CHARGING FOR TRANSPORT INFRASTRUCTURE USE:
QUESTIONS AND ANSWERS

Stef Proost
http://www.kuleuven.ac.be/ete
Center For Economic Studies
Catholic University of Leuven - B

OUTLINE

• Principles good transport pricing
  » Fundamental pricing equation
  » External costs

• Transport sector applications:
  » What are the imbalances
  » What can different instruments achieve
  » Can we expect a big surplus and how to deal with deficits?
  » Pricing and Investment
  » Dealing with imperfections in rest of the economy

• Transport pricing and the environment
• Transport pricing and equity
• The political process ?
OUTLINE

• Principles good transport pricing
  – Fundamental pricing equation
  – External costs
    • Congestion
    • Air pollution, noise
    • Accidents
    • Road wear and tear
• Transport sector applications:
• Transport pricing and the environment
• Transport pricing and equity
• The political process

Basic Economic Principles of Transport Pricing

• Leave choice of volume and mode to users as they know best what is good to them
• Make sure prices reflect full opportunity costs of trips
  – Full means that economists will try to translate all policy objectives (air pollution, speed, etc.) on the same money basis
  – This is one of the distinctive features of an economic approach
The fundamental pricing equation

<table>
<thead>
<tr>
<th>Users’ cost = Marginal Benefit for user</th>
<th>Social Marginal Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resource costs car and fuel</td>
<td>Resource costs car and fuel</td>
</tr>
<tr>
<td>Own time costs</td>
<td>Own time costs</td>
</tr>
<tr>
<td>Fuel + vehicle taxes</td>
<td>Environm. costs</td>
</tr>
<tr>
<td>Insurance (3 rd party liability)</td>
<td>Accidents costs others</td>
</tr>
<tr>
<td></td>
<td>Time losses others</td>
</tr>
</tbody>
</table>

Fundamental Pricing graph

[Diagram showing the relationship between generalised price, demand function, optimal tax, marginal external congestion cost, average time cost, resource cost, and number of cars/hour.]
Marginal external costs methodology

- External Congestion costs: time losses for the other road users – nothing new
- Road wear and tear: improved methodologies, large range of estimates
- Air pollution costs: uncertainty, shifts in emphasis between pollutants, one CO2 damage value for European market
- External costs of accidents: rather small with non-myopic drivers and if insurance with experience rating
- Mohring effect: positive economics of density in public transport
- Check 5th framework UNITE project D15

OUTLINE

- Principles good transport pricing
- **Transport sector applications:**
  - How wrong are current prices?
  - What can different instruments achieve
  - Can we expect a big surplus and how to deal with deficits?
  - Pricing and Investment
  - Dealing with imperfections in rest of the economy
- Transport pricing and the environment
- Transport pricing and equity
How wrong are current prices?

• Simplify fundamental pricing equation:
• Check for each transport mode and period if the condition \( \text{TAX} = \text{MEC} \) holds
• See TRENEN- II for road, rail
  • De Borger & Proost, « Reforming transport pricing in the European union » Edgar Elgar, 2002
• Missing: ports, airports…

What is wrong with current prices and taxes in Europe?- London
How wrong are current prices?

- Urban peak road use underpriced in most countries
- Public transport prices too low in peak in most countries (except UK?)
- Freight transport:
  - Road peak may be overtaxed but in general pricing discrepancy is lower for freight than for passengers

OUTLINE

- Principles good transport pricing
- **Transport sector applications:**
  - How wrong are current prices?
  - What can different instruments achieve
  - Can we expect a big surplus and how to deal with deficits?
  - Pricing and Investment
  - Dealing with imperfections in rest of the economy
- Transport pricing and the environment
- Transport pricing and equity
What can we do about pricing inefficiencies and does it really matter? –

Brussels —source: Proost & Van Dender, Reg Sc.Urban Econ,2001

<table>
<thead>
<tr>
<th>Policy</th>
<th>Relative Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benchmark</td>
<td>0%</td>
</tr>
<tr>
<td>Higher Fuel taxes</td>
<td>5%</td>
</tr>
<tr>
<td>Public Tr.Pricing</td>
<td>5-10%</td>
</tr>
<tr>
<td>Parking Charges</td>
<td>30%</td>
</tr>
<tr>
<td>Cordon Pricing</td>
<td>52%</td>
</tr>
<tr>
<td>Social MC pricing</td>
<td>100%</td>
</tr>
</tbody>
</table>

Other Pricing constraints

- Not all links in network can be tolled
  - Lower tolls on tolled road see Verhoef, Small etc.
- Other implementation constraints
  - Technical, political etc.
- See MC-ICAM work
Do better prices bring surplusses?

– On average and over all modes, and for given capacity, marginal social cost pricing will bring surplusses, certainly in urban areas (see ECMT, FIFI Report Efficient Transport Taxes and Charges 2003)

– Some modes (road) will generate large surplusses, Public transport modes will generate deficits (high Fixed costs, economics of density)
Revenue changes of optimal pricing


<table>
<thead>
<tr>
<th></th>
<th>Britain</th>
<th>France</th>
<th>Germany</th>
<th>Netherlands</th>
<th>Finland</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welfare gain (billion E/y)</td>
<td>17</td>
<td>10</td>
<td>6</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Revenue gain %</td>
<td>+65%</td>
<td>+56%</td>
<td>+64%</td>
<td>+31%</td>
<td>-20%</td>
</tr>
<tr>
<td>Air poll costs</td>
<td>-54%</td>
<td>-50%</td>
<td>-35%</td>
<td>-31%</td>
<td>-42%</td>
</tr>
<tr>
<td>Congestion (increase in rush hour speed)</td>
<td>+10%</td>
<td>+9%</td>
<td>+13%</td>
<td>+12%</td>
<td>-</td>
</tr>
</tbody>
</table>

How important is balancing the financial account by mode?

– Marginal social cost pricing generates a deficit or a surplus for some modes
– If one wants to break even one can choose between:
  • Average cost pricing (price=total cost/volume)
  • Ramsey pricing: mark ups on top of marginal social cost that are inversely proportional to the elasticity of demand (a monopolist would do the same)
  • Two part tariff – not studied here
– Results of Proost & Van Dender (forthcoming) for Unite D13
Welfare impacts of pricing scenarios (2005), % full income change with respect to Ref

<table>
<thead>
<tr>
<th>Region</th>
<th>REF</th>
<th>AVERAGE COST PRICING</th>
<th>RAMSEY PRICING</th>
<th>MARGINAL SOCIAL COST PRICING</th>
</tr>
</thead>
<tbody>
<tr>
<td>GERMANY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DÜSSELDORF</td>
<td>0</td>
<td>-0.8</td>
<td>+0.1</td>
<td>+0.1</td>
</tr>
<tr>
<td>MÜNCHEN</td>
<td>0</td>
<td>-0.6</td>
<td>+0.1</td>
<td>+0.4</td>
</tr>
<tr>
<td>MÜNSTER</td>
<td>0</td>
<td>-2.5</td>
<td>-2.2</td>
<td>+2.5</td>
</tr>
<tr>
<td>WESTFALEN REGION</td>
<td>0</td>
<td>-0.2</td>
<td>-0.1</td>
<td>+0.1</td>
</tr>
<tr>
<td>UK</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LONDON</td>
<td>0</td>
<td>-0.8</td>
<td>+1.3</td>
<td>+2.7</td>
</tr>
<tr>
<td>SOUTH EAST REGION</td>
<td>0</td>
<td>-1.9</td>
<td>+0.2</td>
<td>+0.6</td>
</tr>
</tbody>
</table>

Budget balance per mode

- Average cost pricing does worse than the reference
- “constrained marginal cost pricing” gets between 30 and 90% of the unconstrained marginal social cost pricing
- Caveats:
  - All transport operations are run efficiently: a cost recovery target (lower or higher than 100%) may be useful here
  - Perfect instruments
  - Two part taxes may be of interest
  - Investments are not considered
OUTLINE

• Principles good transport pricing
• Transport sector applications:
  • How wrong are current prices?
  • What can different instruments achieve
  • Can we expect a big surplus and how to deal with deficits?
• Pricing and Investment
  • Dealing with imperfections in rest of the economy
• Transport pricing and the environment
• Transport pricing and equity

Pricing and investment 1

• Does better pricing make sense when capacity is not optimal?
  – Yes, better pricing is always worthwhile
  – Prices will be lower if capacity has been extended
• Comparing
  – an equilibrium with optimal pricing but no new investments
  – with an equilibrium with optimal pricing and optimal investments, prices are not much lower and total surplus not so different because road extension in urban areas is very costly (study for Netherlands: Dings et al.(2002) “Return on roads: optimising road investments”) …
Pricing and investment 2

• Should we not first increase Public Transport capacity before we start charging road taxes and prices?
  – Not necessarily because PT prices may have to go up too so that net demand effect is not always positive and in general not that large
  – Sources:

OUTLINE

• Principles good transport pricing
• Transport sector applications:
  • How wrong are current prices?
  • What can different instruments achieve
  • Can we expect a big surplus and how to deal with deficits?
  • Pricing and Investment
    • Dealing with imperfections in rest of the economy
• Transport pricing and the environment
• Transport pricing and equity
Dealing with imperfections in rest of economy

- Most important market distortion is probably the labour (and payroll) tax
- Several implications for transport pricing
  - If the only motive in peak is commuting, tax = marg ext congestion cost if revenues recycled via lower labour taxes, otherwise optimal tax is much lower, see Parry & Bento, Scand J. Econ, 2001,
    - Intuition: minimize net commuting costs
  - Differentiate transport prices according to motive (make commuters pay 50% of non-commuters?) – see Van Dender, Scand J. Econ, 2003.
  - Best Use of surpluses is to decrease existing labour taxes

OUTLINE

- Principles good transport pricing
- Transport sector applications:
  - Transport pricing and the environment
    - What happens with conventional pollutants?
    - Climate change and fuel efficiency of cars
    - Gasoline versus diesel cars
- Transport pricing and equity
What happens with conventional pollutants?

- Emission of conventional pollutants decreases strongly with new emission standards (in 2020 road transport emissions may be 20% or less of 1990 emissions)
- Standards may be a bad instrument here
  - Source: Calthrop & Proost, ETE wp
- For some pollutants one may have reached the region of strongly increasing costs in road transport sector
- Turn attention to other modes
- TREMOVE 2 project see www.tremove.org
Conventional pollutants and diesel versus gasoline cars

- Many European countries favour diesel cars (France and Belgium: close to 50% of km)
- This is not really wise: a diesel car generates less tax revenue and is more polluting
  - Generates less tax revenue because diesel car consumes less per km
- What happened: tax authorities have not followed up
  - the technological progress in diesel cars
  - the changing emphasis in the damage of particulates

Source: I. Mayeres, S. Proost, (2001), "Should diesel cars in Europe be discouraged?" Regional Science and Urban Economics, 31, 453-470,

Is the reduction of GHG gasses a priority for road transport?

- NO because there exist already 300% or more carbon taxes under the form of fuel excises in transport sector
- So cars are too fuel efficient
- Better turn attention to other GHG saving options

Source:
OUTLINE

• Principles good transport pricing
• Transport sector applications:
• Transport pricing and the environment
• Transport pricing and equity
  – Equity requires checking loss or gain on transport markets and how revenue is used
  – Subsidies to PT may very well be a very inefficient way to favour the poor
  – Illustration: marg tax reform, global tax reform

Sources:

<table>
<thead>
<tr>
<th></th>
<th>$\varepsilon=0$</th>
<th>$\varepsilon=1$</th>
<th>$\varepsilon=5$</th>
<th>$\varepsilon=10$</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCSFP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taxe consommation non transp</td>
<td>$t_1$</td>
<td>1.90</td>
<td>1.24</td>
<td>0.44</td>
</tr>
<tr>
<td>Taxe transp. Voiture Pointe</td>
<td>$t_2$</td>
<td>0.99</td>
<td>0.64</td>
<td>0.22</td>
</tr>
<tr>
<td>Taxe transport Voït. Hors Pointe</td>
<td>$t_3$</td>
<td>1.70</td>
<td>1.12</td>
<td>0.41</td>
</tr>
<tr>
<td>Taxe Transp. Publiques</td>
<td>$t_4$</td>
<td>0.77</td>
<td>0.52</td>
<td>0.20</td>
</tr>
<tr>
<td>Taxe uniforme par tete</td>
<td>$P$</td>
<td>1.27</td>
<td>0.96</td>
<td>0.50</td>
</tr>
<tr>
<td>Reduction depense routière</td>
<td>$R$</td>
<td>4.74</td>
<td>2.95</td>
<td>0.90</td>
</tr>
</tbody>
</table>
Is SMC pricing equitable? – illustration Belgium

<table>
<thead>
<tr>
<th>% equivalent income gain</th>
<th>Average Cost + higher labour taxes</th>
<th>SMC + lower labour taxes</th>
<th>SMC + higher social transfers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quintile 1</td>
<td>-0.78%</td>
<td>+0.47%</td>
<td>+3.88%</td>
</tr>
<tr>
<td>Quintile 2</td>
<td>-0.04</td>
<td>+0.03%</td>
<td>+2.21%</td>
</tr>
<tr>
<td>Quintile 3</td>
<td>-0.24</td>
<td>-0.16%</td>
<td>+0.75%</td>
</tr>
<tr>
<td>Quintile 4</td>
<td>-0.20</td>
<td>+0.22%</td>
<td>+0.00%</td>
</tr>
<tr>
<td>Quintile 5</td>
<td>-0.49</td>
<td>+1.45%</td>
<td>-0.51%</td>
</tr>
<tr>
<td>Gain in Euro/person</td>
<td>-93</td>
<td>+161</td>
<td>+149</td>
</tr>
</tbody>
</table>