Computing what the public wants: Some issues in road safety cost–benefit analysis

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A R T I C L E   I N F O

Article history:
Received 29 January 2010
Received in revised form 25 July 2010
Accepted 3 August 2010

Keywords:
Road safety
Cost–benefit
Economics
Evaluation
Welfare economics
Value of life
Discounting

A B S T R A C T

In road safety, as in other fields, cost–benefit analysis (CBA) is used to justify the investment of public money and to establish priority between projects. It amounts to a computation by which ‘few’ – the CB analysts – aim to determine what the ‘many’ – those on behalf of which the choice is to be made – would choose. The question is whether there are grounds to believe that the tool fits the aim. I argue that the CBA tool is deficient. First, because estimates of the value of statistical life and injury on which the CBA computation rests are all over the place, inconsistent with the value of time estimates, and government guidance on the matter appears to be arbitrary. Second, because the premises of New Welfare Economics on which the CBA is founded apply only in circumstances which, in road safety, are rare. Third, because the CBA requires the computation of present values which must be questioned when the discounting is of future lives and of time. Because time savings are valued too highly when compared to life and because discounting tends to unjustifiably diminish the value of lives saved in the future, the CBA tends to bias decisions against investment in road safety.

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The purpose of a CBA is twofold: to rank actions by their attractiveness and to determine whether spending the money is justified. The hallmark of CBA is that all benefits and all costs are expressed in money terms, discounted to a 'present value', and added up. The benefits of road safety interventions are mainly in terms of life and health. Therefore the main question is how much the ‘many’ are willing to spend to reduce the chance of a future road fatality and injury. Such questions are not easy to answer convincingly. Ascertaining the money costs of road safety management are mainly in investment of money, loss of time, and loss of freedom. Costs in road safety management are mainly in investment of money, loss of time, and loss of freedom. Ascertain the money costs of interventions presents no unusual conceptual difficulties. However, expressing the loss of time and freedom in dollars is problematic. Also problematic is the calculation of the present value of future benefits and costs. In spite of the habitual use of discounting, the notion that a statistical life lost next year has now less value than a statistical life lost this year may raise eyebrows.

Elvik (2001) examined the applicability of CBA in road safety. He discussed the implications of the various criticisms of cost–benefit analysis for its applicability and tells how to determine whether cost–benefit analysis may be applied to a certain intervention. Graham (2008), in a monograph based on his years with the OMB, provides a comprehensive overview of the conceptual and practical issues swirling around the CBA when applied to lifesaving regulation. In this paper I discuss in some detail two issues central to the CBA in road safety: the problem of assigning money value to a statistical life and the problem of discounting life and time. My aim is to diminish the certitude of those who apply CBA to road safety actions without questioning. I ask whether, in road safety, the CBA computation is a reasonable way for few to guide decisions made on behalf of many.

### 1. Value of statistical life in road safety: estimates, guidelines, blemishes

The benefit of a road safety intervention is mainly in the reduction of fatalities and injuries. To represent this benefit in this way one has to use the money equivalents for life and injury. The money equivalent of the loss of life is usually called the ‘value of a statistical life’ (VSL). The term ‘statistical’ serves to emphasize that, at the time the CBA is done it is not known whose life will be saved.

A brief historical review of some typical VSLs used by the U.S. DOT is instructive. In June 1990 the Office of the Secretary of Transportation said that “…those agencies that use a dollar value of life in economic analysis should use $1.5 million.” (FHWA, 1994, p. 2). In January 1993 the use of $2.5 was recommended. Table 1 is from a

<table>
<thead>
<tr>
<th>Severity</th>
<th>Descriptor</th>
<th>Cost per injury (1994 dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIS1</td>
<td>Minor</td>
<td>5,000</td>
</tr>
<tr>
<td>AIS2</td>
<td>Moderate</td>
<td>40,000</td>
</tr>
<tr>
<td>AIS3</td>
<td>Serious</td>
<td>150,000</td>
</tr>
<tr>
<td>AIS4</td>
<td>Severe</td>
<td>490,000</td>
</tr>
<tr>
<td>AIS5</td>
<td>Critical</td>
<td>1,380,000</td>
</tr>
<tr>
<td>AIS6</td>
<td>Fatal</td>
<td>VSL = 2,500,000</td>
</tr>
</tbody>
</table>

| 4 | According to the DOT guidance (FHWA, 1994, pp. 2–3): “Comprehensive Cost – a method of measuring motor vehicle accident costs that include the effects of injuries on people’s lives. This is the most useful measure of accident cost since it includes all cost components and places a dollar value on each one. Comprehensive life values are estimated by examining risk reduction costs from which the market value of safety is inferred. The 11 components of comprehensive safety costs are: property damage, lost earnings, lost household production, medical costs, emergency services, travel delay, vocational rehabilitation, workplace costs, administrative, legal, and pain and lost quality of life.”. |
| 5 | The AIS (Abbreviated Injury Scoring) system was first developed in 1969 by the American Association for Automotive Medicine and has been periodically revised since. It assigns a score between 1 and 6 (1 = Minor, 2 = Moderate, 3 = Serious, 4 = Severe, 5 = Critical, 6 = Virtually Unsurvivable) to injury in each of six body regions (Head or Neck, Abdominal, Extremities, Face, Chest, External). |

### Technical Advisory issued by the Federal Highway Administration (FHWA, 1994).

The VSL value in Table 1 is based on Miller et al. (1991). In 2002 the U.S. DOT adjusted the VSL value noting that: “Recent years have seen considerable expansion in the number of studies published and refinement in analytical techniques. However, it does not appear that newer estimates converge on a consensus value or range that would justify modification of our established standard, and significant estimates continue to lie well below it. We now recommend the use of a value of $3.0 million in all DOT analyses.” (Emphasis added).

The tabulated costs are per injury. To get at ‘per crash’ values one has to account for the average number of injured persons per crash and the severity of their injuries. This was done by Council et al. (2005) and Zaloshnja et al. (2006) who provide cost estimates for each of 22 ‘crash geometries’. To illustrate, the cost of a fatal accident for crash geometry ‘1’ (single vehicle with pedestrian when the speed limit is less than 45 mph) the ‘mean comprehensive cost per crash’ in $2005 is estimated to be $3,234,016. Council et al. (2005) and Zaloshnja et al. (2006) rely on Zaloshnja and Miller (2004) who got their estimate directly from the $3 million VSL set in 2002 by the Office of the Secretary of Transportation. In this manner an estimate given in 2005–2006 to the last dollar comes from a chain that hinges on a round number provided by administrative guidance in 2002, which was inherited from similar guidance in 1994 because the “newer estimates did not converge on a consensus value or range” and which, in turn, evolved from a research report tabulated in 1991.

The FHWA-DOT guidance on VSL is based on meta-analyses. A meta-analysis is a sort of averaging; finding the ‘center’ of many research results. One meta-analysis (Mrozek and Taylor, 2002) examined 203 VSL estimates derived from data about how much wage compensation people tend to accept for work associated with various levels of risk. They find that “Reported estimates of the VSL vary substantially, from less than $100,000 to more than $25 million” and that “This meta-analysis suggests that a VSL range of approximately $1.5 million to $2.5 million (in 1998 dollars) is what can be inferred from past labor–market studies when ‘best practice’ assumptions are invoked.” (p. 253). A year later, Viscusi and Aldy (2003) also reviewed VSL estimates from U.S. labor market studies and report that: “Half of the studies of the U.S. labor market reveal a value of a statistical life range from $5 million to $12 million in US$2006. Estimates below the $5 million value tend to come from studies that used the Society of Actuaries data, which tends to reflect workers who have self-selected them-
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