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

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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

- Travel at 250 km/h or faster
- Existing Lines
- Lines Under Construction
- Planned Lines
- Proposed Lines
- Travel at slower speeds
- Main Intercity Lines
High Speed Trains Traffics in Europe (Billion of pass.km/year)
253 gares au total dont 53 à l'étranger
A Swedish point of view
Contents

1) HSR “models” in Europe and in France

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

Correlation traffic volume and GDP per capita
EU 27 (1995 - 2009)

\[ y = 0.4096x + 4416.3 \]
\[ R^2 = 0.98648 \]

\[ y = 0.1052x - 953.9 \]
\[ R^2 = 0.97997 \]
HSR market share and travel time

**High Speed Rail/ Air Market Share**

- Frankfurt-Cologne (2005)
- Frankfurt-Cologne (2010)
- Madrid-Sevilla
- Madrid-Barcelona (2010)
- Rome-Milano
- Madrid-Barcelona (2005)

**Equation:**

\[ P(\text{train}) = \frac{1}{1 + e^{\alpha + \beta(TT \text{ plane} - TT \text{ train})}} \]

*Source: EC 2006b*

*Source: Lopa Pita 2010*
Intensity of traffic

Travel Volume versus Network Length
(1964 - 2011)

High-speed rail network in operation (route-km)

Travel Volume (million passenger-km per year)

Japan
France
Spain
EU 27
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

<table>
<thead>
<tr>
<th>Region</th>
<th>Ex ante</th>
<th>Ex post</th>
</tr>
</thead>
<tbody>
<tr>
<td>LN 1 (Sud Est)</td>
<td>28.0%</td>
<td>?</td>
</tr>
<tr>
<td>LN 2 (Atlantique)</td>
<td>23.6%</td>
<td>12.0%</td>
</tr>
<tr>
<td>LN 3 (Nord Europe)</td>
<td>20.3%</td>
<td>5.0%</td>
</tr>
<tr>
<td>Interconnexion</td>
<td>18.5%</td>
<td>15.0%</td>
</tr>
<tr>
<td>LN 4 (Rhone-Alpes)</td>
<td>15.4%</td>
<td>10.6%</td>
</tr>
<tr>
<td>LN 5 (Med)</td>
<td>12.2%</td>
<td>8.1%</td>
</tr>
</tbody>
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\[
\text{NPV} = \sum_{j=t_\text{p} - t_\text{r}}^{j=t_\text{n} - t_\text{r}} - \Delta I_j + \Delta R_j - \Delta C_j + \Delta A_j \frac{K_{t_n}}{(1 + a)^{t_n - t_r}} + \frac{K_{t_n}}{(1 + a)^{t_n - t_r}}
\]
### 4 new HSR lines under construction (2011-2017)

<table>
<thead>
<tr>
<th></th>
<th>EAST</th>
<th>BPL</th>
<th>CNM</th>
<th>SEA</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total cost (million euro)</td>
<td>2000</td>
<td>3300</td>
<td>1800</td>
<td>7800</td>
<td>14900</td>
</tr>
<tr>
<td>Length (km)</td>
<td>106</td>
<td>182</td>
<td>80</td>
<td>303</td>
<td>671</td>
</tr>
<tr>
<td>Cost/km (million euro)</td>
<td>18.9</td>
<td>18.1</td>
<td>22.5</td>
<td>25.7</td>
<td>22.2</td>
</tr>
<tr>
<td>Paid by RFF (million euros)</td>
<td>520</td>
<td>1400</td>
<td>0</td>
<td>1000</td>
<td>2920</td>
</tr>
<tr>
<td>Paid by central gvnmt (million)</td>
<td>680</td>
<td>950</td>
<td>1200</td>
<td>1500</td>
<td>4330</td>
</tr>
<tr>
<td>Paid by local gvnmt (million)</td>
<td>640</td>
<td>950</td>
<td>600</td>
<td>1500</td>
<td>3690</td>
</tr>
<tr>
<td>Paid by EU + Luxembourg</td>
<td>160</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>160</td>
</tr>
</tbody>
</table>
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)

Per Capita Traffic Volume, pkm


Source: Schafer & alii (2009): economic growth rates based on IPCC IS92a/e scenario
Correlation between accessibility and GDP/capita

- GDP/capita
- Number of Accessible Jobs in 40’
Correlation between accessibility and GDP/capita

GDP/capita vs. Number of Accessible Jobs in 40'
Correlation is not causality
Correlation is not causality
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
  \( 1 / [(1/600) + (0.1/8)] = 70 \text{ km/h} \)
- HSR
  \( 1 / [(1/200) + (0.15/8)] = 40 \text{ km/h} \)
- Heavily subsidized HSR
  \( 1 / [(1/200) + (0.5/8)] = 14.8 \text{ km/h} \)