Economics of Trans European Networks

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Research results of EU “FUNDING” consortium, joint work with De Borger, Dunkerley, Van der Loo, Van Dender
Issues

• TEN = large transport investment programme (700 billion Euro) with public aid of EU mainly for infrastructure with cross border element (« transit »)

• Main Policy Question:

Is there a need for public and EU intervention? How large?
Is there a need for public subsidies?

Some non answers

• Europe needs it …..always possible to find a set of models and parameters to prove it is beneficial

• Elementary « common pool » lobbying theory:
  – You will observe the largest lobbying (and political interest) for those infrastructures that are paid by the federation and serve only local interests (exemple: Light Rail in Strasbourg?)
  – Paper by Knight (2004): in US (interstate highway fund) for every $ invested there is a $ wasted

• Can we do better in Europe?

• We approach question from an economic efficiency point of view in 3 steps:
Research Questions

1. How will prices and investment be set in absence of EU intervention? How would regions or member states take decisions if they pursue their own interest?

2. Does the cost structure matter? Does infrastructure with high fixed cost (rail, canals) need more subsidies?

3. Is there a need for public and EU intervention? What type of subsidies and regulations make sense?
1. How will prices and investment be set in absence of EU intervention?

2 Basic model settings

PARALLEL TOLL AND INVESTMENT COMPETITION (crossing of Alps via Austria or Switzerland)

SERIAL TOLL and INVESTMENT COMPETITION (link from Antwerp to Switzerland via B, FR single mode or intermodal traffic)
1. How will prices and investment be set in absence of EU intervention?

- In both network structures assume that
  1) country or local governments decide on basis of MAX LOCAL USER SURPLUS
     + REVENUE FROM LOCAL & TRANSIT TRAFFIC
     - COST OF MAINTENANCE & INVESTMENT
  2) They play NASH (non-cooperatively: take decision of other country as given)
  3) They each choose
     - STEP 1 CAPACITY levels of infrastructure (congestion levels) anticipating correctly the outcome of the pricing game
     - STEP 2 Choice of user PRICE (we discuss results for 2 regimes)
       - NO TOLL
       - TOLL (which can be chosen freely)
1. How will prices and investment be set in absence of EU intervention?

• PRICING results for given capacities
  – In whatever network structure: in presence of transit traffic, if tolling is feasible, **tolls >>marginal external cost**
    • Also called « tax exporting »
  – In « PARALLEL » structure, the competition for transit traffic (and extra revenue) keeps margins down
  – In « SERIAL » structure bigger problem: « **double margins** » problem because sum of tolls charged by the two transit countries is larger than what one unified country would charge (cartel would be beneficial for the 2 countries and for the transit traffic)
2 Basic model settings

PARALLEL TOLL AND INVESTMENT COMPETITION (crossing of Alps via Austria or Switzerland)

SERIAL TOLL and INVESTMENT COMPETITION (link from Antwerp to Switzerland via B, FR single mode or intermodal traffic)
1. How will prices and investment be set in absence of EU intervention?

• CAPACITY results for NO TOLL case
  - In « PARALLEL » structure, when one country extends capacity, the other country will benefit and may actually find it beneficial to reduce its capacity (or delay extension)
  - In « SERIAL » structure, when one country extends its capacity it may actually force the other country to also invest
  - In both cases one finds rather underinvestment compared to federal optimum, underinvestment larger in parallel case – underinvestment may disappear if tolling is allowed
Relative efficiency of different tolls with endogenous capacity and pricing decisions – PARALLEL -

<table>
<thead>
<tr>
<th>Identical countries</th>
<th>Total EU welfare change compared to no toll case (capacity relative to no toll case)</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Transit 50% in no toll</td>
<td>NO TOLL (reference) 0 % (100) Underinvestment because larger capacity attracts all the transit</td>
<td></td>
</tr>
<tr>
<td>Capacity no toll Nash equilibrium =100</td>
<td>FEDERAL (EU) OPTIMUM +16% (225) Lower tolls and more capacity</td>
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<tr>
<td></td>
<td>TOLL +14% (177) BETTER Competition in parallel network keeps tax exporting under control</td>
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Relative efficiency of different tolls with endogenous capacity and pricing decisions – SERIAL -

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<td><strong>NO TOLL</strong> (reference)</td>
<td>0 % (100)</td>
<td></td>
</tr>
<tr>
<td><strong>TOLL</strong></td>
<td>-14% (72) WORSE</td>
<td>Lower capacity and high tolls for transit and local</td>
</tr>
<tr>
<td><strong>FEDERAL (EU) OPTIMUM</strong></td>
<td>+3 % (124)</td>
<td>Higher capacity and positive tolls</td>
</tr>
</tbody>
</table>
1. How will prices and investment be set in absence of EU intervention? **Conclusions**

- Member countries will adopt pricing and capacity solutions different from Marginal Social Cost pricing
- Capacities are often lower than EU optimum, certainly if tolling is not feasible
- Parallel networks:
  - Competition avoids too high charges
  - Better to allow tolling even uncontrolled
- Serial networks:
  - Large inefficiencies (too high tolls) when transit is important
  - It may be better not to allow any tolling at all if it can not be regulated
  - Integration of operators and/ or infrastructure managers in a serial network not only improves service but also increases profits for all parties and raises surplus of users
2. Does the cost structure matter?

- Previous analysis was for constant average cost of capacity expansion (correct for roads not for rail and canals)
- Does infrastructure with high fixed cost need more subsidies?
  - Literature (« cost recovery theorem): IF
    • there are decreasing average costs of capacity extension
    • AND there is marginal social cost pricing
    THEN the infrastructure provider runs a deficit
    \[ \text{Investment Annuity} = (1-\varepsilon) \]
    Where \( \varepsilon \) is elasticity of cost function (\( \varepsilon=0.3? \) for rail)
2. Does the cost structure matter?

- Here we want to analyse the same problem in a setting where country governments charge local and transit traffic and do not follow Marginal Social Cost pricing (cfr. previous analysis in absence of EU intervention)

- Compare cost structures by comparing alternatives along an « isocost-isocapacity » line
2. Does the cost structure matter?

isocost-isocapacity lines

\[ TC_{\text{capacity}} = F + kZ \]
2. Does the cost structure matter?
One country, local + transit traffic

• **Proposition**: Comparing cost structures along an isocost and isocapacity line, a higher share of fixed costs can only increase welfare for the country and for the EU as a whole

  • Holds both for infrastructure that can be priced and for the case without tolls
  • Intuition: start from 0 fixed costs and increase the level of fixed costs (hence decreasing variable cost). The initial solution remains feasible. However, capacity extensions have become cheaper so that one can do better by extending capacity, reducing congestion
Theory: One country, only local traffic II

Variable Capacity Cost $k$

$T_{C\text{capacity}} = 0 + k_1 X_1$

Fixed capacity cost $F$

$T_{C\text{capacity}} = F_2 + k_2 X_1$
2. Does the cost structure matter?

One country, local and transit demand

• Cost recovery ratio likely to decline when the share of fixed costs rises, but:
• Cost recovery ratio could exceed 1 if there is a lot of tolled transit traffic
• Cost recovery ratio 0 when traffic cannot be tolled
• Even with high fixed cost shares, federal subsidies are not needed when countries are allowed to toll transit traffic, but this does not produce maximal EU welfare
2. Does the cost structure matter? Should EU subsidize interstate investments with high fixed costs?

<table>
<thead>
<tr>
<th>Pricing possible</th>
<th>Marg cost pricing NOT enforceable by EU</th>
<th>Marg cost pricing enforceable by EU</th>
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<tbody>
<tr>
<td>NO (tax exporting, cost recovery less a problem)</td>
<td>YES (and function of % transit and % fixed costs)</td>
<td></td>
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<tr>
<td>YES (cost recovery low)</td>
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| Pricing not possible | | |
|----------------------| | |
| | | |
3. What EU subsidies make sense?

- If there is no cross border element: not needed, leads to common pool problems, leave it to the regions or member states.
- In serial networks, there is a serious risk of overcharging so marginal social cost pricing should be enforced and then EU subsidies are required for the high fixed cost modes.
- Public money is costly: 1 Euro has a marginal cost of public funds $\Gamma$ that may be 1.2 or 1.5 Euro as an extra Euro means higher labour taxes that distort the labour market.
- EU has no comparative advantage in sharing risks (adverse selection) so better prefer small upfront subsidies to risky loans?
3. What EU subsidies make sense?

X = share transit, \( \Gamma = \text{MCPF} \)

<table>
<thead>
<tr>
<th>Source of aid</th>
<th>Present system</th>
<th>Efficiency Subsidies IFF MSCP</th>
<th>Efficiency+ Equity</th>
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<tr>
<td>Rail</td>
<td>EC</td>
<td>0.10 I</td>
<td>((1-\epsilon\Gamma)X) INV [1-(0.3)(1.2)] 0.50 = 32%</td>
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<tr>
<td>IWW</td>
<td>Member State</td>
<td>?</td>
<td>((1-\epsilon\Gamma)(1-X)) INV [1-(0.3)(1.2)] 0.50 = 32%</td>
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<tr>
<td>Road Airports</td>
<td>EC</td>
<td>0.10 I</td>
<td>0</td>
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<td></td>
<td>?</td>
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</tbody>
</table>
• FUNDING research consortium (2005 - sept 2007)
    • Deliverables 1 and 2 available as well as task reports
    • 5 TEN case studies with MOLINO II
    • RAIL-AIR model for EU
    • Freight model for certain corridors in EU
• De Borger, B., Dunkerley, F. and S. Proost. 2006. “Road versus rail”, discussion paper