

Methodological Note – PIN Report 2011 Chapter 1

1. Regression estimation of the annual average percentage change in deaths and serious injuries (Table 1, Fig. 5, Fig. 6)

To estimate the annual average percentage change in deaths or serious injuries occurring between 2001 and 2010 one should make use of the whole time series of counts, not just the counts in 2001 and 2010.

We assume a priori a reduction in risk of deaths or serious injuries over time, so to fix the sign of a change; we will assume reduction, so that a minus sign indicates an increase. Let the average reduction per year as a percentage of the previous year be p . If y_n is the risk of deaths in year n , then we wish to fit a model $y_n = y_0 \times (1 - p/100)^n$, where in this case year 0 is 2001 and $n = 9$ in 2010.

This is equivalent to $\ln(y_n/y_0) = n \times \ln(1 - p/100)$ so if we fit $\ln(y_n/y_0) = an$ by linear regression, then a is the estimate of $\ln(1 - p/100)$ and p is estimated by $100(1 - e^a)$.

2. Monetary valuation of preventing one road death (VPF)

Road collisions result in many kinds of social and economic costs, such as medical costs, production loss, human losses, property damage, settlement costs and costs due to congestion¹. In countries where the monetary value attributed to human losses is estimated on the basis known as *Willingness-To-Pay*, human losses constitute of the order of one-half of total value of the costs of road collisions. In the case of deaths on the road, other kinds of cost represent only a very small part of the total costs. The number of deaths is also the consequence of collisions for which EU-wide data are the most reliable. We therefore decided to focus attention first upon the valuation of human losses resulting from road deaths.

These human losses cover harm in the form of suffering, pain and loss of the joy of living of the person killed as well as the sorrow and disruption experienced by their family and friends. It is important for policy and its supporting research to be able to attach a value to this harm in terms of money. Information about costs of inadequate road safety is used in the preparation and assessment of national road safety policy, and cost-benefit analysis is increasingly applied to set priorities for road safety measures.

The *monetary Value of the human losses avoided by Preventing one Fatality* (VPF) is estimated here using the *Willingness-To-Pay* approach. *Willingness-To-Pay* (WTP) is recognised as an appropriate scientific method for estimating the monetary value to be attributed to preventing fatalities in the context of policy formulation and economic evaluation. The WTP method is based on estimating the amount of money people are

¹ SWOV Fact Sheet, Road crash costs, http://www.swov.nl/rapport/Factsheets/UK/FS_Costs.pdf

prepared to pay to prevent human suffering². The following European countries have updated the PIN team about their use WTP valuations in road safety: AT, DK, FI, IE, LU, NL, NO, SE, and the UK. In BE a WTP valuation has been estimated, and CH uses a different method which gives a value in the middle of the range of values from the WTP countries. The harmonised guidelines for project assessment developed by the EU funded research project HEATCO recommend the use of WTP³. All other PIN countries use values somewhat or appreciably below the range of values used by most of the WTP countries.

The use of WTP valuations in transport safety has been advocated by ETSC since 1997⁴. In doing so, ETSC wishes to make clear two important points:

- The VPF in no way represents a monetary valuation of the lost life of a person who has been killed: it is instead a valuation of achieving small reductions in risk to large numbers of road users in such a way that some one of them, whose identity can never be known, escapes being killed
- In adopting a particular value for the VPF for use in consideration of policies and measures for transport safety at the EU level, it is recognised that the value used in this context within each Member State remains a matter for the country concerned.

The PIN team has obtained through its panelists the valuations currently used in the WTP countries and CH. The resulting values of VPF (which include the value of subsequent consumption that the killed person would have enjoyed) have been adjusted in the ways recommended by HEATCO to factor cost in euros at 2009 prices adjusted to purchasing power parity (PPP, EU27 = 1) and taking account of changes in GDP/head up to 2009 assuming an elasticity of 1.0⁵. These adjustments for the sake of comparability between countries lead to values which in general differ from those that are in current use in the countries concerned. The resulting values are in million euro:

| | Value of Preventing one Fatality (VPF) <i>At factor cost in million euro, at 2009 prices and PPP</i> |
|-----------------|--|
| Austria | 2.08 |
| Belgium | 1.77 |
| Ireland | 1.50 |
| The Netherlands | 1.98 |
| Norway | 1.70 |

² SWOV, The valuation of human losses of road deaths
http://www.swov.nl/rapport/Factsheets/UK/FS_Immaterial_costs.pdf

³ Bickel, P. et al (2006) HEATCO deliverable 5. Proposal for harmonised guidelines. EU-project developing harmonised European approaches for transport costing and project assessment (HEATCO). Institut für Energiewissenschaft und Rationelle Energieanwendung.
<http://heatco.ier.uni-stuttgart.de/>

⁴ ETSC (1997), Transport Accident Costs and the Value of Safety.

⁵ http://epp.eurostat.ec.europa.eu/tgm/web/download/Eurostat_Table_tsieb020FlagDesc.xls

| | |
|----------------|------|
| Sweden | 1.38 |
| Switzerland | 1.62 |
| United Kingdom | 1.53 |

The value for Finland is omitted pending clarification, but is related to that for Sweden. The average of the above eight values is 1.695 million euro. In round figures, therefore, we have taken the monetary value of the human losses avoided by preventing one fatality (VPF) to be **1.70 million euro** (in 2009 euro).

3. Monetary valuation of preventing all EU road deaths, serious injuries and collisions in 2010

Analyses from countries that have made comprehensive estimates of the value of preventing collisions indicate that the valuation of the reduction in the human costs of road deaths probably represents of the order of 25% of the value to society of proportionate reductions in collisions of all severities, with a broadly similar proportion accounted for by prevention of serious injuries.

If no one had been killed in road traffic collisions in 2010, the benefits to the society would have been valued at 2009 prices at **53 billion euro**. If no one had been killed nor seriously injured, the benefits to society would have been of the order of **105 billion euro** and they would have been of the order of **210 billion euro** if there had been no collisions at all on EU roads.

The GDP for the EU27 in 2009 was **12,000 billion euro**⁶.

210 billion euro therefore represents 1.75% of EU GDP

If it had been possible to do so, the value of preventing all road collisions in 2010 would have been more than 50% greater than the EU budget⁷.

These estimates illustrate the continuing social and economic importance of working to reduce collisions, injury and deaths on EU roads.

4. Monetary valuation of the benefits to society resulting from reduction in road deaths in EU27 between 2001 and 2010

To estimate the monetary value of the benefits to society resulting from reduction in road deaths between 2001 and 2010, we first noted that the VPF estimated on the WTP basis is

⁶ Eurostat, Gross domestic product at market prices (in Purchasing Power Standards)

<http://epp.eurostat.ec.europa.eu/tgm/refreshTableAction.do?tab=table&plugin=1&init=1&pcode=tec00001&language=en>. Retrieved 27 May 2011.

⁷ <http://www.europarl.europa.eu/sides/getDoc.do?language=en&type=IM-PRESS&reference=20091215IPR66441>

assumed to change from year to year in proportion to real GDP/head⁸. We therefore estimated the VPF for each year from 2002 to 2010 at 2009 prices starting from the 1.70 million euro for 2009 by multiplying by the ratio of EU27 real GDP/head in the year concerned to its value in 2009. For each year from 2002 to 2009 we then multiplied the VPF for that year by the reduction in the number of road deaths in EU27 in that year compared with the number in 2001.

Thus the value of the reduction of 945 deaths in 2002 is estimated as 1.53 billion euro, and this figure increases year by year to 40.51 billion euro for the reduction of 23,454 deaths in 2010 compared with 2001.

The total value of the reductions in road deaths in EU27 over the years 2002-2010 compared with 2001 is estimated as 176 billion euro.

While it would be wrong to attribute the whole of this reduction to explicit road safety policies and efforts, the scale of the total value points strongly to the importance to society of striving to improve road safety.

If the EU target of 50% reduction in deaths from 2001 had been reached in 2010 by equal percentage reductions in each year 2002-2010, the value of the reduction would have been **81.5 billion euro greater** partly because the eventual reduction in 2010 would have meant 3,700 fewer deaths, and partly because more of the reduction would have been achieved in the early years of the target period than was actually the case.

5. Monetary valuation of the further benefits to society that would result from reduction in road deaths in EU27 between 2010 and 2020 if the EU achieves the 2020 target to reduce road deaths by 50% from the number in 2010.

Because $1-(0.5)^{1/10} = 0.067$, halving deaths over a 10-year period by a uniform annual percentage reduction requires a reduction of 6.7%/year.

The EUROSTAT forecast⁹ of growth in EU27 GDP/head is 1.6% between 2010 and 2011 and 1.7% between 2011 and 2012. We have assumed that the annual increase of 1.7% will continue from 2012 until 2020.

By increasing the VPF at 2009 prices by 1.6% from its 2010 value to obtain a value for 2011, and then 1.7% for each subsequent year we obtain a VPF at 2009 prices for each year from 2011 to 2020.

And by applying the annual percentage reduction of 6.7% we obtain an estimate of the reduction in EU27 road deaths in each year 2011-2020 compared with the number in 2010. An estimate of the value of that reduction in deaths in each year is then obtained by multiplication.

⁸ http://epp.eurostat.ec.europa.eu/tgm/web/download/Eurostat_Table_tsieb020FlagDesc.xls

⁹ <http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=tsieb020>. Retrieved 30 May 2011.

Thus the value of the reduction of 2072 deaths that would be achieved in 2011 is estimated as 3.64 billion euro, and this figure increases yearly to 31.6 billion euro for the reduction of 15,460 deaths in 2020 compared with 2010.

The total value of the further reductions in road deaths in EU27 over the years 2011-2020 compared with 2010 that would be achieved by reaching the 2020 target by equal annual percentage reductions is estimated at 182 billion euro at 2009 prices.

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References:

Bickel, P. et al (2006) HEATCO deliverable 5. Proposal for harmonised guidelines. EU-project developing harmonised European approaches for transport costing and project assessment (HEATCO). Institut für Energiewissenschaft und Rationelle Energieanwendung.

<http://heatco.ier.uni-stuttgart.de/>

Blaeij, A. de (2003) The value of a statistical life in road safety: stated preference methodologies and empirical estimates for the Netherlands. Tinbergen Institute Research Series, Vrije Universiteit, Amsterdam

Brabander, B. de, Vereeck, L. (2007) Valuing the prevention of road accidents in Belgium. *Transport Reviews*, 27, 715-732

DfT (2011), Updating the VPF and VPIs: Phase 1, Final Report from NERA Economic Consulting. <http://www.dft.gov.uk/pgr/economics/rdg/updatingvpfvpi/pdf/vpivpfreport.pdf>

Elvik, R. (2001). Cost-benefit analysis of road safety measures: applicability and controversies. *Accident Analysis and Prevention*, 33, 9-17.

ETSC (1997), Transport Accident Costs and the Value of Safety.

SWOV Fact Sheet, Road crash costs. http://www.swov.nl/rapport/Factsheets/UK/FS_Costs.pdf

SWOV Fact Sheet, The valuation of human losses of road deaths. http://www.swov.nl/rapport/Factsheets/UK/FS_Immaterial_costs.pdf

Wieser, S. and al. (2009), Cost-benefit analysis of road accident prevention programmes in Switzerland from 1975 to 2007, Report commissioned by the Swiss Federal Office of Public Health. www.health-evaluation.admin.ch