Recent developments in willingness-to-pay methods for estimating the social cost of crashes

Dr Cliff Naude
Overview

• Methods
• Current practice in Australia
• Current estimates
• Scoping a national WTP study for Australia
• Interim values
• Conclusions
Methods

- **Human capital** (Hybrid HC in Australia) - loss of output to households & workplace due to death, injury (later incl. human costs)
- **Willingness-to-pay** – respondents’ WTP to reduce risk of death or injury
- **Revealed preference**
  - inferred WTP based on actual data of purchases in related markets (hedonic)
  - e.g. safety attributes of cars
- **Stated preference**
  - survey of respondents to determine WTP (WTA)
  - contingent valuation or more recently choice modelling (choice experiment)
- **Other** – *life satisfaction* approach
Assessment of preferences (additional)

- **Revealed preference**
  - Estimates based on real economic choices
  - Cost effective
  - Causal relationships need to be correctly understood
  - Link between the real dependent & inferred variables
  - Functional form specification (missing variables)
  - Data must be of high quality

- **Stated preference**
  - Widely applied (CV & more recently choice modelling)
  - Can explore reasons behind preferences
  - Ex ante application
  - WTP vs WTA disparity
  - Costly
  - Time-consuming
  - Survey bias
Current practice in Australia

- Described in detail in Austroads reports & VicRoads submission
- **Human Capital** (2000) approach (BITRE) – loss of output to households & workplace due to death, injury
- **Hybrid (modified) Human Capital** (2006) approach (BITRE) – HC plus ‘pain & suffering’, additional costs of crashes, e.g. Emergency services, cleanup costs
- **NSW RTA study** (2007) – SP (WTP), value of risk reduction, choice experiment
- **Austroads updating** (bi-annual) – HC approach (BITRE) & NSW RTA values
NSW RTA study (additional)

- Car users – 10 games (situations) of choice between two hypothetical alternative routes which differ in characteristics, i.e. traffic conditions, speed, travel time, number of lanes, risk of fatality and injury
- Pedestrians - choose between two routes differing in terms of number of lanes, speed limit, crossing type, walking time, council rate/housing rent increase to cover road safety improvements, number of fatalities and injuries
- Sample sought 210 respondents, 213 interviews conducted (142 urban/Sydney trips, 71 non-urban/Bathurst trips)
- Interviews took 15-45 mins
## Current estimates

<table>
<thead>
<tr>
<th>Method</th>
<th>Cost per fatality (June 2010) (AU$m)</th>
<th>Cost per serious injury (June 2010) (AU$m)</th>
<th>Cost per other injury (June 2010) (AU$m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HC (BITRE)</td>
<td>1.84</td>
<td>0.44</td>
<td>0.017</td>
</tr>
<tr>
<td>WTP - NSW RTA (urban)</td>
<td>6.92</td>
<td>0.34</td>
<td>0.018</td>
</tr>
<tr>
<td>WTP - NSW (rural)</td>
<td>6.84</td>
<td>0.21</td>
<td>0.022</td>
</tr>
<tr>
<td>WTP – NZ (urban)</td>
<td>3.19</td>
<td>0.58</td>
<td>0.070</td>
</tr>
<tr>
<td>WTP - Singapore</td>
<td>1.50</td>
<td>0.20</td>
<td>0.014</td>
</tr>
</tbody>
</table>
Scoping a national WTP study for Australia

- Objective: scoping study for Austroads
- National Road Safety Strategy recommendation for action:
  ‘Develop a nationally agreed approach to applying the willingness-to-pay methodology to value safety’
- ARRB project team, Austroads Project Manager: Dr Mark Harvey (BITRE)
- Review of local & international case studies
- Interviews with identified experts
- Scoping a national WTP study
- Interim values
<table>
<thead>
<tr>
<th>Study</th>
<th>Key components</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSW RTA (2007)</td>
<td>• SP (WTP) / ‘Stated Choice’</td>
</tr>
<tr>
<td></td>
<td>• VRR, WTP to reduce risk of death &amp; injury</td>
</tr>
<tr>
<td></td>
<td>• Choice experiment with interview survey</td>
</tr>
<tr>
<td>New Zealand (1991, 1996)</td>
<td>• SP (WTP plus willingness to accept WTA)</td>
</tr>
<tr>
<td></td>
<td>• Linked to household travel survey</td>
</tr>
<tr>
<td>Norway (2009)</td>
<td>• SP (choice experiment compared with CV)</td>
</tr>
<tr>
<td></td>
<td>• Internet-based questionnaire (repeated)</td>
</tr>
<tr>
<td>Sweden (2004)</td>
<td>• Revealed preference (hedonic pricing)</td>
</tr>
<tr>
<td></td>
<td>• Vehicle safety attributes</td>
</tr>
<tr>
<td>UK (1997)</td>
<td>• SP (chained approach), CV questions used for valuing non-fatal injuries, SG compares with risk of death</td>
</tr>
<tr>
<td></td>
<td>• VPF (1987), VPI (1991)</td>
</tr>
<tr>
<td>Singapore (2008)</td>
<td>• SP (choice experiment &amp; CV compared)</td>
</tr>
</tbody>
</table>
Interviews

• Aim to get behind published material & get input
• Australian experience:
  - Prof. David Hensher & Prof. John Rose (Institute of Transport and Logistics Studies, ITLS, University of Sydney)
  - Vartgues Markarian (Pricewaterhousecoopers, PwC)
  - Frank Perry (Transport for NSW, formerly RTA)
  - Prof. Jordan Louviere & Prof. Joffre Swait (Centre for the Study of Choice (CenSoC), University of Technology Sydney) (discrete choice modelling expertise)
  - BITRE (crash data consistency)
• New Zealand experience:
  - Dr Jagadish Guria (formerly of LTSA)
Scoping a national WTP study for Australia

- Stated preference with choice experiment
- Experiment design & survey / interview component critical
- Estimated cost (2012): $1m
- Timeframe: 3-4 years overall
- Range of expertise required & identified
- Life of 8-10 years for results
- Funding availability a key issue
- Value of statistical life, serious injury, etc
- Interim values: Updated by CPI or indexed by per capita GDP & adjusted by income elasticity (ATC National Guidelines)
- Importance of crash risk & exposure data – consistency of definitions & recording of crash data across jurisdictions
Scoping a national WTP study for Australia (additional)

- Data collection through choice experiment
- Experiment design crucial
- Survey component (market research expertise)
- Interview technique
- Preparation of respondents
- Online vs personal interviews
- Pilot study (approx 1,500) to test interview technique, software, etc
- Sample size of 6,000-8,000
- Sample segmentation:
  - urban and non-urban respondents (given variations in routes, trip lengths, speed limits, travel time, running costs, crash rates & severities)
  - crash types (e.g. fatal, serious injury & minor injury)
  - range of road users (e.g. car drivers & passengers, trucks, public transport commuters, pedestrians)
  - as wide an age group as possible, e.g. 18–75 years
Scoping a national WTP study for Australia (additional)

- Expertise required:
  - Technical experts
  - Survey / market research firm
  - Project management
  - Client project management
  - Peer review
Conclusions

• SP technique recommended in absence of RP
• Recent developments in this direction taken into account
• Cost, complexity & time as major considerations
• Need to estimate values for fatalities & injuries across modes
• Comparison of methods
• National WTP study as a way forward
• Additional costs, e.g. Emergency services
• Interim values
• Implications for economic evaluation
Key references