Targeting TDM Policies Based on Individual Transport Emissions

Yusak O. Susilo, University of the West of England, Bristol, UK
Dominic Stead, Delft University of Technology, the Netherlands
Who has the largest share?

<table>
<thead>
<tr>
<th>Population</th>
<th>CO₂ emissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>48%</td>
<td>12%</td>
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<tr>
<td>40%</td>
<td>40%</td>
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<tr>
<td>12%</td>
<td>48%</td>
</tr>
</tbody>
</table>

4th International Symposium on Travel Demand Management, July 16-18, 2008, Vienna
Tales in two countries …

Netherlands

United Kingdom

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People and their emissions:

In the NL:

90% of all CO₂ emissions

Who are these guys? 90’s-2005: Were they the same group of people?

In the UK:

4th of Car 61%

Do they have a same behaviour toward a certain policies?

Annual CO₂ emissions from land-based passenger transport:

- Car (48%)
- Train (2%)
- Bus/tram/metro (3%)
- Motorcycle/scooter (1%)
- Other (26%)

In the UK:

90% of all CO₂ emissions

0% of all CO₂ emissions
Objectives, data and methodology

Objectives
- Explore the profiles and trends of travellers based on their transport CO₂ emissions
- Differences between two countries
- The acceptability of various policy measures

Data
- Dutch NTS (OVG/MON) - 1990, 1995, 2000, 2005
- UK NTS - 2000 & 2004

Calculation Method
COPERT: mode, distance, fuel type, vehicle age, occupancy, and speed

Attitude: EC FLASH-EUROBAROMETER 2007
Analysis outline

• Explore the trends and profiles of travel and CO$_2$ emissions overtime
• Cluster and identify the ‘extremist’ and the ‘extremist’ – who and how
• Influences overtime (regression analyses)
• Match the clustered group with their policy acceptability (Eurobarometer)
Travel and emissions trends: gender

CO₂ Emissions

Travel Distance

Travel Time

Number of Trips

- CO₂ Emissions
- Travel Distance
- Travel Time
- Number of Trips

Legend:
- 1990
- 1995
- 2000
- 2004 (UK) / 2005 (NL)
Travel and emissions trends: employment
Travel and emissions trends: personal income

**CO₂ Emissions**

- Daily CO₂ emissions (kg)
  - Dutch high income
  - Dutch medium income
  - Dutch low income or no income
  - UK high income
  - UK medium income
  - UK low income
  - UK all

**Travel Distance**

- Daily travel distance (km)
  - Dutch high income
  - Dutch medium income
  - Dutch low income or no income
  - UK high income
  - UK medium income
  - UK low income
  - UK all

**Travel Time**

- Average daily journey time
  - Dutch high income
  - Dutch medium income
  - Dutch low income or no income
  - UK high income
  - UK medium income
  - UK low income
  - UK all

**Number of Trips**

- Average number of daily journeys
  - Dutch high income
  - Dutch medium income
  - Dutch low income or no income
  - UK high income
  - UK medium income
  - UK low income
  - UK all

Legend:
- 1990
- 1995
- 2000
- 2004 (UK) / 2005 (NL)
Extremist vs Extremist

In the Netherlands:

Percentiles based on daily transport emissions

1990:

- Proportion among travellers
  - Zero CO2 emission travellers: 30.18%
  - Group 0 - 20 % Percentile: 31.00%
  - Group 20 - 40 % Percentile: 56.61%
  - Group 40 - 60 % Percentile: 13.96%
  - Group 60 - 80 % Percentile: 58.72%
  - Group 80 - 100 % Percentile: 13.80%

1995:

- Proportion among travellers
  - Zero CO2 emission travellers: 31.00%
  - Group 0 - 20 % Percentile: 31.00%
  - Group 20 - 40 % Percentile: 58.72%
  - Group 40 - 60 % Percentile: 13.80%
  - Group 60 - 80 % Percentile: 58.72%
  - Group 80 - 100 % Percentile: 13.80%

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Extremist vs Extremist (NL)

Population

CO₂ emissions

30% 10%
58% 33%
28% 57%
28% 14%
Extremist vs Extremist (UK)

<table>
<thead>
<tr>
<th>Population</th>
<th>CO₂ emissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>3%</td>
<td>22%</td>
</tr>
<tr>
<td>60%</td>
<td>20%</td>
</tr>
<tr>
<td>57%</td>
<td>58%</td>
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<tr>
<td>18%</td>
<td></td>
</tr>
<tr>
<td>19%</td>
<td></td>
</tr>
</tbody>
</table>
### Socio-economic profile by quintile (NL)

<table>
<thead>
<tr>
<th>零碳排</th>
<th>第1 quintile</th>
<th>第2 quintile</th>
<th>第3 quintile</th>
<th>第4 quintile</th>
<th>第5 quintile</th>
</tr>
</thead>
<tbody>
<tr>
<td>30%</td>
<td>14%</td>
<td>14%</td>
<td>14%</td>
<td>14%</td>
<td>14%</td>
</tr>
</tbody>
</table>

↓ age < 24  
↓ age > 64  
↓ not in work  
↑ in full-time work  
↑ received higher education
Socio-economic profile by quintile (UK)

<table>
<thead>
<tr>
<th>zero emissions</th>
<th>1st quintile</th>
<th>2nd quintile</th>
<th>3rd quintile</th>
<th>4th quintile</th>
<th>5th quintile</th>
</tr>
</thead>
<tbody>
<tr>
<td>3%</td>
<td>19%</td>
<td>19%</td>
<td>19%</td>
<td>19%</td>
<td>19%</td>
</tr>
</tbody>
</table>

↓ age < 24
↓ age > 64
↓ not in work
↓ low income
↑ in full-time work
Validity test: Regression analyses

• The most significant variables that influence the amount of CO₂ emissions: car availability, full-time employment, and income

• In the NL:
The influences of car availability and being a full-time workers have continuously increased
  – Car availability: +2.2, +2.3, +2.4, +2.7 kg CO₂
  – Full-time workers: +1.3, +1.4, +2.3, +2.4 kg CO₂

• In the UK:
  – Men: +1.1, +1.3 kg CO₂ - Full-time workers: +1.9, +1.5 kg CO₂

• Consistent with quintiles analysis:
  - No full-time employment, no car, low income ⇒ lower quintiles
  - Full-time employment, car availability, high income ⇒ higher quintiles
How about the policy acceptability of these group of people?
Mix responses toward various policies

The type of car and the way of its usage has an important impact on the environment in the respondents’ area.

Preparedness to pay more for using a less polluting transport: not prepared to pay more

<table>
<thead>
<tr>
<th>Category</th>
<th>EU27</th>
<th>Gender</th>
<th>Male</th>
<th>Female</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>43</td>
<td>39</td>
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</tbody>
</table>

Age Group

<table>
<thead>
<tr>
<th>Age Group</th>
<th>EU27</th>
<th>15-24</th>
<th>25-39</th>
<th>40-54</th>
<th>55+</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>34</td>
<td>41</td>
<td>41</td>
<td>44</td>
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</tr>
</tbody>
</table>

Education (End OpF)

<table>
<thead>
<tr>
<th>Education</th>
<th>EU27</th>
<th>15-29</th>
<th>20+</th>
<th>Still in education</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>47</td>
<td>44</td>
<td>32</td>
<td>36</td>
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</tbody>
</table>

Subjective Urbanization

<table>
<thead>
<tr>
<th>Urbanization</th>
<th>EU27</th>
<th>Metropolitan zone</th>
<th>Other town/urban centre</th>
<th>Rural zone</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>39</td>
<td>40</td>
<td>40</td>
<td>43</td>
</tr>
</tbody>
</table>

OCCUPATION

<table>
<thead>
<tr>
<th>Occupation</th>
<th>EU27</th>
<th>Self-employee</th>
<th>Employees</th>
<th>Manual worker</th>
<th>Not working</th>
<th>Drive</th>
<th>Primarily driven car</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
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<td>42</td>
<td>39</td>
<td>47</td>
<td>41</td>
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<td>40</td>
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The best way to reverse the rise of CO2 emissions from road transport

- Only allow the sale of less polluting vehicles: 55%
- Promote the purchase of fuel-efficient vehicles through tax incentives: 30%
- Introduce restrictions to the use of cars: 16%
- Promote the purchase of fuel-efficient vehicles by giving better information: 11%
- DK/NA: 8%

Paying for congestion and environmental damage through road tolls

<table>
<thead>
<tr>
<th>Yes</th>
<th>EU27</th>
<th>No</th>
<th>DK/NA</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td>40</td>
<td>60</td>
<td>6</td>
</tr>
</tbody>
</table>

Source: EC (2007)
### Who support which?

<table>
<thead>
<tr>
<th>Better public transport (%o)</th>
<th>Restrictions in city centres (parking, access for private cars or trucks) (%)</th>
<th>Speed limits (%)</th>
<th>Charges for road use (e.g. city tolls) (%)</th>
<th>No need for improvement (%)</th>
<th>Other (%)</th>
<th>DK/NA (%)</th>
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<tbody>
<tr>
<td><strong>Sex:</strong></td>
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<tr>
<td>Male</td>
<td>49.1</td>
<td>17.9</td>
<td>12.5</td>
<td>5.8</td>
<td>6.3</td>
<td>5.4</td>
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<tr>
<td>Female</td>
<td>48.0</td>
<td>15.9</td>
<td>20.3</td>
<td>5.9</td>
<td>5.5</td>
<td>2.3</td>
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<td>15-24</td>
<td>47.6</td>
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<td>4.3</td>
<td>2.1</td>
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<tr>
<td>25-39</td>
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<td>15.5</td>
<td>5.0</td>
<td>4.3</td>
<td>3.0</td>
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<tr>
<td>40-54</td>
<td>53.1</td>
<td>15.1</td>
<td>13.3</td>
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<tr>
<td>55+</td>
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<td><strong>Age of completing education:</strong></td>
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<table>
<thead>
<tr>
<th>Introduce restrictions to the use of cars (%)</th>
<th>Only allow the sale of less polluting vehicles (%)</th>
<th>Promote the purchase of fuel efficient vehicles by giving better information (%)</th>
<th>Promote the purchase of fuel efficient vehicles through tax incentives (%)</th>
<th><strong>DK/NA</strong> (%)</th>
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<td><strong>Sex:</strong></td>
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Roughly speaking …

<table>
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<th>5th quintile</th>
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Different attitudes and opinions across the quintiles

- Better public transport
- Road user charges
- City centre restrictions
- Tolls for congestion
- Better public transport
- Road user charges
- Restrictions in car use
- Tolls for congestion
- Tax incentives for cleaner vehicles

**Mostly agreed: clean car!**

Based on secondary data, need for further analyses

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Recent attitude evidences in the UK

For the sake of the environment, everyone should reduce how much they use their cars.

Anyone who thinks that reducing their car use will help is wrong - one person doesn't make a difference.

People who drive less environmentally harmful cars should pay less to use the roads.

People will generally not change their travel behaviour - unless it is made easy for them to do so AND there is a clear direct benefit from them.

"Economic growth ... should be given priority."

"It would be difficult to change my driving behaviour, even if it would help the environment."

"Bus is the polluter, not car!"

"It's just another trojan horse for taxation."

KEY: help people to understand their proxy benefit from the measurements and understand their readiness to change their behaviour.
Summary

- Trends and differences between two countries
- Zero emissions group – generally not the well-off, well-educated full-time workers
- High emissions group – fastest growth in CO$_2$ emissions
- Reduction of emissions in upper quintile by a given proportion will lead to a larger reduction in CO$_2$ emissions than by the same proportion across all the other quintiles
- Certain instruments (e.g. fuel pricing, vehicle maintenance programmes) are regressive and may affect the greatest emitters least → targeting
- Groups responsible for high CO$_2$ emissions less supportive of measures to reduce emissions
- Key: understanding behaviour and interest of different segment of the population → different needs and readiness to change their behaviour
Questions ?