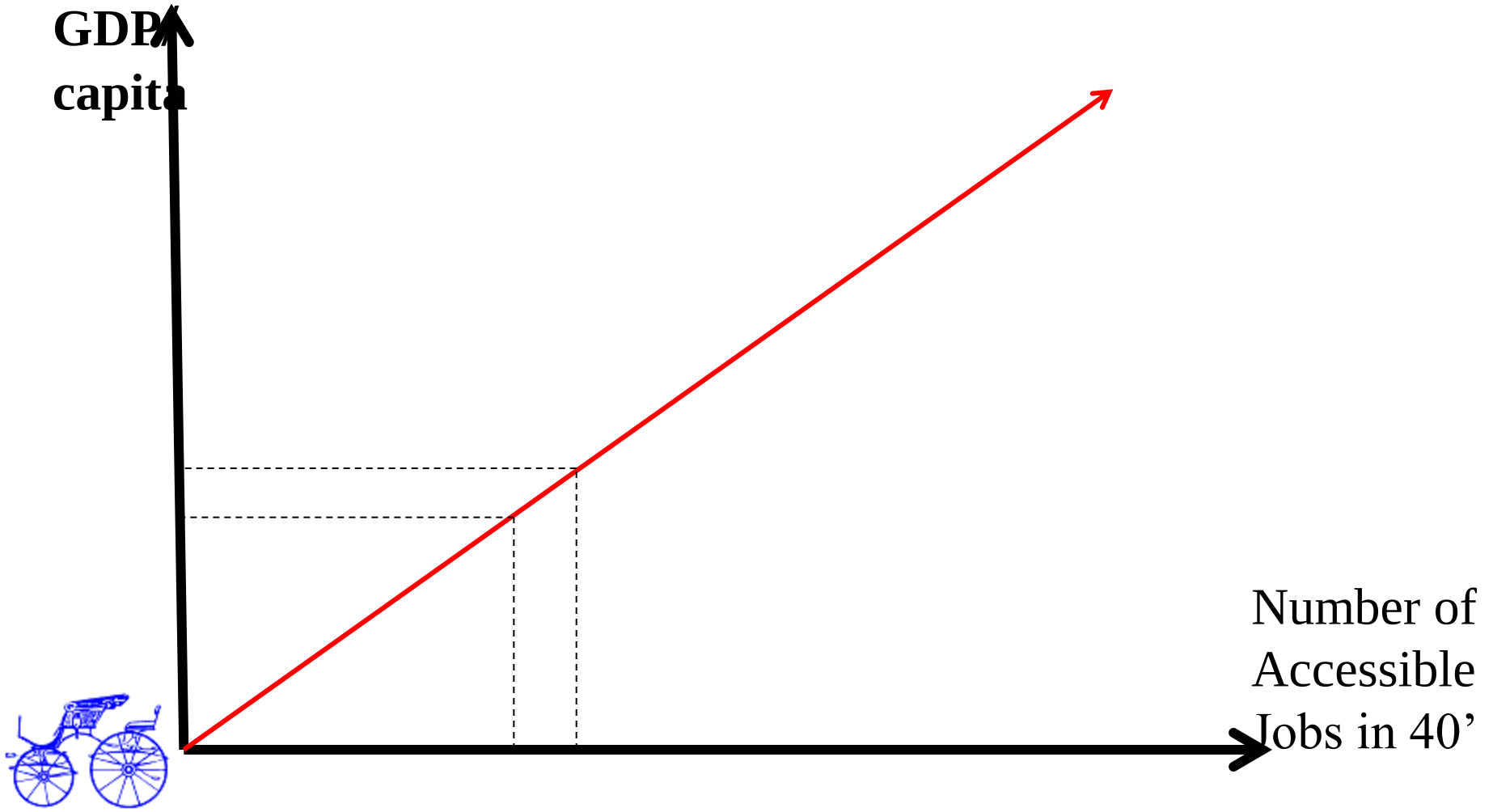


Source : Schafer & alii (2009) :
economic growth rates based on IP CC IS92a/e scenario

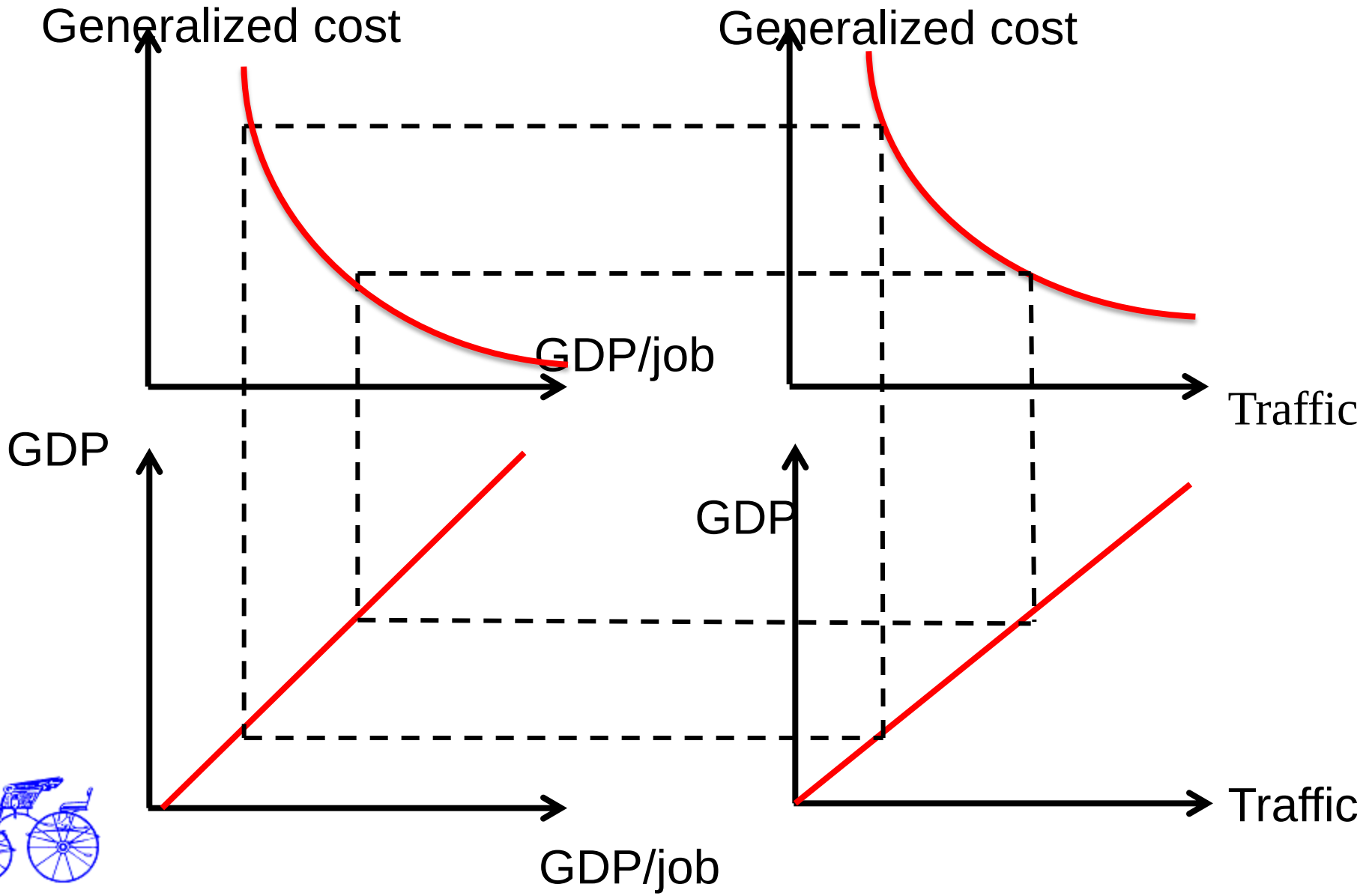
Correlation between accessibility and GDP/capita



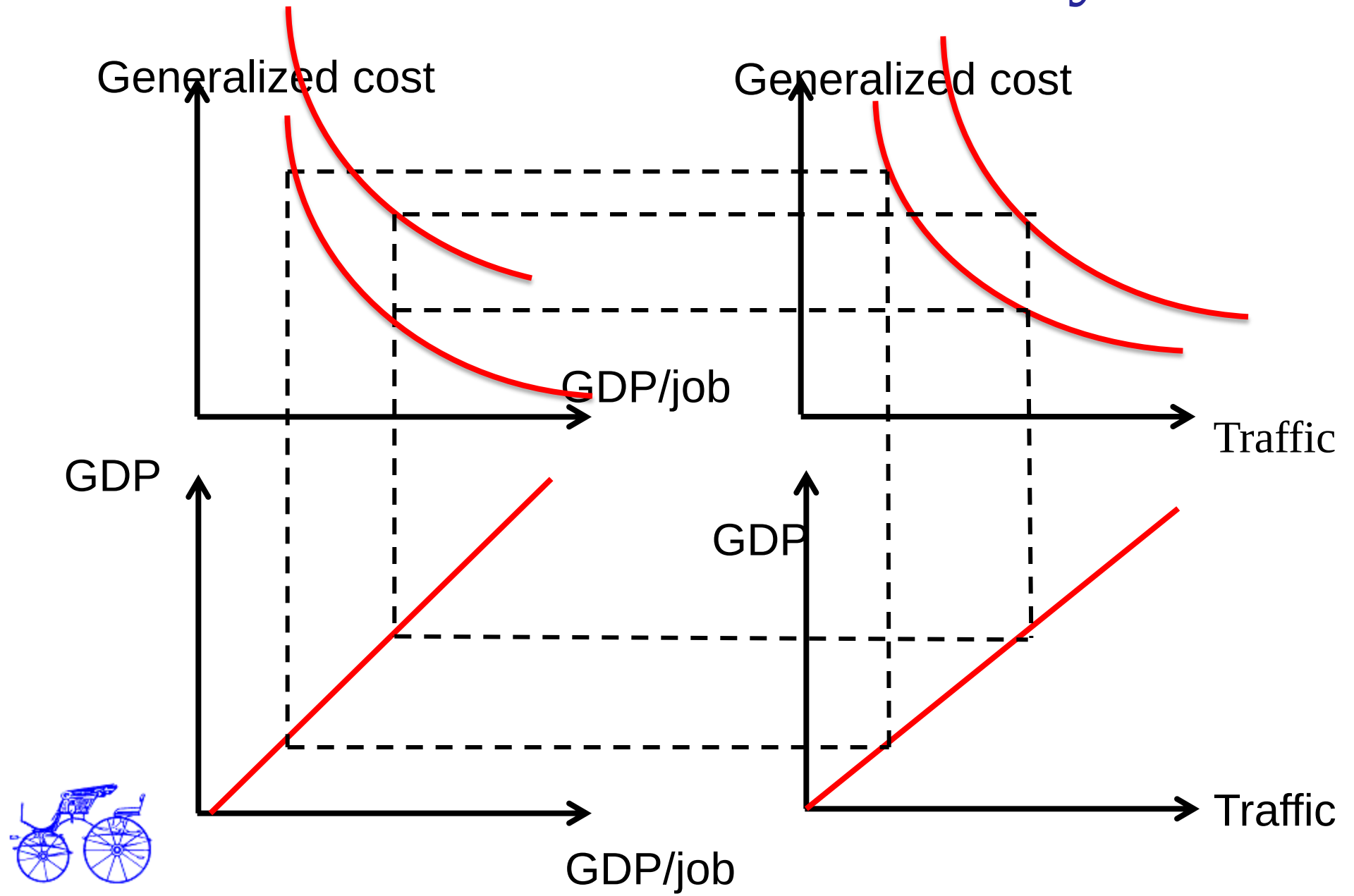
Correlation between accessibility and GDP/capita



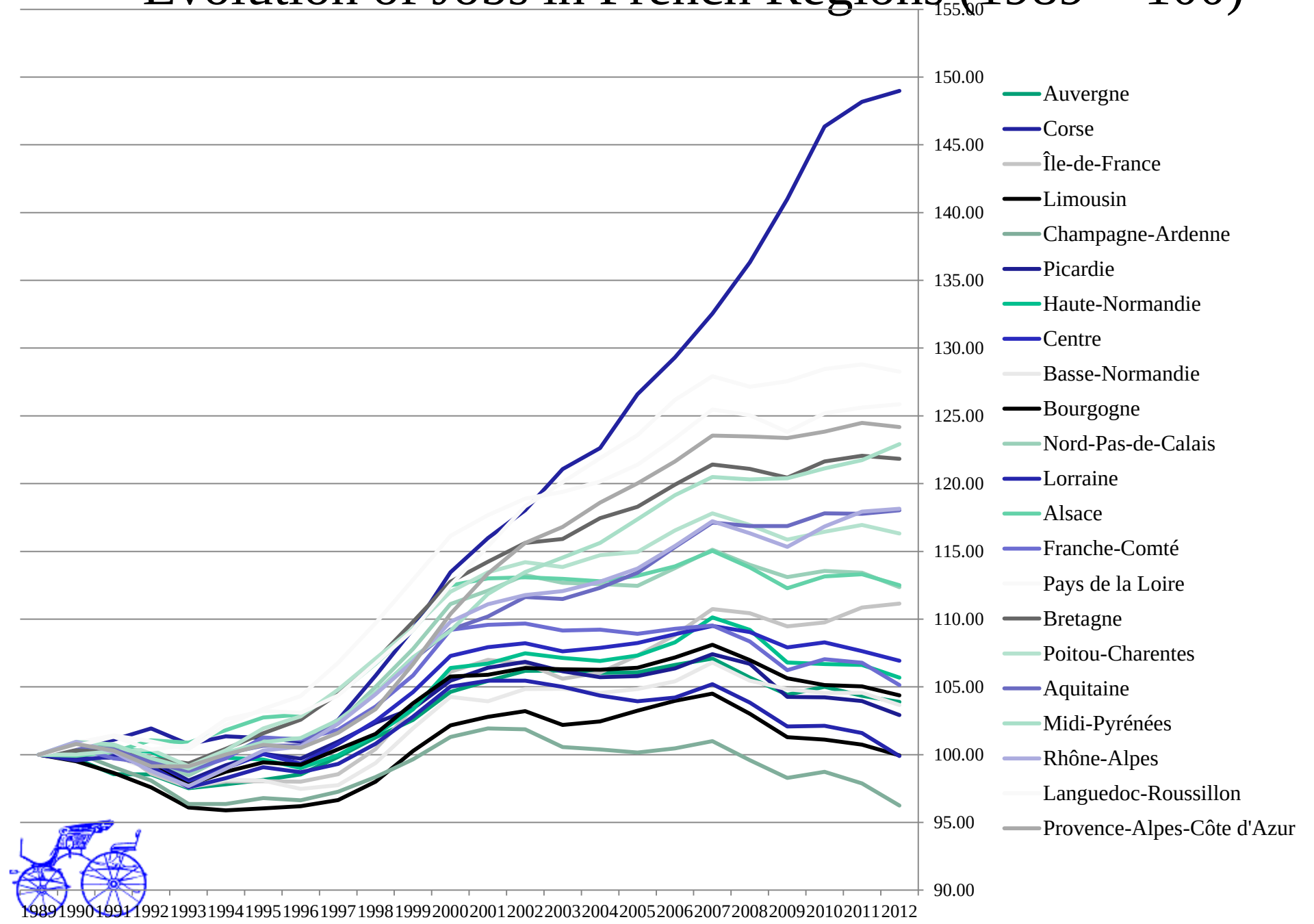
Correlation is not causality

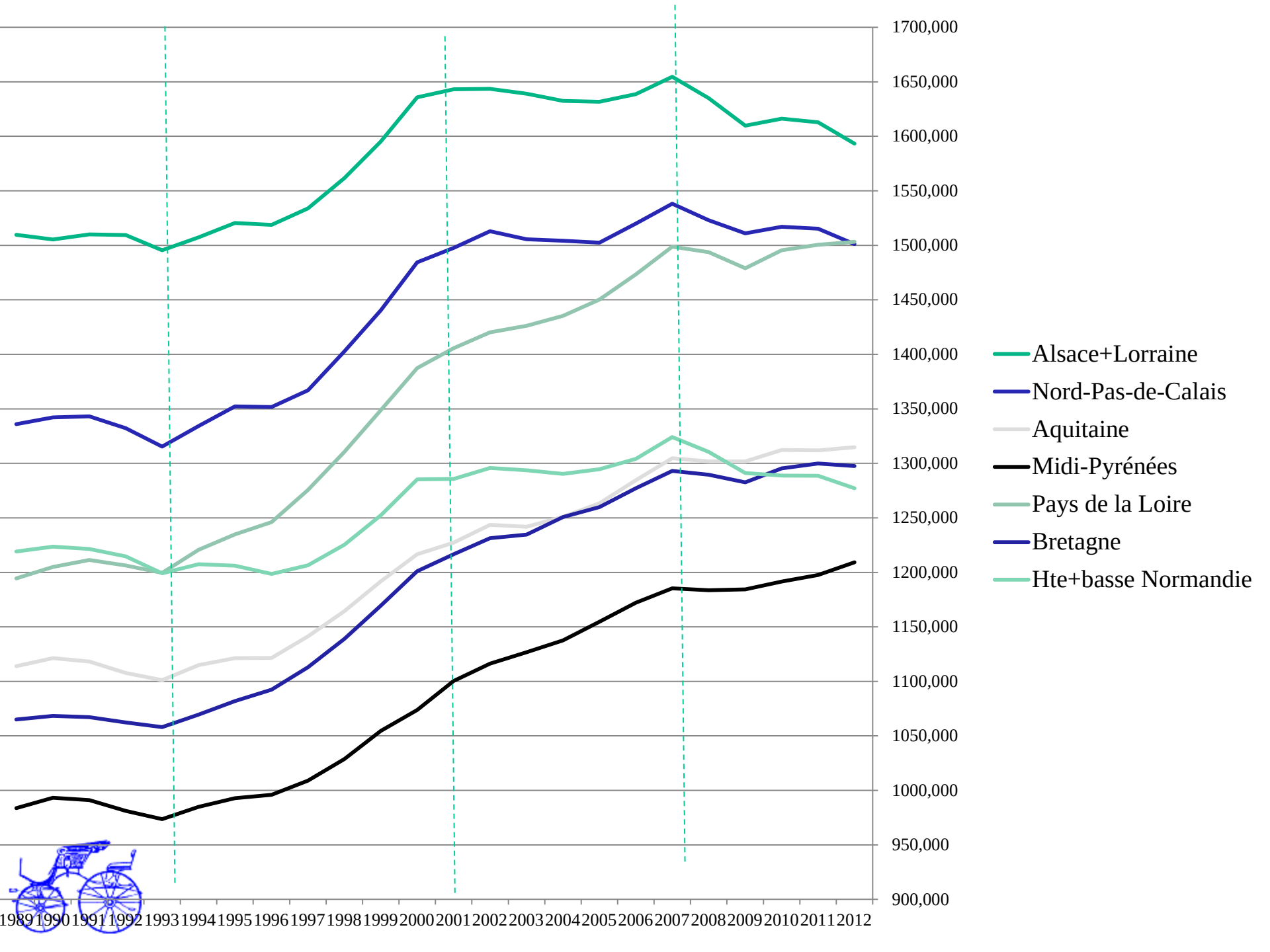


Correlation is not causality



Evolution of Jobs in French Regions (1989 = 100)




1700,000
1650,000
1600,000
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1250,000
1200,000
1150,000
1100,000
1050,000
1000,000
950,000
900,000
1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012
Alsace+Lorraine
Nord-Pas-de-Calais
Aquitaine
Midi-Pyrénées
Pays de la Loire
Bretagne
Hte+basse Normandie

Energy and Equity (Ivan Illich and J.P. Dupuy 1973)

- The more you increase speed, the more you reduce equity
- From the generalized cost to the generalized speed or « effective speed »
- Ef. Speed = 1 / (1/S) + (k/w))

Effective speed

I. Illich, *Energy and equity, 1973*

- Average speed = harmonic speed = $n/ [(1/V_1)+(1/V_2)]$
- Bicycle
- $1/ [(1/V)+(k/W)]$
- $1/ [(1/14)+ (0,001/8)$ = 13,9
- Supersonic « Concord « in 2000
- $1/ [(1/2000)+ (1/6)$ = 6
- = non sustainable

- Subsonic aircraft

$1/ [(1/600)+ (0,1/8)$ = 70 km/h

- HSR

$1/ [(1/200)+ (0,15/8)$ = 40 km/h

- Heavily subsidized HSR
- $1/ [(1/200)+ (0,5/8)$ = 14,8 km/h