

Transport infrastructure and accessibility : how to foster the impacts on economic development

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Outline

- Beyond CBA: the final effects
- What do we know about location effects
- What do we know about growth effects
- Impact of policies

To assess location and growth effects, it is necessary to go beyond CBA

BEYOND CBA

Interest and limits of traditional CBA

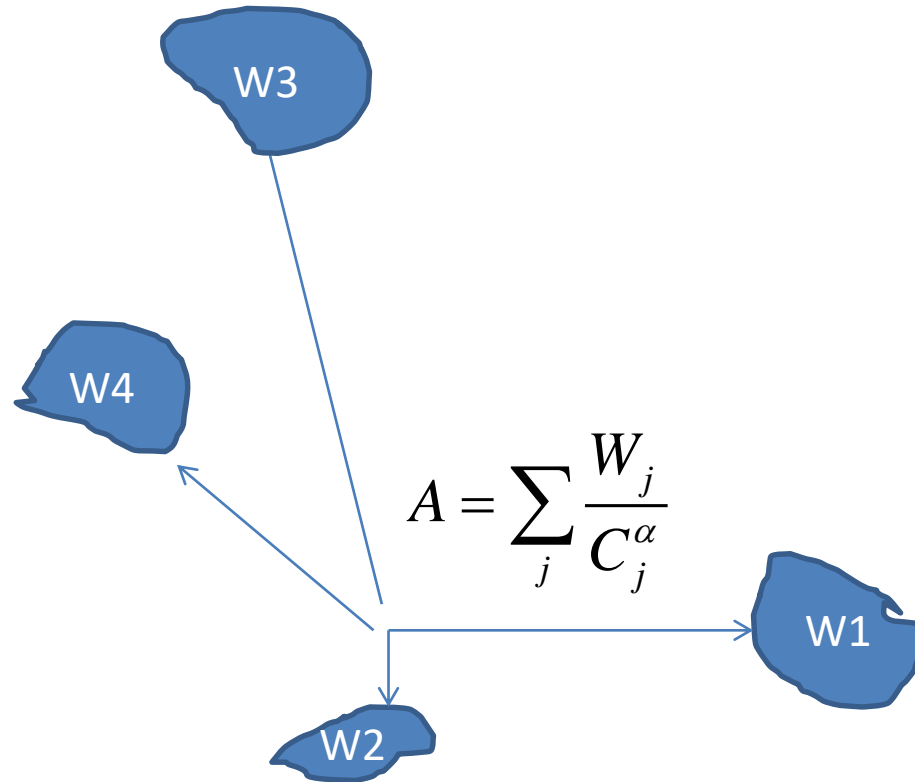
- Interest (unvaluable):
 - Provides an overall view of the interest of the project
 - Allows to compare different projects
- But:
 - It provides only the first round of the effects of the project:
 - The transport users
 - The environmental effects to the neighbours of the track
 - It does not provide the final effects:
 - For instance: the reduction in freight transport costs are passed on to the final consumers
 - It does not provide any break-down of the effects
 - Especially no indication on the consequences in terms of location
- Our interest: the location effects and level of economic activity effects
- The sources of knowledge:
 - Economics Analysis
 - Statistical studies
 - Results of modeling exercises
 - Ex post observations, case studies

A universal tool: accessibility

- Accessibility: an index showing how close you are from the « rest of the world »:
 - Depends on the size of nodes around you
 - Weighted by the « distance » (cost, time, ..) between you and each node
- A formula:
 - Node j has a size W_j (for instance its wealth)
 - And is distant from you by transport cost C_j
 - An accessibility index is for instance:
 - Each node is weighted proportionally to its size and inversely to its farness
- It shows how well you are located vis-à-vis the markets or the settlements or the employments

$$A = \sum_j \frac{W_j}{C_j^\alpha}$$

A universal tool: accessibility

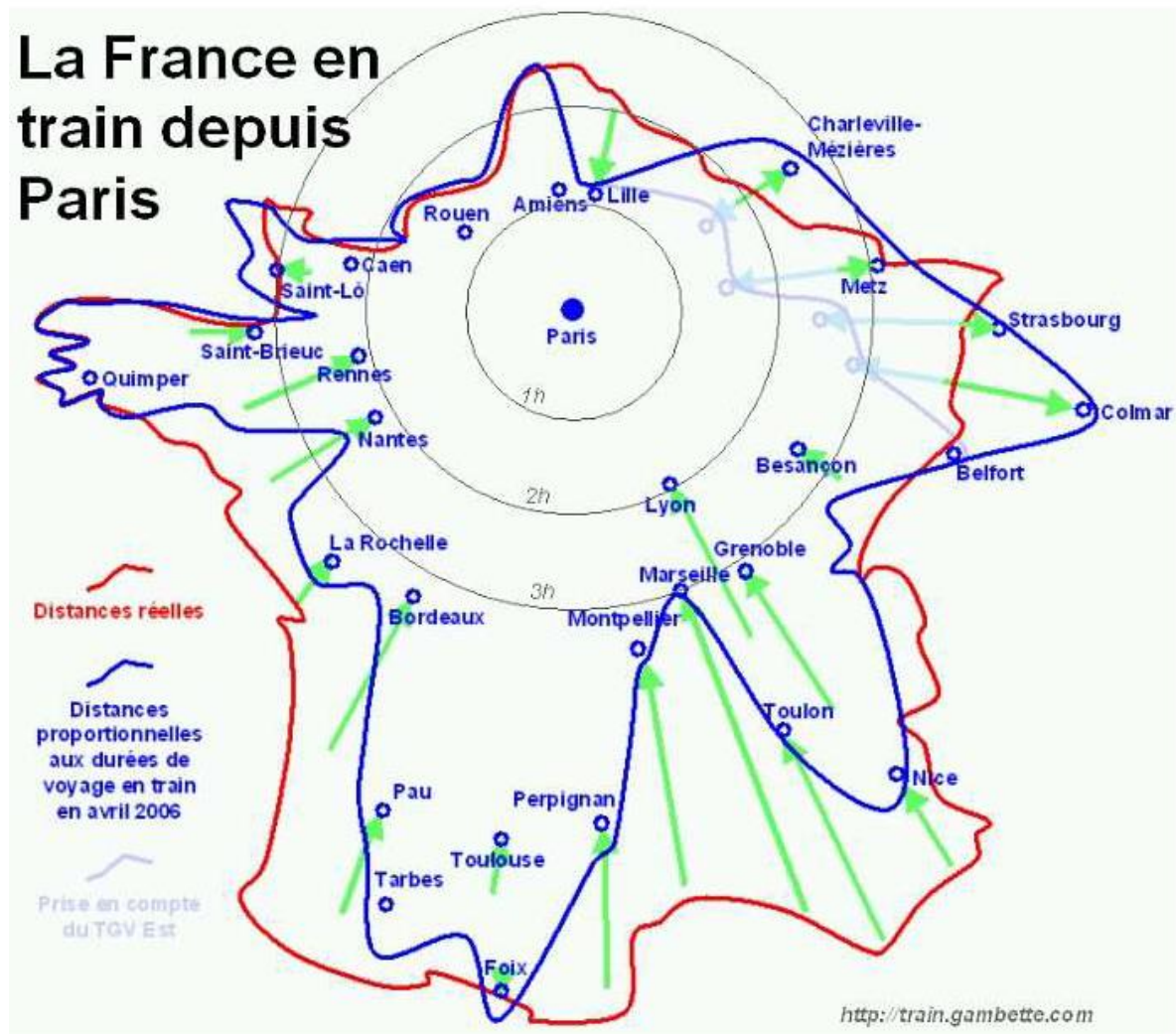


Infrastructure improvements induce polarization and concentration

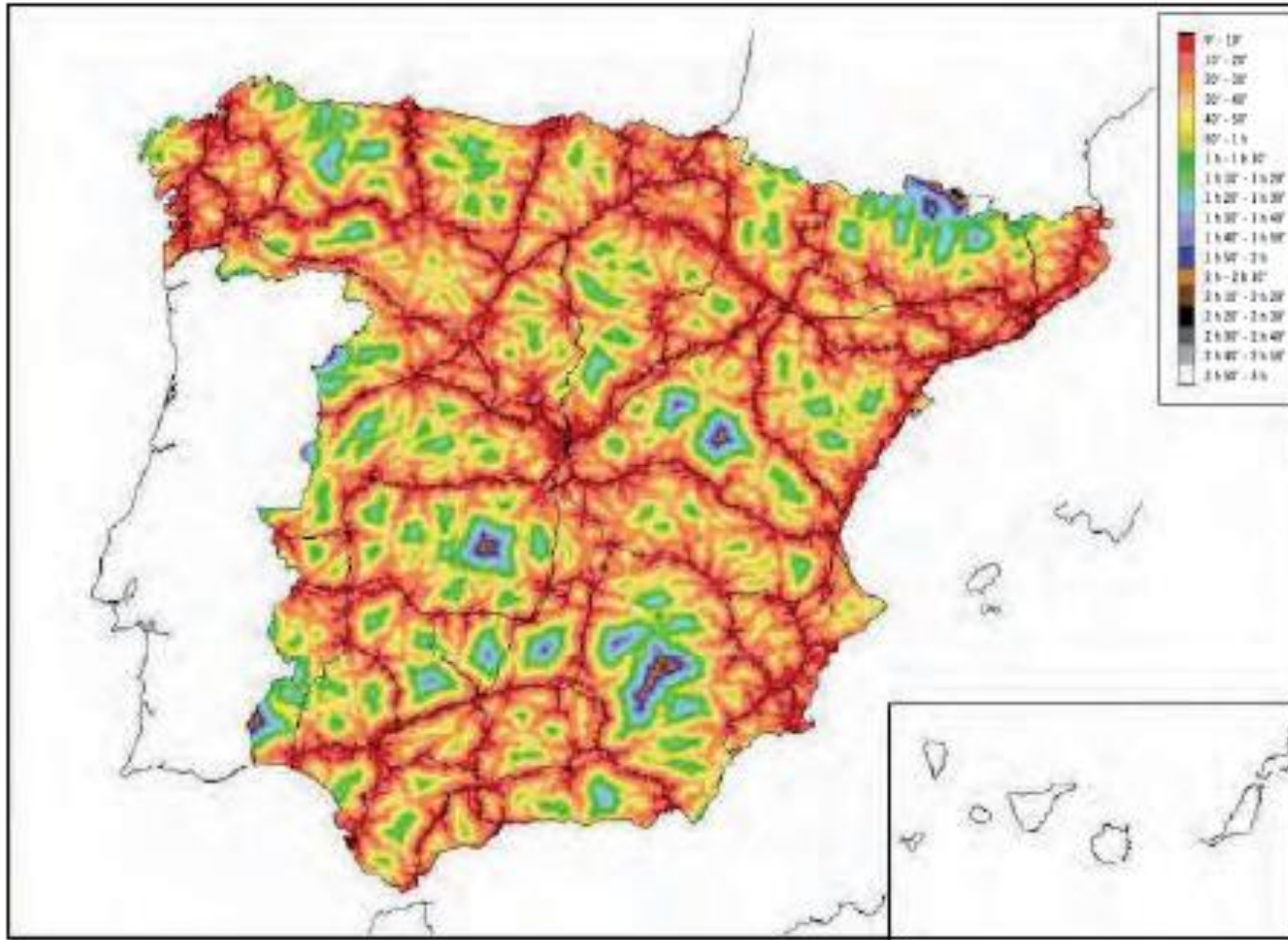
LOCATION EFFECTS

Speed distorts geography

Effect of HST in France



Speed distorts geography



Map 5.A.10. Accessibility to rail, Spain, 2005

Note: Minutes to the closest rail stations by road. MCRIT

Source: CEDEX-Ministerio de Fomento

Railways change accessibility: the case of Netherlands

- Maps of successive relative accessibility levels (Koopmans and alii):
 - Difference of each area to the average accessibility level of the country
 - Rail development increases disparities, induce polarization

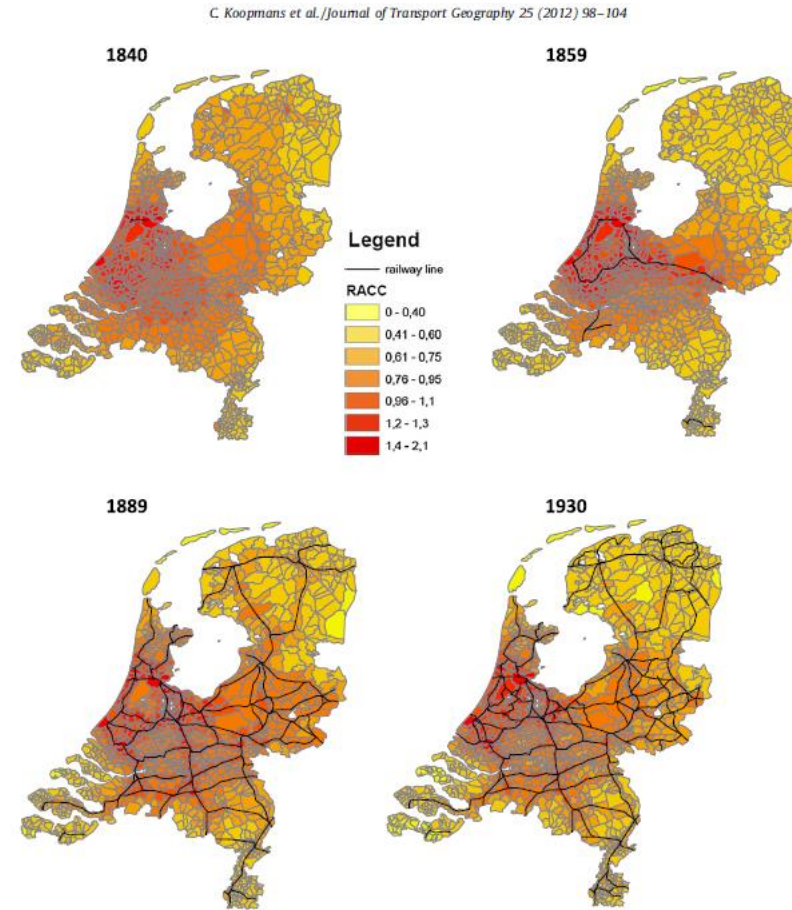


Fig. 1. Railway network and relative accessibility improvements, Netherlands, 1840–1930.

Accessibility changes locations: the case of Netherlands

- Consequences for population location (Koopmans and alii)
 - Relation between rail accessibility and growth of population
 - Rail accessibility improvements induce population increases
 - But to a rather small extent compared to other factors such as general urbanization/crowding trends (5 to 10%?)

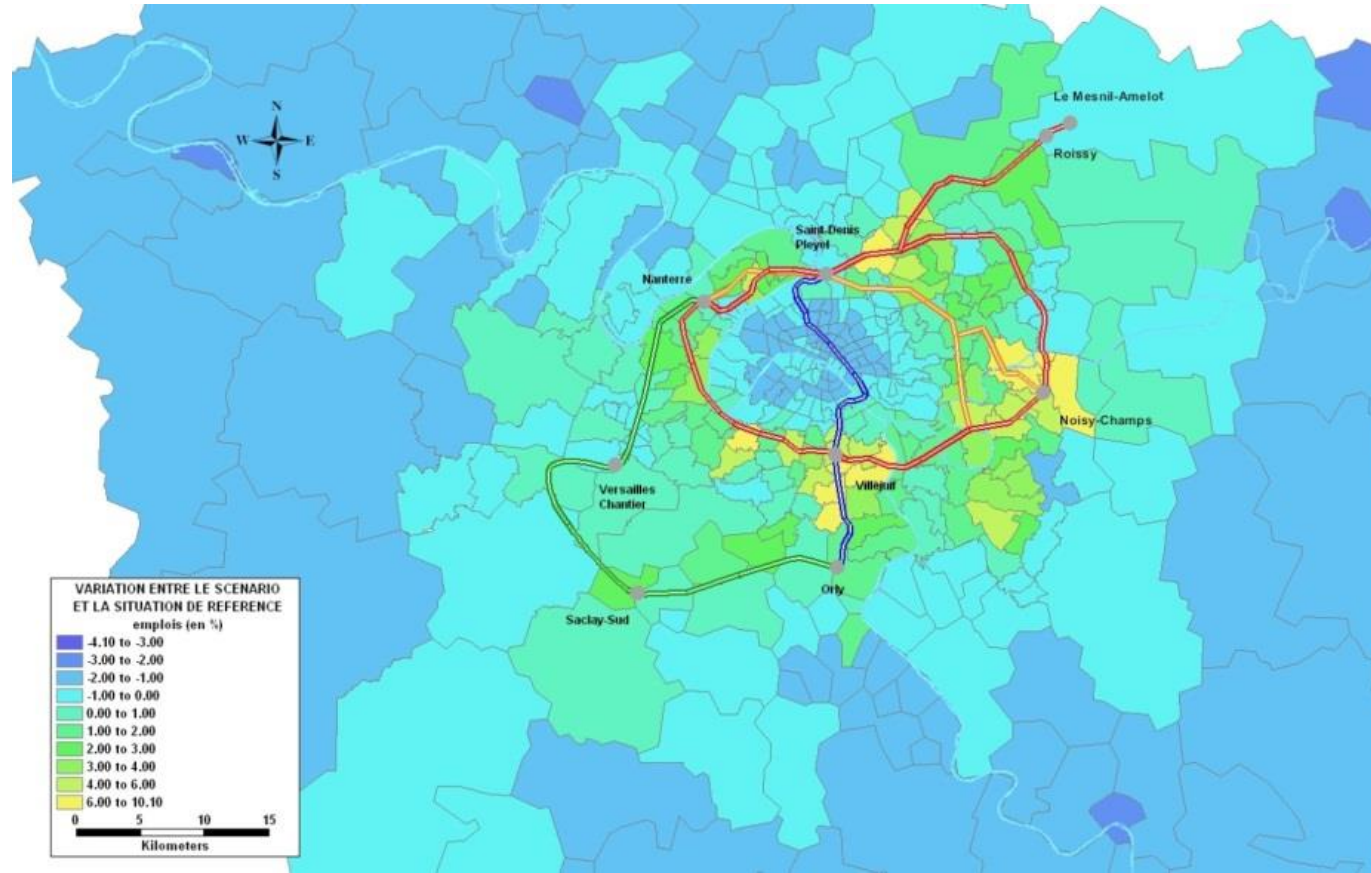
The lessons of economic geography

- As transport costs decrease:
 - Polarization and concentration
 - Peri-urbanisation around the stations, connections and interchanges
- When a link between two agglomerations is improved:
 - Migrations from the smaller to the larger agglomeration
- Checked by econometric studies

Spatial Modelling

- The principles of spatial models
 - A transport submodel, modelling the transport flows issued from a given economic activity
 - An economic activity model, analysing how economic activity and the corresponding transport flows are shaped by transport costs
 - Many such models: CGEurope, Rhomolo, Delta

Modelling: the case of the Grand Paris Express



Lessons from ex post studies

- Effects around stations (maximum 1 km):
 - New urbanization
 - Increase in density
- Extension of commuting to distances up to 100 km → sleeping cities

Stylized facts about the urban location effects for USA (Turner 2009)

- Effects of roads
 - Roads increase the population density nearby land.
 - Roads change the composition of production and population.
 - Roads disproportionately attract wealthier people.
 - Roads decrease density in cities.
- Effects of mass transit
 - Transit increases the population of cities.
 - Transit disproportionately attracts poorer people to cities.

Infrastructure improvements induce increase in GDP, to various extents and with heterogeneities

GROWTH EFFECTS

A loose link between accessibility and growth

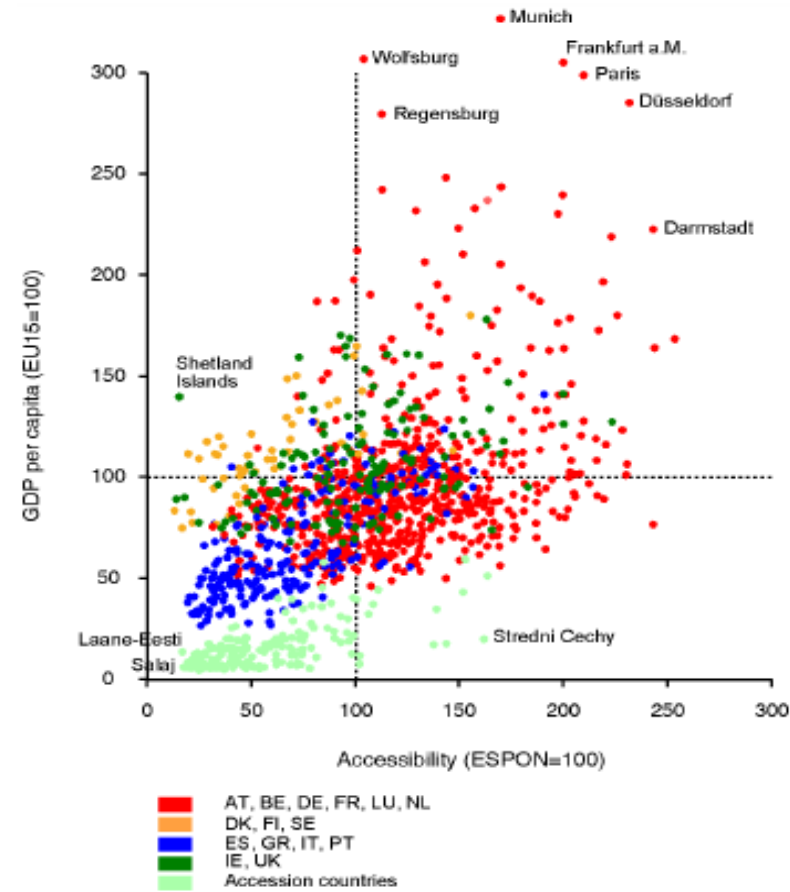
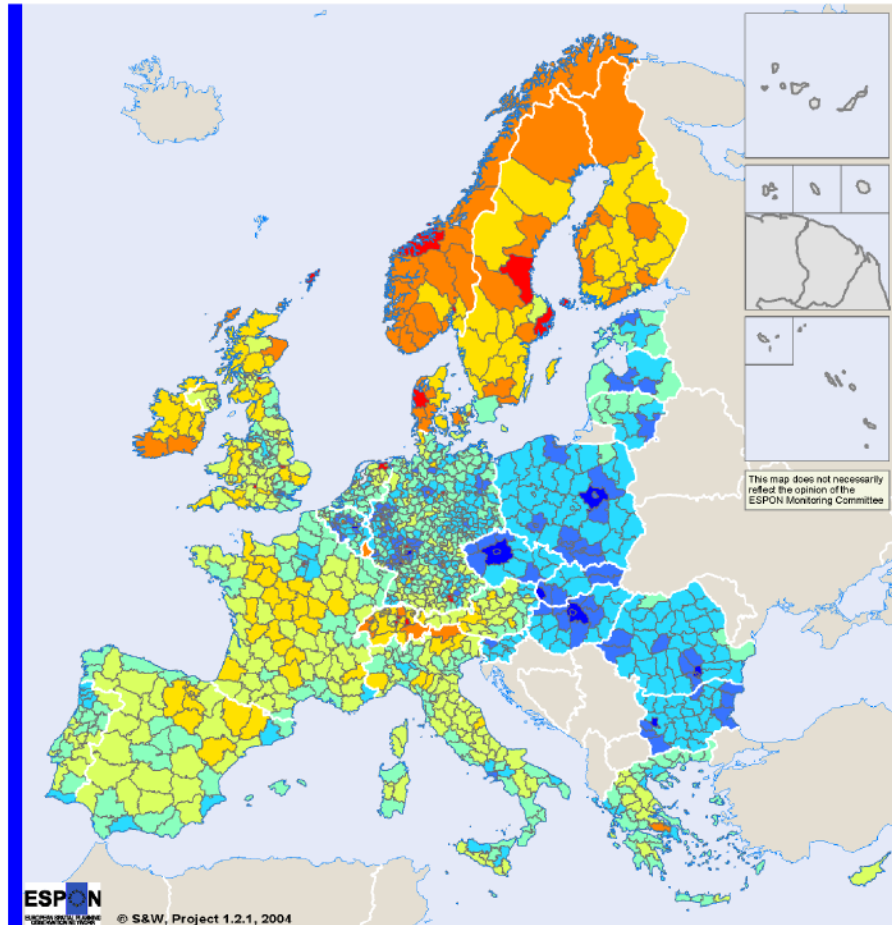
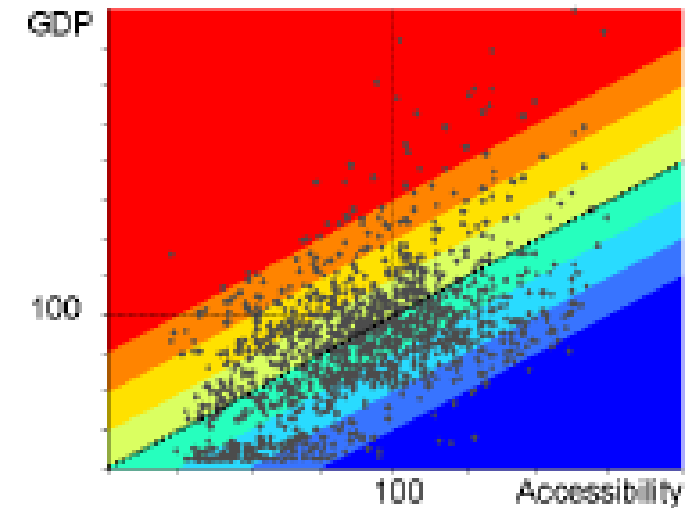


Figure 7.2.1. Accessibility and GDP per capita in NUTS-3 regions

Accessibility and economic growth



Relation of economic performance to location



Impact of public infrastructures on GDP

- A lot of econometric studies (Graham and Melo 2013)

Table 2
Summary statistics of the meta-sample.

Dimension of study design		N	Share (%)	Mean	Median	SD	CV
Country	Europe	177	31.44	0.039	0.013	0.219	5.618
	Other countries	34	6.04	0.083	0.082	0.079	0.950
	US	352	62.52	0.069	0.014	0.328	4.775
Measure of transport infrastructure	Monetary	431	76.55	0.046	0.010	0.319	7.006
	Physical	132	23.45	0.108	0.038	0.134	1.241
Publication status	Published	544	96.63	0.060	0.015	0.292	4.896
	Unpublished	19	3.37	0.074	0.051	0.079	1.072
Industry	Whole economy	411	73	0.065	0.016	0.179	2.754
	Primary	38	6.75	0.071	0.051	0.761	10.718
	Manufacturing	65	11.55	0.082	0.057	0.423	5.183
	Construction	23	4.09	-0.012	0.001	0.061	-5.154
	Energy	3	0.53	-0.002	-0.002	0.001	-0.500
	Services	23	4.09	-0.016	0.002	0.049	-3.110
Mode of transport	All	196	34.81	0.028	0.005	0.108	3.893
	Airport	26	4.62	0.027	0.006	0.094	3.481
	Port/ferry	27	4.80	0.068	0.016	0.170	2.495
	Railway	32	5.68	0.037	0.011	0.097	2.607
	Roads	282	50.09	0.088	0.045	0.389	4.435
Time frame	Short-run	187	33.21	0.038	0.012	0.080	2.083
	Intermediate-run	74	13.14	0.079	0.030	0.678	8.583
	Long-run	302	53.64	0.069	0.015	0.197	2.845
Total		563	100	0.060	0.016	0.288	4.780

N – number of observations; SD – standard deviation; CV – coefficient of variation.

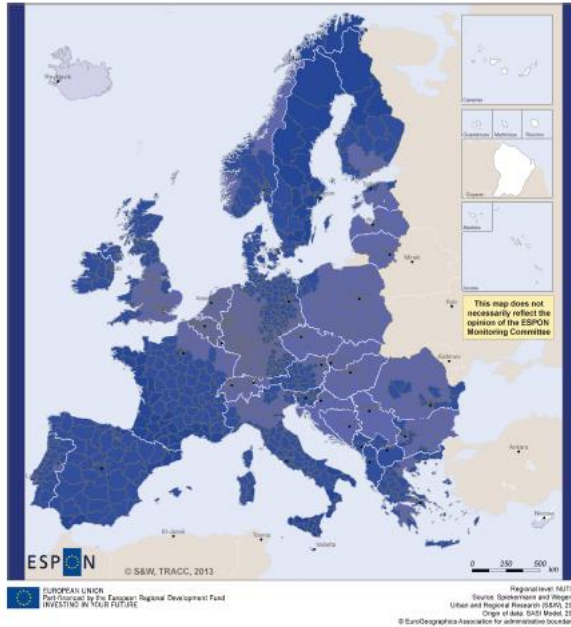
Urban economics point of view: The agglomeration effects

- When accessibility is improved, productivity and economic activity grows.
- The three effects on productivity
 - Sharing
 - Matching
 - Learning
- The effect is mainly intra-urban
- Elasticity of productivity to accessibility:
 - In the range of 2%-5%
 - Depending on the sector: larger in services, lower in primary industries
 - The effects vanish with distance: 80% within 50 km
- Improved accessibility positively impacts the labour market :
 - Decrease of unemployment
 - Reducing exclusion zones
 - Improve the situation of remote areas

Lessons of Economic geography

- General lesson:
 - Decrease in transport cost induce polarization and concentration
 - Due to increasing returns to scale and increasing variety of goods, and larger market, the « big » agglomeration benefits more
- The « problem of the three bodies »

Results of modelling (SASI): changes in accessibility

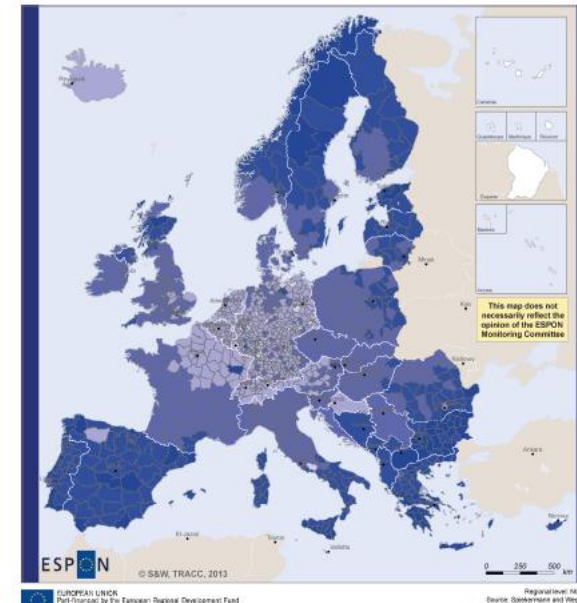


Accessibility travel road/rail
Sustainability scenario TC
Difference to Baseline Scenario (%) 2051

Light blue	-10 - 0	White	no data
Medium blue	-20 - -10		
Dark blue	-30 - -20		
Very dark blue	-40 - -30		
Black	-50 - -40		

Figure 12.7. TRACC SASI scenarios: Sustainability scenario TC: accessibility travel road/rail, difference to Baseline Scenario (%) 2051

GDP



GDP per capita (in 1,000 Euro of 2010)
Sustainability scenario TC
Difference to Baseline Scenario (%) 2051

Light blue	-10 - 0	White	no data
Medium blue	-20 - -10		
Dark blue	-30 - -20		
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Lessons of ex post studies

- Rail effects on firms
 - Re-organization of firm between headquarters and affiliates
 - With increases in productivity and in employment
 - Mainly on services and tourism
 - Depending on the size of the agglomeration (larger for large agglomerations)
- Road effects on firms
 - Enlargement of markets
 - Increase in competition → increase in variety of goods and services, decrease of prices

The additionality issue

- Several approaches
 - Macro-economic impact of infrastructure on GDP
 - Agglomeration effects
 - Results of large models
 - Case studies
- Do they add each other or overlap?
 - They overlap
 - The most robust one are agglomeration effects
- Do they add to CBA results?

IMPACT OF POLICIES

Preconizations are hasardous

- No clear automatic outcome
- Specificity of each situation
 - HST in Spain
- A lot of uncertainty

Lessons from ex post studies

- Beneficial consequences are not automatic
 - The size of agglomeration matters, as well as the proximity of other cities, depending on whether they are large or small: the Lille and Macon cases
 - Urbanism around the stations
 - The importance of a pre-existing economic potential
 - The indirect effects are linked to direct effects
 - Dynamism of local authorities and entrepreneurship

Lille (1,2 Minhab, 600 km²) : Euralille 600 000 m² of offices and houses



Macon (60 000 inhabitants)



The role of public policies

- Transport policy:
 - Importance of the feeders to the main infrastructure
 - Organization of parkings around the stations
- Other public policies
 - Urban regulation for housing and offices around the stations, and farther
 - In order to facilitate the migrations and changes induced by the new infrastructure

HSTs and TGVs in France



Cooperation between public authorities and private firms

- A careful design and monitoring of urban development
- Examples:
 - Société du Grand Paris: working groups gathering the major actors of urban development around each station
 - Seine Nord Escaut: « road shows » for attracting private firms along the waterway, and fostering intermodal platforms
 - Japan Railways: the station operators act as developers around the stations

Some specific points

- The role of nodes
 - Stations are not just transport exchanges
 - Intermodal platforms foster location of activities
- Target the right sectors
 - Services and tourism for high speed transports
 - Shopping and delivery for roads

Main messages

- Infrastructures induce location effects and foster economic activity
 - To various extents depending on the mode and on the specific situation
 - The size of those effects is linked to the direct effects
- Beneficial effects are not certain
- They depends
 - First on natural tendancies;
 - it is important to have a good knowledge of them
 - as it is not sensible to fight against them
 - Second on public policies and private entrepreneurship
 - And their coordination
 - Building the infrastructure is just the first step

Thank you for your attention

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