Reforming private and public urban transport pricing

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Road congestion in Paris
Addressed with cheap public transport which gave us ...
Metro in Paris at peak hours
Main message

• In many metropolitan areas and in peak periods, PT has a larger market share than private road transport and its pricing is suboptimal.

• Public Transport has an important role to play in urban areas, but
  – Cheap PT cannot substitute road pricing
  – Road pricing AND reform of PT pricing are necessary

• Difficult political message, decentralisation of pricing to city level may help
Outline

• First principles of pricing of road and PT
• Some numerical evidence
  – Stockholm
  – Paris
• Getting political support for a pricing reform
• Conclusions
First principles road pricing

\[ \text{Road toll}_t = \text{marginal external cost of a car} \]
\[ = \text{marginal external congestion cost} + \text{other external costs} \]
\[ = \sum_{\text{all road users}} \text{cost of additional delay due to extra vehicle} \]
\[ + \text{environmental and accident costs generated by this vehicle} \]
First principles PT pricing + frequency

\[
\text{bus fare} = \text{marginal cost of an additional bus user} \\
= \text{marginal external cost of an additional bus user} \\
= \text{additional time cost for other users due to mounting and alighting of an extra passenger} \\
+ \text{additional crowding discomfort costs of an additional bus user.}
\]

OPTIMAL FREQUENCY

Benefits of an extra bus = Saved waiting cost + Saved discomfort cost \\
Costs of an extra bus = extra congestion delay to other road users + rental cost \\
+ operation cost of one bus + external environmental and accident costs of a bus.
"DIVERSION RATIO" = 0.15 to 0.35?

- When a reduction of fares of PT attracts 100 new passengers, 15 to 35 are ex car users
- If DIVERSION RATIO = 1, then pricing public transport is sufficient (except for deficit financing)
Outline

• First principles of pricing of road and PT
• Some numerical evidence
  – Stockholm (model of one corridor to the city but probably good cross-price elasticity information)
  – Paris (“full” model of the city)
• Getting political support for a pricing reform
• Conclusions
STOCKHOLM CORRIDOR: Replace uniform bus prices by high peak bus prices, and off peak prices can decrease to 0

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<thead>
<tr>
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<th>Road toll Off-Peak in €/trip</th>
<th>Bus fare Peak in €/trip</th>
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STOCKHOLM CORRIDOR: If all prices are optimal, higher tolls on cars and peak bus prices are not so much higher and subsidy for bus no longer needed.

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STOCKHOLM CORRIDOR: How low should peak bus prices be if there would be no road tolls?

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Conclude on Stockholm

• Need for higher peak bus prices whether road tolls are low or high
Paris: no road pricing – low PT prices

Figure 1 Model representation of Paris

4 categories of travellers: rich/poor and working/not working, living in 4 zones
Calibrated to traffic survey
Do we need to complement the introduction of zonal road pricing of 3 Euro by an increase or a decrease of the PT fares?

- An INCREASE in PT peak fares generates more welfare than a PT fare decrease.
- Why? PT peak prices are already too low and not covering marginal operation costs so adding more users with low PT fares reduces welfare.
- An increase in PT charges works better but hurts mainly the POOREDER households when net toll revenues are redistributed uniformly.
- When a double weighting is given to the utility change for the poor, the total efficiency of a PT price increase is still higher for society as a whole.
Other elements

• Paris introduced flat monthly pass so that price becomes virtually zero?

• London shows the nice example with peak/off peak differentiations and differentiations by zone

• Bottleneck congestion representation means steering finely departure times
  – Pricing pays off much more – in limit generalised price does not increase (one substitutes queuing by tolling)
  – For road but also for Public Transport

• Pricing improves locational efficiency
  – Supply of public transport relocates economic activity but net gain (“wider economic benefits”) not clear
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  – Other elements
• Getting political support for a pricing reform
  - Step 1: simple majority voting – fixed total demand
  - Step 2: simple majority voting – price-elastic PT demand
  - Step 3: why not decentralise pricing and investment decisions?
• Conclusions
Reforming transport pricing is difficult – why?-

• When a total welfare gain exists, one can, in theory, via compensation make everybody better off via redistribution policies BUT

• Information asymmetry: values of time and schedule delay costs are individual-specific:
  – everybody claims compensation...
  – low income may be poor indicator of welfare loss

• Political mechanism decides
MAJORITY EX ANTE AGAINST AND EX POST IN FAVOUR

COMMUTING TRANSPORT TRIPS

Generalised price

MSC = Marginal social cost

AC = Average cost

\[ t^* \]

\[ X_B \quad X_C \quad X_A \quad N \]

Car use \quad PT use
Where is the majority?

• Road pricing is a typical reform problem
  – Majority ex ante against but ex post in favour
    • because there is an expected loss for most car drivers – they don’t know how easy it is to adapt..
  – A referendum will not give a majority for an experiment
    • Because ex ante there is a loss for most drivers
    • Stockholm and London did not have a referendum before the test

• Promise to redistribute revenues to PT users via lower PT prices is efficient and may help to find a majority
  – IF total number of trips is price-inelastic
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What happens with PT subsidies when public transport trips are price-elastic and diversion ratio (number of car users attracted) is small?

• Subsidy to PT attracts much more users – but this is costly to accommodate

• Once the PT prices are low, it is difficult to find a majority for the grand reform that is needed as both car users and PT users will object higher peak prices.
COMMUTING TRANSPORT TRIPS

MSC Marginal social cost

AC Average cost

t**

WTP for other PT trips

Car use

PT use

X_B X_S X_A N

Y_C Y_S

PT use for non-commuting
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Decentralise pricing to the metropolitan level?

- Opportunity is there as fuel consumption (traditional tax base) is disappearing in 10 years, in 20 years?
- Who can set prices?
  - Federal government – but constitutionally it is difficult to state that city A pays a different charge than city B
  - So differentiation of charges has to come from decentralised decision making
Advantages and problems of decentralised pricing

- Costs of PT system will become clear
- Use of city roads and PT system by outsiders forces the cities to charge at least the marginal cost and even more
  - otherwise the inhabitants are subsidizing the outsiders
  - RISK of too large charges on road and PT
  - Can be solved by a federal constraint that forces cities to invest all charge revenues into operation or infrastructure extension – this together with non-discrimination between inhabitants and outsiders guarantees optimal pricing and investment
Conclusions

• Most cities have poor pricing of road transport AND of public transport (large market share)
• Low public transport prices only won’t solve the road congestion issue
• Peak pricing of road and PT users is needed
• Obviously difficult political message
• Making cities responsible for pricing can make it easier