Round table on Social Impacts of Time and Space-Based Road Pricing
Auckland – 30/11 & 1/12/2017

Urban Toll: Rethinking Acceptability through Accessibility

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Contents

• 1) Road pricing: the acceptability issue
  - Congestion charging: a thwarted evidence
  - Winners, losers and public transit
  - Congestion charging: a spatial approach

• 2) Accessibility and the tension between acceptability and economic efficiency
Additional travel time due to congestion (Cities of more than 5 million inhabitants)

- Hangzhou
- Chongqing
- Beijing
- London
- Tianjin
- Saint Petersburg
- Los Angeles
- Chengdu
- Moscow
- Rio de Janeiro
- Istanbul
- Bangkok
- Mexico City
Economic efficiency and the evidence of congestion charging
Congestion charging: a distributive issue

Graph showing the relationship between generalized cost, demand, and density, with Marginal cost, Average cost, and Demand axes.

- Generalized Cost vs. Density
- Marginal cost
- Average cost
- Demand

The graph illustrates how congestion charging can affect distribution, focusing on the costs associated with different levels of density.
The acceptability issue

• Congestion charging = welfare improvement
• The main winner of the congestion charge is the beneficiary of the revenues of the toll
• Road users are paying more than their welfare gain under the assumption of a single value of time
• What if we adopt another hypothesis
Value of time and modal split

- Generalized Cost
- Public Transit
- Car
- Value of time
- Public transit
- Car

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Winners and losers of congestion pricing
Public transit improvement: a win-win game?
From winners and losers to public transit

- Value of time and the sensitivity to congestion charging
- More losers than winners
- Except if there is a huge improvement of public transit
- Why do we need to introduce other modes of transport?
Compared space-time consumption

<table>
<thead>
<tr>
<th>Category</th>
<th>$m^2.h/veh\ km$</th>
<th>Occupation rate</th>
<th>$m^2.h/traveler\ km$</th>
<th>Difference / pedestrian</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pedestrian</td>
<td>0,3</td>
<td>1</td>
<td>0,3</td>
<td>1</td>
</tr>
<tr>
<td>Cyclist</td>
<td>0,6</td>
<td>1</td>
<td>0,6</td>
<td>2</td>
</tr>
<tr>
<td>Two-wheeled motor vehicles</td>
<td>1,7</td>
<td>1,05</td>
<td>1,6</td>
<td>5</td>
</tr>
<tr>
<td>Cars</td>
<td>1,8</td>
<td>1,3</td>
<td>1,4</td>
<td>5</td>
</tr>
<tr>
<td>Bus (12 m) in peak hour</td>
<td>7</td>
<td>17</td>
<td>0,3</td>
<td>1,4</td>
</tr>
<tr>
<td>Articulated bus (18 m) in peak hour</td>
<td>10</td>
<td>23</td>
<td>0,3</td>
<td>1,4</td>
</tr>
</tbody>
</table>

12/12/2017
Speed and Space-time consumption of a car (Héran 2008)
The speed-flow curve
Congestion charging and the scarcity of urban space

- A new approach of congestion charging
- For individual, time is the rarest resource
- For the community, space is the rarest resource
- Two key spatial issues
  - the space consumption of different mode of transports
  - How to address the spatial impacts of congestion charging
Contents

• 1) Road pricing: the acceptability issue

• 2) Accessibility and the tension between acceptability and economic efficiency
  - A spatial approach of the acceptability issue
  - Accessibility to identify winners and losers
  - The compensation issue
Accessibility: A concept to address “the tension between acceptability and economic efficiency”

- Paradox between search for maximum economic efficiency and the acceptability transport policies
  Westin et al. (2016)

  ➞ how to reconcile efficiency and equity dimensions by introducing a spatial dimension?
  ➞ to what extent and under what conditions a spatial accessibility based approach help resolve the acceptability issue?
The gravity-based access measure

Following Hansen (1959):

\[ A_i = \sum_j D_j \exp (-\beta c_{ij}) \]

- Transport/ land use interaction
- Accessibility to jobs
Accessibility: A concept to integrate individual and local disparities

- Travel cost sensitivity and income level

Impact of value of time on accessibility

→ Efficiency issues according VoT hypotheses

Accessibility variation per zone following a EUR 5 urban toll implementation (Souche et al., 2016)
• Travel cost sensitivity and socio-economic factors
Impact of socio-economic factors on travel cost sensitivity

Figure 10: Travel time sensitivity

![Table showing travel time sensitivity for different trip purposes and labor categories](image)

- Source: Bonnafous et al., 2009
Figure 11: Accessibility to jobs (homogeneous cost sensitivity)

Figure 12: Accessibility variation when taking into account heterogeneous cost sensitivity

Source: Crozet et al., 2012
Accessibility to identify winners and losers

The example of two urban toll schemes in Lyon

Job-access variation for car drivers (EUR 3 zone toll)

Job-access variation for car drivers (EUR 3 cordon toll)

Source: Crozet et al., 2012
How to interpret accessibility in terms of acceptability: the example of the « Anneau des Sciences » bypass implementation

Source: Crozet et al., 2012
Accessibility to answer the compensation issue

What type of compensation scheme can be implemented to compensate major losers and make road charging more acceptable?

• Time compensation: the example of a EUR 5 cordon toll in Lyon
  • 5% car traffic decrease in the city center due to a lower incoming traffic
  • For a worker located in the city center: time gain of 30 seconds to join inner city jobs (average time trip = 8 minutes)

≠ for people living in suburban areas
• Cost compensation: encouraging people to share their vehicle
  -> high-occupancy vehicle lane

• Increase of accessibility

• However travel time gains depends on the level of traffic on reserved lines and are likely to decline with the success of carpooling

→ Space consumption issues
Conclusion

• Congestion charging for time gains of to take care of the scarcity of space?

• Congestion charging and accessibility
  – A way to address the issue of acceptability for people living in the outskirts
  – A way to imagine different compensation process and the development of shared mobility