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Final Internship Report

Meta-Analysis on the Value of a Statistical Life in Road Safety

Abstract

We conduct in this paper a meta-analysis on the value of a statistical life (VSL) in road safety. Accordingly, we determine the factors that can explain the variation in VSL estimates reported in the literature. Our base of work is composed by 401 observations extracted from a total of 64 published articles. We found that the VSL estimates are significantly sensitive to the GDP per capita, to time and space. The significance of the baseline risk and of the risk change in the whole sample raises the question of the validity of some benefit transfer approaches in this context. We retrieve also some common results in the literature; the VSL is directly impacted by the value assessment approach (revealed vs. stated preferences), by the elicitation format (willingness-to-pay vs. willingness-to-accept) and by the dimension of the safety policy (public vs. private).

Keywords: Road safety; Value of a Statistical Life; Meta-Analysis

1. Introduction

Road accidents represent the determinant factors of the external costs of traffic. The implied damage costs may take several forms: material destruction, traumatisms, medical treatment… However, the most important component of those costs is related to fatal accidents. Around 23,000 deaths have been identified in the E.U in 2015, and approximately 35,000 in the U.S.A the same year.[1] Thus, the introduction of safety enhancements by governments as the implementation of new safety devices in the vehicles, road improvement and change of people's behaviour is crucial to reduce the number of deaths and then to increase the social welfare.

To evaluate the efficiency of such policies, a common approach is to conduct a Cost-Benefit Analysis (CBA). Simply, it consists to compare the losses due to the implementation of a policy, for instance the monetary costs of road improvement, and the gains: the number of saved lives. Consequently, as the benefits and the costs must be expressed in the same unit to be compared, we need to estimate the economic value of preventing a fatality, even though for some people a life must not have a monetary value (Ackerman, 2010).

On that account, determining the people's willingness-to-pay (WTP) for mortality risk reductions constitutes a good way to fix that issue. Different methods have been investigated to determine an efficient WTP estimate in this context. For instance, the contingent valuation method is widespread among stated preference

[1] Number extracted from the National Highway Traffic Safety Administration (NHTSA) website: https://www.nhtsa.gov/ on 08/06/18, and from the Observatoire National Interministériel de la Sécurité Routière (ONISR) website: http://www.securite-routiere.gouv.fr/la-securite-routiere/l-observatoire-national-interministeriel-de-la-securite-routiere/accidentalite-routiere. on 08/06/18

studies (SP). Basically, it implies to ask individuals, via a questionnaire, to express in monetary terms their evaluation of a risk reduction of dying in a given situation. A common alternative to the previous SP approach is to use a revealed preference model (RP). In a nutshell, consumers reveal their preferences when making decisions in which risk plays a role: choosing to use or ignore safety belts, buying a car with or without an airbag. This rate of trade-off between mortality risk and wealth is often called the "Value of a Statistical Life" (VSL)[2]. We observe in the literature a lot of variation in the VSL estimates between and among studies. Some study differences reflect actual differences in WTP, like context dependence. Concerning the sample used in the following analysis, the estimates range from 50,000 to 295 million US dollar in 2016 prices. The final acceptance of a public policy being very sensitive to the VSL, it makes very hard the decision-making. Hence, the main objective of our work is, through a meta-analysis (MA), to investigate the factors which impact the variation in the VSL estimates. Our main contribution is to consider a significant number of recent estimates, which were absent in the lasts main MA: Lindhjem *et al.*, 2011, de Blaeij *et al.*, 2003. (*see section 2.1*)

The paper is organized as follows. In section 2, we present the different steps of the MA: the literature review describing our research methodology and the selection criteria, the data collection detailing the construction of the output, listing the explanatory variables and providing some descriptive statistics, and finally the empirical assessment highlighting the models we use. Section 3 presents the results

[2] We assume that most readers are familiar with the VSL concept, hence we do not provide a further description of it. Those who are not familiar with the concept are referred to have a look to Andersson & Treich (2011).

of three meta-regressions on VSL estimates for three samples: All-Set, Best-Set and Trimmed-Set (respectively 401, 111 and 105 observations). Section 4 concludes our paper, presents some discussions of the results and some directions for a probable extended research.

2. Meta-Analysis

2.1. Literature Review

The first main step of a MA is the literature review. In other words, the first task implies to find the primary studies which provide one or many VSL estimates in a traffic context. For doing so, we used different electronic research tools. The main one is EconLit, a huge databank of economic articles. We have employed it from 23/04/18 to 11/05/18. Our method consisted to highlight the studies containing the following words (only one or a combination of them): "*value statistical life*", "*value of preventing a fatality*", "*road safety*", "*traffic*", "*transport*", "*car*", "*risks*", "*automobile*", "*motorist*", "*road crash*". In the case where the PDF of a relevant study was not directly available on EconLit, Google Scholar or on ScienceDirect.com, we used to ask directly the authors to send us their papers. Finally, to complete our research, we utilized the 28th May 2018 version of the OECD database[3] (Lindhjem *et al.*, 2011) which gathers many VSL estimates from traffic context.

Concerning the selection criteria, we focused only on published articles. The

[3] "Meta-Analysis of the Value of Statistical Life Estimates" (2011): http://www.oecd.org/env/tools-evaluation/env-value-statistical-life.htm

main reason is that published articles are considered as more reliable and often of a better quality than unpublished one. Nevertheless, Viscusi (2017) exposed that selecting only published articles may lead to a significant bias in the empirical results. He observed that the methodology and the estimates from published articles are frequently close. Finally, by lack of studies, we have also restricted our research to road safety; excluding then rail, air and sea contexts.

In three weeks of research, we found 64 studies usable in our analysis. Almost half of the total number of our studies were conducted between 2001 and 2009 (Figure 1). A good point is that sixteen studies (25% of the sample) were conducted between 2010 and 2018. Hence, a significant number of "new" VSL estimates are considered in our analysis, which were not in the lasts main MAs on this topic (Lindhjem *et al.*, 2011, de Blaeij *et al.*, 2003).

[Figure 1 here]

Twenty-two countries are represented in the whole sample (Figure 2). Unsurprisingly, a substantial part of studies comes from the United-States: seventeen studies representing 26.5% of the observations.

[Figure 2 here]

2.2 Data Collection

2.2.1 The VSL

Our work uses the VSL estimates of 64 studies consisting of an All-Set of 401 VSL estimates. We also consider a sub-sample "Best-Set" (111 observations) constituted of the best or the twos bests estimates of each study, which are determined according to the personal author's point of the view. We note that, often, a primary study provides two best estimates since they cover different kind of policy. For instance, one might cover a public safety measure whereas the second might cover a private one. A few extreme positive values of the VSL estimates were detected in the All-Set (Figure 3) and in the Best-Set (Figure 4). Accordingly, we decided to implement a second sub-sample called "Trimmed-Set" (105 observations), which is simply the Best-Set trimmed at 95% level.

All the extracted VSL estimates were converted in 2016 US dollar based on the CPI-PPP[4]. We have also income-adjusted the base VSL estimates discussed above to address changes in real income over time. For that, we used the equation:

$$VSL_{2016} = VSL_t * (\frac{Y_{2016}}{Y_t})^e \qquad (1)$$

Where Y models the average individual annual income, here approximated by the GDP per capita (*see section 2.2.2.*), and e the income elasticity. Under advice from Hammit & Robinson (2011), it is reasonable to apply an income elasticity of 1.0 since the sample is composed by high and low-income countries. Thus, we have applied an income elasticity equal to 1.0 for all the considered countries in the sample.

[4] Using the databases:
-World Development Indicators. . (Version of 02/05/2018) https://data.worldbank.org/indicator/NY.GDP.PCAP.CD, https://data.worldbank.org/indicator/FP.CPI.TOTL
-Meta-Analysis of Statistical Value of Life Estimates. (Version of 28/05/2018) http://www.oecd.org/env/tools-evaluation/env-value-statistical-life.htm
-International Labour Organization. World Bank. (Version of 28/05/2018) https://data.worldbank.org/indicator/PA.NUS.PPP

2.2.2 Explanatory variables: description and expected VSL relationship

We have categorized the VSL estimates in different sub-groups. A summary of those categories including a brief description, their expected relationship with the VSL estimates and some descriptive statistics are available in Table 1.

From the theory (Drèze, 1962, Jones-Lee, 1974), we know that the VSL depends directly on two factors: wealth w and baseline risk of dying r. Consequently, two standard effects are identified: the dead-anyway effect and the wealth effect (Andersson & Treich, 2011). The dead-anyway effect states that the VSL increases with the baseline risk of dying. Indeed, if one is quite sure to die (high value of r), one does want to invest a lot to reduce the risk and inversely, if one is quite sure to survive (low value of r), one doesn't want to pay a lot to decrease further r. This standard effect is empirically nuanced in practice by de Blaeij *et al.* (2003). They found that, at low risk levels, the demand function may be close to the horizontal, implying that small differences in initial risk among studies will not have an impact on estimated VSL. The wealth effect states that VSL increases with wealth w: wealthier people have more to lose if they die and have a lower marginal cost of spending (if risk averse). On that account, we have extracted the information concerning the *baseline risk* but, unfortunately, approximately half of the primary studies didn't provide enough data to extract the average individual annual income. To fix this issue, we have implemented a proxy: the corresponding *GDP per capita*. For doing so, we have collected the GDP per capita of the corresponding year of each primary study and converted it in US dollar 2016 based on CPI [5].

We decided to control also for the *risk change* induce by the safety policy considered in the primary study. In theory, the number of saved lives must not impact the value of one statistical life since that WTP is predicted to increase proportionally with the risk reduction. In practice, it is common to find that the risk change impacts the VSL. A reason is that respondent do not perceive small change in risk. One can illustrate this situation by taking a simple example. People might don't perceive the difference between a 5:100,000 reduction in mortality and a 3:100,000 reduction. Accordingly, people would provide the same marginal willingness-to-pay, resulting in a smaller VSL in the first case.

We have implemented a dummy variable for the estimates which have passed an internal or external *scope test* in their primary study. A scope test is interpreted as passed when the mean WTP is found to be significantly higher for respondent facing a risk change A compared with a risk change B, with A>B.

We have made a distinction between *SP* and *RP* studies. Lanoie *et al.* (1995) stated that VSL estimates in RP studies are in general lower than in SP studies. Indeed, in RP studies, economists refer their work to policy measures that are actually implemented. At the opposite, in SP studies, economists always refer to purely hypothetical policy measures, explaining possibly the difference between the VSL valuation. In addition, we have specified two variables concerning the SP studies only: *Payment Vehicle* and *Risk Description*. Both are information given by the

[5] Using: World Development Indicators. Last Update 02/05/2018 to get CPIs and GDPs values https://data.worldbank.org/indicator/NY.GDP.PCAP.CD, https://data.worldbank.org/indicator/FP.CPI.TOTL

investigators to the respondents before to make the experiment. The payment vehicle is modelled by: *the price of a private good*, a *tax*, a *toll*, a *donation* or *another payment vehicle*. We expect tax aversion to play role, resulting in a lower VSL estimate as compared to the private good. Investigators may also describe the baseline risk in many different ways: provide *only the risk probability*, give some *visual description*, provide *further details to the concept of probability*, or to give simply *the number of victims in the population*.

We have also differentiated *public* and *private* safety aspects. The latter witnesses the fact that the VSL is determined by reducing the risk of dying after the implementation of a private safety device (for instance an air-bag in a vehicle), and the former witnesses the fact that the VSL is determined by reducing the risk of dying after the implementation of a public good (for instance new street lights). The economic theory suggests that VSLs based on public good valuation are expected to be lower. The reasons are not well identified yet, but some authors tried to provide some informal explanation: the free-rider problem inherent to public goods (de Blaeij *et al.,* 2003), the fact that many people must not believe public programs to be effective or to benefit them (Lindhjem *et al*., 2011). A concern with much empirical evidence is that comparisons are confounded since results from different studies are compared where context, design, etc., may differ. (Andersson *et al.,* 2017). We precise that an alike variable is also implemented in the study: *Type of safety enhancing measure* which takes the values: *Vehicle*, *Road related*, *Behaviour*, and *Other*.

Concerning the distinction between *WTA* and *WTP*, several papers exposed that WTA estimates tend to be higher. There is no consensus on why a large gap between the two values is often observed: people may perceive gains and losses in an asymmetrical fashion (Guria, 2005) or, as the empirical evidence suggests, the disparity could be due to experimental-design features and elicitation techniques (e.g., Plott and Zeiler, 2005, 2007) or be confounded by the type of good; the disparity being smaller for ordinary private goods and larger for public or non-market goods. (Tunçel & Hammit, 2014).

We have stratified our sample by *location*. To obtain some relatively balanced groups (with respect to Figure 2), we have clustered the U.S with the Canada as the *Northern America* group, Sweden with Norway and Denmark as the *Northern Europe* group, France with the U.K, Switzerland and Italy as the *Western Europe* group, and the other countries together as the *Rest of the world* group.

A *time* variable is relevant since four decades are covered in our analysis. *Early* corresponds to the studies published between 1974 and 1991, *Early Late* to the ones published between 1992 and 2000, *Late Early* to the ones published between 2001 and 2009 and *Late* to the ones published between 2010 and 2018.

Finally, by focusing only on published articles, it was interesting to investigate the impact of those publications on the VSL. Practically, we can suppose that the authors of the primary studies might select a VSL estimate which is consistent with past studies of a given journal to enhance the likelihood of the paper's acceptance for publication and to bolster the general acceptance of the result (Viscusi, 2017). Inversely, the economists working in a given journal might accept only the studies which provide VSL estimates belonging to a given range of value. This behavioural bias is the main reason why we have implemented the variable *Journal*, which takes the value *Journal of Risk & Uncertainty, Accident Analysis & Prevention,* and *Other*.

[Table 1 here]

2.3 Descriptive analysis

2.3.1 The VSL

The VSL distributions in the All-Set and in the Best-Set are likely to differ since one would not expect the authors to designate the outlier values as their best estimate of the VSL in their study. Indeed, we observe a large difference in the range with respect to the three samples (Table 2). The range in the All-Set is $812 million whereas the range in the Best-Set and Trimmed-Set are respectively $221.05 and $37.86 million. By observing the means in the All and Best-Sets, we can suppose the existence of a negative "Best Selection Bias" in our analysis. Another remarkable point is that, by trimming the Best-Set at 95% level, the maximum of the statistical series drops from $222 million to $38 million.

[Table 2 here]

The median estimates are very similar in the three samples: $4.31 million in the All-Set and $4.06 million in the Best and Trimmed-Set. We detect also a right skewed distribution of the VSL estimates (Table 3). In the Best-Set, the 99th percentile of the whole sample drops from $218.0 million to $129.0 million and from $218.0 to $26.2 million in the Trimmed-Set. We remark that the biggest outliers are provided by studies from the "Rest of the World" group. The 99th percentile of the "Rest of the World" group drops from $588 million ($893 million in the VSL-Income adjusted group) to $222.0 million in the Best-Set (resp. $295 million) and to $38.0

in the Trimmed-Set (resp. $57.8 million).

[Table 3 here]

Figure 3 provides the funnel plot for the All-Set of VSL estimates. It is relevant to highlight the fact that negative VSL values are reported here. A reasonable supposition could be that all those values will disappear in the Best-Set since there is some apparent reluctance of researchers to report theoretically improbable negative estimates. In addition, as mentioned above, there is clustering of the small positive values combined with an upper right tail of the distribution that extends farther than does the left tail. This overall design is consistent with the presence of some publication selection bias (Viscusi, 2017).

[Figure 3 here]

The funnel plot for the Best-Set in Figure 4 is much more skewed than the All-Set distribution, as it has an absolutely asymmetric form and is highly right-skewed. As expected, this distribution is truncated at the vertical axis since no negative estimates are reported as the best estimates in any of the articles. One might expect two opposite effects through the "Best Estimate Selection Bias". The first effect is supposed to be positive since no negative values are reported anymore. The second effect is assumed to be negative since the most extreme positive values are deleted, reducing the range of the statistical series.

[Figure 4 here]

The funnel plot for the Trimmed-Set (Figure 5) is obviously almost the same as the funnel plot of the Best-Set since only 6 values have been deleted. The main difference is, as we have mentioned above, the noticeable reduction of the right tail of the distribution. Hence, the negative effect of the best estimate selection bias could be predominant is our study. It would explain the decrease of the simple mean and of the median VSL estimates observed in Table 1.

[Figure 5 here]

2.3.2 A first observable link between VSL and explanatory variables

Table 4 exposes the conditional means of VSL and VSL-Income adjusted for various categories of studies. We observe a net difference in the conditional mean VSL between SP studies and RP studies in the All and Best-Sets, the RP studies providing apparently lower estimates (resp. $6.98 and $6.08 millions) than the SP studies (resp. $22 and $13.6 millions). However, this tendency is not so clear in the Trimmed-Set. We can input the same remark concerning the means of VSL computed from a WTP and from a WTA approach in the All-Set, the latter method leading to higher estimates ($38.7 millions) than the former ($17.4 millions). It seems also that the articles published in the *Journal of Risk & Uncertainty* and in the *Accident Analysis & Prevention* journal provide lower estimates than articles published in other journals, in the All and Best-Sets.

[Table 4 here]

Those phenomenon, exposed and expected in the previous theory reminder (*see section 2.2.2.*), are observable thanks to the conditional means. Now, the existence of such impacts will be investigated in the following econometric analysis.

2.4 Benchmark Models

Lindhjem *et al.* (2011) state that the classic OLS is the most common approach in the Meta-Analysis literature. To go further in the analysis, they also propose to run some regressions on different sub-samples (for instance on *SP* studies only in the first hand and on *RP* studies only on the other hand) to see how vary some given effects with respect to a given population. Accordingly, it is interesting to run a regression on the VSL estimates by considering the whole population as a first step of our analysis (*see section 3.1 and 3.2*), and finally to run the regressions on each sub-population as a second step (*see section 3.3*).

A log–log model, modifying the VSL, the GDP per capita and the initial risk variables but leaving the dummies unchanged, is applied in our analysis. The log-log form is in effect a good fit for our data since we have only positive values and since it reduces the effect of outliers detected in section 2.3.1. Hence, the model used is given by:

$$\log(VSL_i) = \beta_0 + \beta_1 \log(GDP\ per\ capita_i) + \beta_2 \log(Baseline\ risk_i) + \Sigma\, \beta_k X_{ki} + \varepsilon_i \quad (2)$$

Where X_k is a vector of the covariates describe in section 2.2.2.

Another common and recommended method (Nelson & Kennedy, 2009) is to apply some weights in the regression, and particularly apply the inverse of the standard deviation of the VSL reported in the primary study. Certainly, the weighted least square (WLS) estimation is a good method to control for potential heteroskedasticity since the extracted VSL estimates come from different studies, all conducted in different countries at different period and using different estimation methods. Unfortunately, the main issue we faced during the data collection was precisely the lack of information concerning the VSL's standard errors. The missing data represented around fifty percent of the sample. To impute a standard error anyway, a common method is to proxy the variances using the primary study sample sizes, as seen in Viscusi and Masterman (2017). Hence, we estimated a regression of the VSL estimate's standard error divided by the VSL on the sample size used in the estimation.

We have identified the heteroskedasticity by running an auxiliary regression on the square of the residuals of the OLS regression[6], which justify the implementation of a weighted regression (WLS), in addition to the unweighted one (OLS).

3. Results

3.1 First regressions

The first estimations consists of meta-regressions, unweighted and weighted, on *log(VSL-Income Adjusted)* reported in Table 5.

The results show that *log(GDP per capita)* is significant at 1% level in the three different sets, in both weighted and unweighted regressions. We remark that we cannot reject at 95% level that the coefficient is equal to 1 in all regressions. The

[6] $\varepsilon_i^2 = \alpha_0 + \Sigma\ \alpha_k X_{ki} + error_i$. Where ε_i^2 is the square of the residuals of the OLS regression and X_k is a vector of the covariates describe in section 2.2.2. By checking the significance of the coefficients α_k, we valid or invalid the presence of heteroskedasticity.

value of the VSL-Income elasticity equal to 1.0 used in section 2.2.1 is then well-founded.

Log(baseline risk) is only significant in the All-Set, at 5% level in the Unweighted regression and at 10% level in the Weighted regression. The coefficient in both regressions being negative, the results are not in line with our theoretical expectation (dead-anyway effect). Nonetheless, the coefficient is not significant in the Best and Trimmed-Sets. As exposed in section 2.2.2, one explanation of the non-significance may be provided by Blaeij *et al.* (2003). In our analysis, we can wonder about the low number of observations in the Best and Trimmed-Set playing a role in the significance of the estimate of interest.

Log(risk change) is not significant in all cases but in the All-Set Weighted one. We consider this result as reasonable: the number of saved lives must not impact the value of a statistical live. However, as mentioned in section 2.2.2, find empirically a significant negative result is neither totally surprising.

A very interesting point is that, later is the publication higher is the significant negative impact on the VSL estimate. In addition, in the All-Set, *Northern America* and *Western Europe* provide higher VSL estimates than the rest of the world. On average, if the primary study were conducted in the United-States or in Canada, it implies an increase from 27.2 to 38.9% in VSL ceteris paribus, whereas if it were conducted in the United-Kingdom, in France, in Italy or in Switzerland, it implies an increase from 31.0% to 45.9% in VSL ceteris paribus. These results highlight the fact that a geographical and a time selection bias may occur by focusing only on a given region or a on given period.

Willingness-to-accept is significant in both types of regression in the All and Best-Set, confirming our expectation. In those cases, we can interpret our finding as following; On average, if the format of VSL is WTA, it implies an increase from 66.9 to 75.2% in VSL, ceteris paribus.

The coefficient of *Public* is significant and negative in the All-Set both regressions and in the Best-Set weighted regression. Our anticipations were also well-founded in that case.

Our empirical results concerning *Revealed Preferences* match with the de Blaeij's study (2011). On average, if the study is based on revealed preferences, it implies a decrease from 22.1 to 30.6% in the estimated VSL, ceteris paribus.

Journal of Risk & Uncertainty is significantly negative in the All-Set, at 5% level in the Weighted regression and at 10% level in the Unweighted regression. It is interesting to see that the journal in which the study is published may have an impact on the VSL estimate. Viscusi (2017) talked about a "Publication Selection Bias", we have showed empirically that the existence of a "Journal Selection Bias" is also non-excludable. In effect, on average, studies published in the Journal of Risk & Uncertainty provides VSL estimates that are between 13.9 and 16.6% lower than the studies published in other journals.

[Table 5 here]

3.2. Second Regressions

The second estimations consists of meta-regressions, unweighted and weighted, on *log(VSL-Income Adjusted)* reported in Table 6. Those are the same regressions as in section 3.1., but the dummy variable *Public* is replaced by the categorial variable *Type of safety enhancement*. In effect, we consider that these variables are correlated since, for instance, if the type of safety enhancement is the adding of a safety device in a car it implies that the safety policy is private. Contrarywise, if the type of safety enhancement covers people's behaviour or a road related improvement, the safety policy is public.

Road Related is not significant, even though the coefficient is negative. *Behaviour* is significant in the All-Set sample at 5% level. On average, if the type of enhancement of a safety policy covers people's behaviour, it implies an increase in the VSL from 13.1 to 13.5%, ceteris paribus. These results seem quite surprising since we expected to find significant negative coefficients (*see the results of Public in section 3.1.*). We suppose that, within public safety policy, two opposite effects remain. A negative effect associated to the sub-category "road related improvement" (even if found non-negative in our analysis) caused by the free-rider problem, and a positive effect associated to the sub-category "People's behaviour". Concerning the latter category, people may perceive the risk in an asymmetrically fashion in traffic. In general, the drivers consider themselves as "a good driver" and believe that the danger come from the other's behaviour. Accordingly, in the case of an improvement of the general behaviour, the drivers' willingness-to-pay can be bolstered.

[Table 6 here]

3.3. Third regression

The third estimations consists of meta-regressions, unweighted and weighted, on *log(VSL-Income Adjusted)* in the SP studies sub-sample, reported in Table 7. In those regressions, we have then implemented the categorical variables *Risk Description* and *Payment Vehicle*.

We note that, concerning *Risk Description*, if the investigators provide the risk level to the participants by stating the number of victims in the population or if they provide the risk probability to the participants by adding further explanation about the probability concept, the VSL is higher. The respondent, in those cases, may surely better understand the actual risk rather than giving solely the probability which can be not well-understood by everyone. Hence, it seems that a better understanding of the risk leads to an increase in the valuation of the risk reduction.

A quite surprising result is that *Tax* is significantly positive at 1% level. Because of tax aversion, we expected to find a negative coefficient. By implementing in the regression the dummy variable *Public,* some correlation between the sub-category of *Payment vehicle* and this variable may interfere in the results.

We also remark that the sub-categories of *Location* are not significant anymore.

[Table 7 here]

4. Conclusion and Discussion

The value of a statistical life was the object of many studies for several decades. Because of the heterogeneity of the estimates across countries and over time, the policy decisions are directly impacted. Through the popularity and the apparent efficiency of the OLS and WLS estimations, we have been able to model the VSL estimate as a function of theoretical parameters and of some primary studies characteristics. Our main contribution was to include a substantial number of recent primary works. We found that the VSL estimates are significantly sensitive to the GDP per capita, to time and space. The significance of the baseline risk and of the risk change in the whole sample raises the question of the validity of some benefit transfer approaches in road safety. In addition, the government decision to implement a new public safety policy can be negatively affected since, in that case, the VSL estimate seems undervalued. We also point out that, concerning the SP studies, some improvements such as a "guideline" could be created to reduce the heterogeneity in the VSL estimates. The risk change being significant in our third regression, the definition of a range of risks which are understandable and valuable by everyone could be a great beginning. Or, for time and simplicity sake, provide the number of victims in the population instead of the probability risk, which seem to be better understood by the respondents. To extent our work, it would be great to run some other regressions by clustering with respect to different variables (only on RP studies etc..) to see how vary some given effects, for instance the sensitivity of *log(GDP per capita)*, with respect to a given sub-population.

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Annex

Figures

Figure 1. Bar chart of the number of primary studies found in the literature by period.

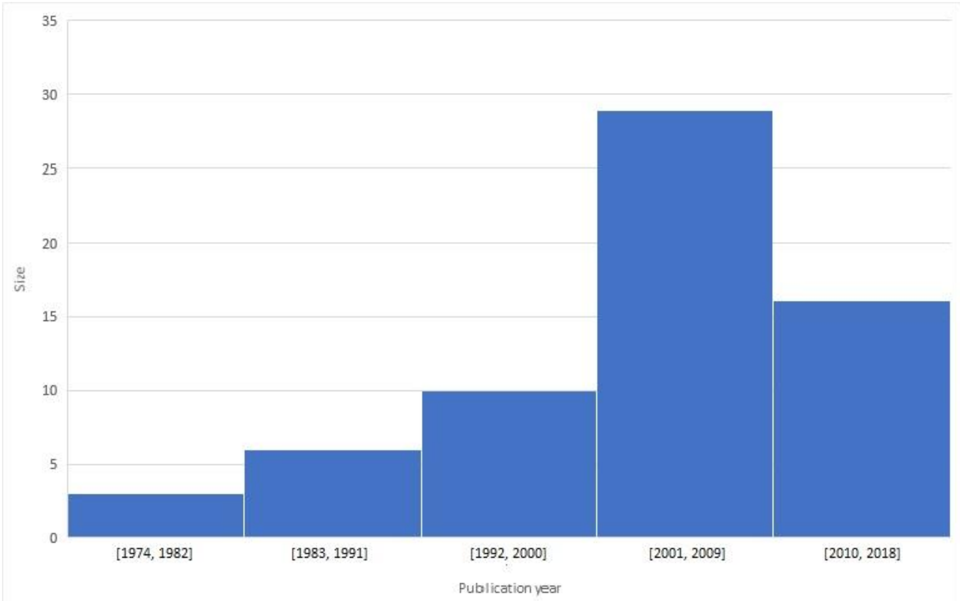

Figure 2. Bar chart of the number of primary studies found in the literature by country.

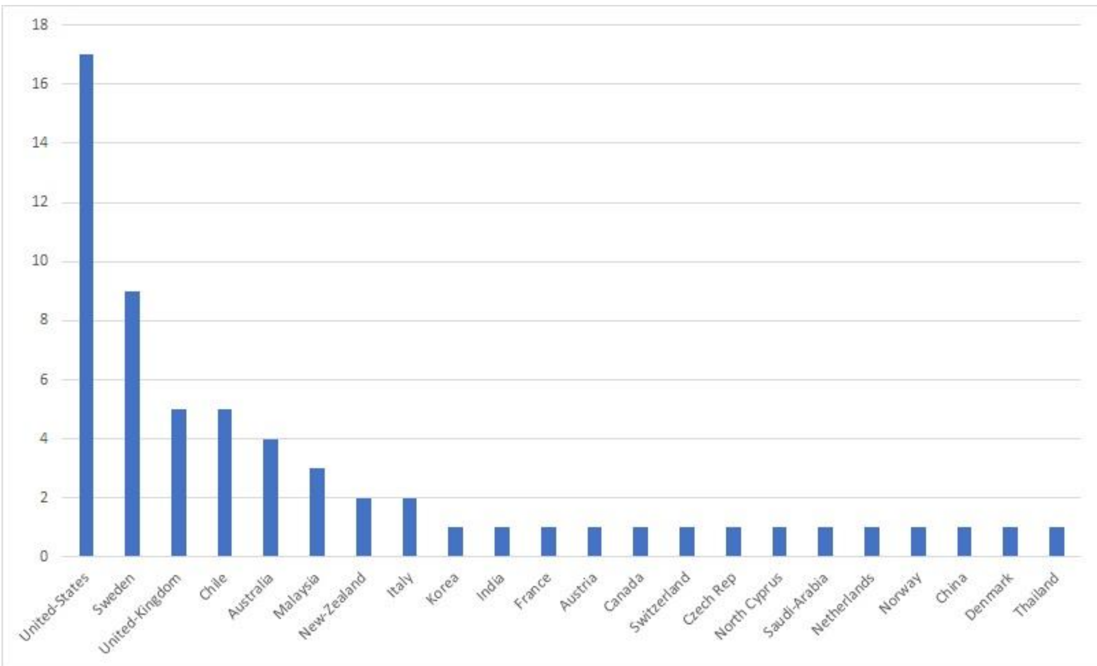

Figure 3. Funnel plot of the VSL-Income adjusted Estimates in the All-Set. *Note: N = 401*

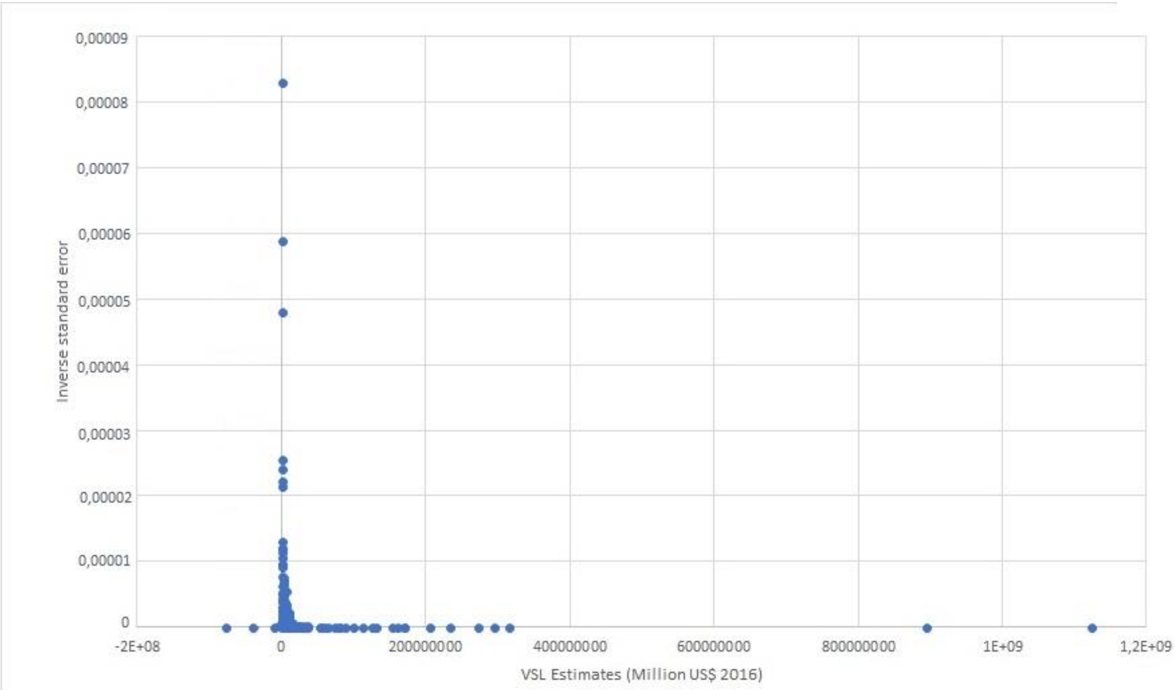

Figure 4. Funnel plot of the VSL-Income adjusted Estimates in the Best-Set. *Note: N =111*

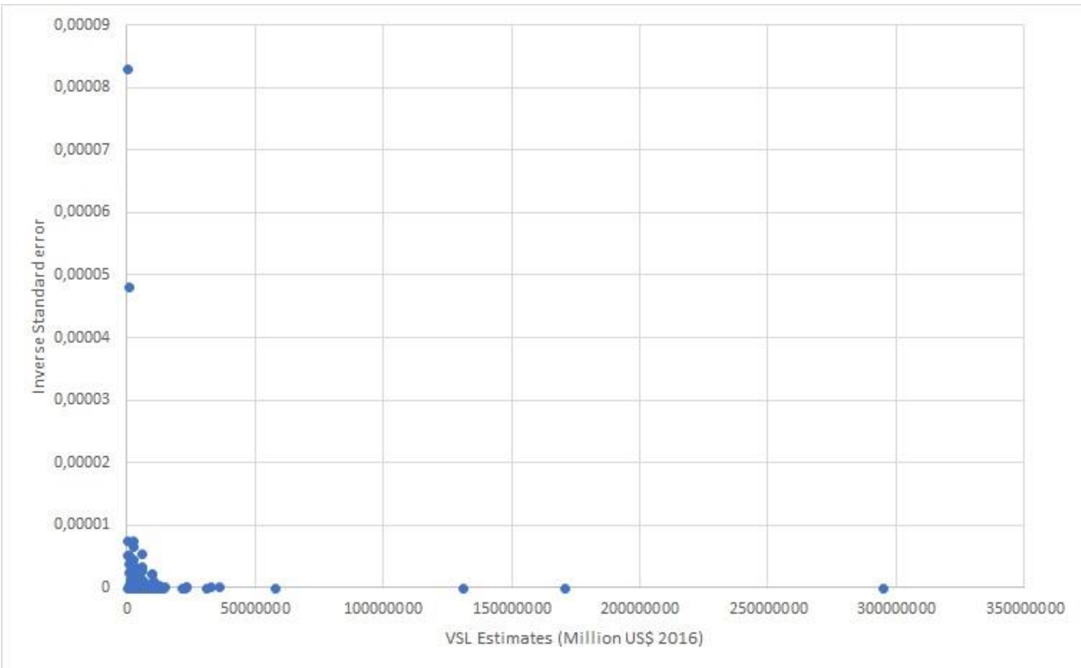

Figure 3. Funnel plot of the VSL-Income adjusted Estimates in the Trimmed-Set.

Note: N = 105

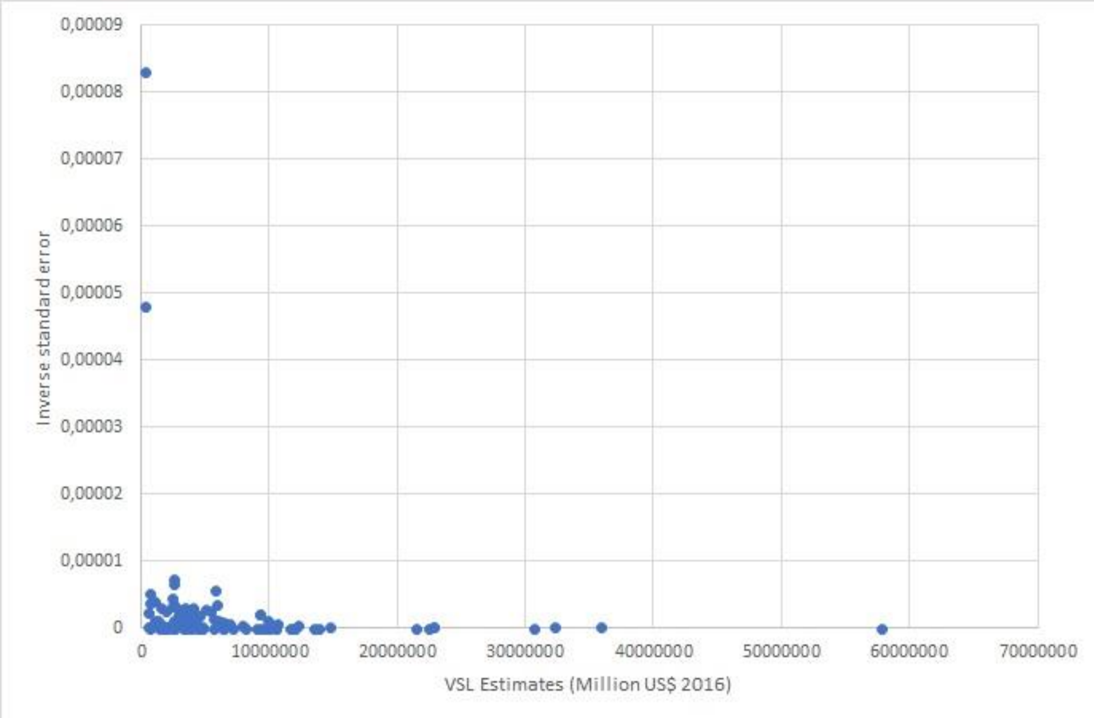

Table 1. Explanatory variables expected VSL relationship and descriptive statistics.

Variable	Description	Reference	Dimension	Expected relationship	Mean (s.e)
Income and Risk			All studies		
GDP per capita	Continuous. In USD 2016.			+	36,319.97 (18,662.04)
Log(GDP per capita)	Continuous.			+	4.45 (0.39)
Baseline risk	Continuous. The baseline risk of dying exposed in the primary study.			0	0.0003 (0.0008)
Log(baseline risk)	Continuous.			0	-4.12 (0.85)
Risk change	Continuous. The risk change of dying implied by the safety policy.			0	-0.00007 (0.0001)
Log(Risk change)	Continuous.			0	-4.59 (0.69)
Context variables			All studies		
Revealed P. Studies	Binary: 1 if the study is a RP one.			-	0.26 (0.44)
Willingness-to-accept	Binary: 1 if the format of VSL is WTA.			+	0.04 (0.19)
Public	Binary: 1 if the VSL is determined by reducing the risk of dying after the implementation of a public good.			-	0.29 (0.45)
Household	Binary: 1 if WTP is stated on behalf the household; 0 if WTP is only for the individual asked.			?	0.49 (0.56)
Scope test	Binary: 1 if WTP estimate passed an internal or external scope test in the primary study.			?	0.30 (0.46)
Risk description			SP only		
Risk only (*Reference*)	Binary: 1 if investigators provide only the risk probability of dying.	Yes			0.40 (0.49)
# Victims in population	Binary: 1 if investigators provide the number of victims in the population.			+	0.423 (0.49)
Visual explanation	Binary: 1 if investigators provide the risk probability of dying + some visual explanation.			+	0.12 (0.33)
Further Explanation	Binary: 1 if investigators provide the risk probability of dying + further explanation.			+	0.06 (0.24)
Location			All studies		
Northern America	Binary: 1 if the study was conducted in the U.S or Canada.			?	0.30 (0.46)
Northern Europe	Binary: 1 if the study was conducted in Sweden, Norway or Denmark.			?	0.24 (0.43)
Western Europe	Binary: 1 if the study was conducted in the U.K, France, Italy or Switzerland.			?	0.17 (0.38)
Rest of the World	Binary: 1 If the study was conducted in another country.	Yes		?	0.29 (0.45)
Time			All studies		
Early	Binary: 1 if the study has been published between 1974 and 1991.	Yes		?	0.10 (0.30)

Late Early	Binary: 1 if the study has been published between 1992 and 2000.		?	0.17 (0.38)
Early Late	Binary: 1 if the study has been published between 2001 and 2009.		?	0.49 (0.50)
Late	Binary: 1 if the study has been published between 2010 and 2018.		?	0.24 (0.43)
Payment Vehicle		SP only		
Price of private good	Binary.	Yes		0.65 (0.48)
Tax	Binary.		-	0.06 (0.25)
Toll	Binary.		?	0.08 (0.28)
Donation	Binary.		?	0.04 (0.20)
Other payment	Binary.		?	0.17 (0.38)
Type safety enhancing measure		All studies		
Vehicle	Binary: 1 if implementation of a vehicle safety device (ex: air bag).	Yes		0.56 (0.47)
Road related	Binary: 1 if implementation of a road improvement device (ex: new street lights).		-	0.21 (0.41)
Behaviour	Binary: 1 if safety policy aims to change behaviour (ex: new street lights).		?	0.19 (0.39)
Other improvement	Binary.		?	0.04 (0.19)
Journal		All studies		
Risk & Uncertainty	Binary: 1 if the article has been published in the Journal of Risk & Uncertainty.		?	0.25 (0.44)
Accident Analysis & Prevention	Binary: 1 if the article has been published in the Journal Accident Analysis & Prevention.		?	0.08 (0.27)
Other	Binary: 1 if the article has been published in another journal.	Yes	?	0.63 (0.48)

Table 2. Summary of the different types of VSL with respect to the sample in US$ 2016 (x10^6)

	Observations	Mean	Std. Dev.	Min	Median	Max
VSL						
All estimates	401	13.5	54.0	-73.0	3.49	739
Best estimates	111	8.87	25.4	0.05	3.35	222
Best + Trimmed	105	5.22	5.91	0.14	3.35	38
VSL-Income adj.						
All estimates	401	18.2	79.5	-75.5	4.31	1120
Best estimates	111	11.7	34.3	0.05	4.06	295
Best + Trimmed	105	6.74	8.31	0.20	4.06	57

Table 3. Distribution of different types of VSL estimates by quantile.

	5%	10%	25%	50%	75%	95%	99%
VSL							
All-set							
Whole sample	0.14	0.43	1.46	3.49	7.90	41.4	218
Northern America	0.92	1.61	2.70	5.50	10.5	31.0	71.4
Northern Europe	1.62	1.85	2.67	4.88	7.80	11.8	19.8
Western Europe	0.64	2.11	3.50	6.16	13.0	164	218
Rest of the World	0.08	0.14	0.47	1.12	2.87	81.7	588
Best Set							
Whole sample	0.33	0.62	1.74	3.35	7.20	24.9	129
Northern America	1.35	1.65	2.10	4.24	8.86	24.9	26.2
Northern Europe	1.62	1.79	2.44	3.39	4.71	9.37	15.8
Western Europe	0.33	0.70	3.17	6.22	11.9	129	129
Rest of the World	0.10	0.19	0.53	1.51	3.39	85.9	222
Trimmed Set							
Whole sample	0.42	0.70	1.91	3.35	6.71	17.8	26.2
Northern America	1.62	1.91	2.25	4.62	8.80	24.9	26.2
Northern Europe	1.62	1.79	2.44	3.39	4.71	9.37	15.8
Western Europe	0.33	0.70	3.17	5.93	9.48	179	179
Rest of the World	0.19	0.41	0.62	1.51	3.35	5.31	38.0
VSL-Income Adj.							
All-set							
Whole sample	0.25	0.59	1.87	4.31	9.66	57.8	27.3
Northern America	1.63	1.96	3.56	7.36	12.7	30.6	35.7
Northern Europe	1.91	2.28	3.15	5.84	8.70	15.7	26.7
Western Europe	1.31	2.70	4.01	8.48	16.4	205	273
Rest of the World	0.16	0.25	0.62	1.59	3.83	124	893
Best Set							
Whole sample	0.48	0.95	2.41	4.06	8.98	32.3	171
Northern America	1.65	2.45	2.68	5.98	10.2	32.3	35.8
Northern Europe	2.19	2.41	2.83	3.81	6.35	9.83	21.4
Western Europe	0.67	1.42	3.68	6.85	13.8	171	171
Rest of the World	0.20	0.29	0.65	1.87	4.51	131	295
Trimmed Set							
Whole sample	0.65	1.25	2.46	4.06	7.99	22.7	35.8
Northern America	1.77	2.46	2.86	6.31	10.5	32.3	35.8
Northern Europe	2.19	2.41	2.83	3.81	6.35	9.83	21.4
Western Europe	0.67	1.42	3.68	6.60	12.1	22.4	22.8
Rest of the World	0.29	0.51	0.95	1.87	4.44	7.08	57.8

Groups	VSL						VSL-Income Adjusted					
	All estimates *n=401*		Best estimates *n=111*		Best + trimmed *n=105*		All estimates *n=401*		Best estimates *n=111*		Best + trimmed *n=105*	
	Size	Mean (s.e)	Size	Mean (s.e)	Size	Mean (s.e)	Size	Mean (s.e)	Size	Mean (s.e)	Size	Mean (s.e)
RS, SP												
(1) Stated preferences	298	16.1 (62.1)	84	10.1 (29.0)	78	5.32 (6.54)	298	22.0 (91.6)	84	13.6 (39.3)	78	6.97 (9.33)
(2) Revealed preferences	103	5.90 (11.4)	27	4.93 (3.66)	27	4.93 (3.66)	103	6.98 (12.2)	27	6.08 (4.19)	27	6.08 (4.19)
Private vs. Public safety												
(1) Public	115	13.0 (35.0)	42	7.77 (20.2)	41	4.81 (6.38)	115	16.4 (44.5)	42	9.88 (27.0)	41	5.97 (9.25)
(2) Private	286	13.7 (60.1)	69	9.55 (28.2)	64	5.48 (5.64)	286	18.9 (89.8)	69	12.8 (38.2)	64	7.32 (7.68)
Format of VSL												
(1) Willingness-to-pay	386	12.9 (54.0)	107	6.94 (15.4)	102	5.17 (5.98)	386	17.4 (79.7)	107	9.21 (21.5)	102	6.71 (8.93)
(2) Willingness-to-accept	15	30.0 (54.5)	4	60.6 (107)	3	6.98 (2.31)	15	38.7 (73.0)	4	79.6 (143)	3	7.91 (1.48)
Household, Individual												
(1) Household	198	16.11 (62.3)	41	13.5 (38.8)	37	5.53 (4.63)	198	21.2 (90.6)	41	17.4 (51.6)	37	6.75 (5.89)
(2) Individual	203	11.0 (44.6)	70	6.14 (11.6)	68	5.05 (6.53)	203	15.2 (66.9)	70	8.40 (17.5)	68	6.73 (9.41)
Payment vehicle												
(1) Price of private good	179	13.0 (71.2)	44	5.97 (13.1)	40	4.42 (4.39)	179	18.8 (10.2)	44	8.37 (20.0)	40	6.01 (6.1)
(2) Tax	26	42.4 (65.7)	9	19.8 (41.3)	8	6.18 (5.09)	26	54.2 (83.0)	9	25.7 (54.6)	8	7.63 (6.28)
(3) Donation	18	8.85 (9.90)	7	8.50 (13.3)	7	8.50 (13.3)	18	11.6 (14.5)	7	12.0 (20.5)	7	12.0 (20.5)
(4) Toll	28	2.97 (4.10)	15	3.34 (3.37)	15	3.34 (3.37)	34	3.45 (4.13)	15	3.93 (3.33)	15	3.93 (3.33)
(5) Other	47	24.1 (48.3)	9	33.4 (71.3)	8	9.92 (10.7)	47	31.4 (63.6)	9	44.1 (94.8)	8	12.8 (13.4)
Risk Description												
(1) Risk only	110	11.3 (3.33)	20	16.6 (48.8)	19	5.84 (5.08)	113	14.9 (43.8)	20	22.2 (64.8)	19	7.89 (9.80)
(2) Risk + visual explanation	48	3.68 (1.80)	14	3.49 (1.63)	14	3.49 (1.63)	48	4.62 (2.19)	14	4.31 (1.85)	14	4.31 (1.85)
(3) Victims in population	115	28.2 (92.7)	42	7.99 (14.2)	40	6.25 (7.12)	115	39.3 (13.9)	42	10.8 (21.7)	40	8.10 (10.2)
(4) Risk + explanation	25	5.53 (25.8)	8	16.9 (45.4)	5	1.10 (1.73)	25	7.41 (34.0)	8	22.5 (59.9)	5	1.80 (2.96)
Elicitation Method												
(1) Choice experiment	98	2.28 (2.76)	31	3.19 (2.71)	31	3.19 (2.71)	98	2.50 (2.79)	31	3.50 (2.69)	31	3.50 (2.69)
(2) Hedonic pricing	89	6.60 (12.1)	23	5.61 (3.47)	23	5.61 (3.47)	89	7.77 (13.0)	23	6.86 (4.04)	23	6.86 (4.04)

(3) Dichotomous choice	129	15.4 (41.2)	29	11.8 (40.6)	28	4.35 (4.33)	129	19.9 (33.4)	29	15.7 (53.9)	28	5.69 (5.47)
(4) Open-ended question	50	7.70 (18.2)	15	14.2 (32.3)	12	6.93 (5.56)	50	10.0 (24.2)	15	19.7 (42.7)	12	10.4 (9.67)
(5) Risk-risk trade off	9	43.9 (24.7)	3	22.3 (5.67)	3	22.3 (5.67)	9	54.4 (30.0)	3	28.5 (5.08)	3	28.5 (5.08)
(6) Human Capital	26	70.6 (179)	10	13.4 (28.0)	8	6.01 (12.9)	26	107 (273)	10	20.2 (42.6)	8	8.91(19.8)
Type safety enhancing measure												
(1) Vehicle	221	14.6 (67.8)	57	11.6 (33.2)	53	5.88 (5.99)	221	20.3 (10.1)	57	15.4 (44.1)	53	7.80 (8.24)
(2) Road related	86	14.6 (38.1)	25	5.29 (7.70)	24	5.50 (7.79)	86	18.5 (48.1)	25	6.77 (11.5)	24	7.05 (11.7)
(3) Behaviour	78	11.7 (20.2)	25	7.35 (16.7)	24	4.08 (3.39)	78	15.0 (30.5)	25	9.84 (25.4)	24	4.81 (3.45)
(4) Other	16	1.07 (0.90)	4	1.65 (0.50)	4	1.65 (0.50)	16	1.68 (1.4)	4	2.29 (1.03)	4	2.29 (1.03)
Journal												
(1) Journal of Risk & Uncertainty	103	8.85 (13.8)	26	6.09 (6.93)	24	6.59 (6.98)	103	10.8 (11.3)	26	7.54 (8.49)	24	8.16 (8.55)
(2) Accident Analysis & Prevention	32	3.49 (2.68)	14	2.29 (1.80)	14	2.29 (1.80)	32	3.49 (3.51)	14	2.97 (2.38)	14	2.97 (2.38)
(3) Other	266	16.6 (65.6)	71	11.2 (31.3)	67	5.34 (5.96)	266	22.8 (96.7)	71	15.0 (42.2)	67	7.02 (8.85)
Scope test												
(1) Yes	121	8.51 (31.0)	32	10.7 (38.6)	29	4.13 (3.48)	121	11.2 (40.7)	32	14.0 (51.4)	29	5.26 (4.65)
(2) No	280	15.7 (61.3)	79	8.14 (17.7)	76	5.64 (6.58)	280	21.1 (91.1)	79	10.8 (24.1)	76	7.31 (9.30)
Time												
Early	42	45.8 (14.4)	12	15.6 (24.7)	11	9.20 (11.5)	42	69.9 (21.8)	12	24.6 (37.5)	11	14.9 (17.8)
Late Early	68	19.2 (43.6)	19	11.6 (28.9)	18	5.02 (4.99)	68	24.6 (54.7)	19	15.4 (38.0)	18	6.77 (6.20)
Early Late	182	9.04 (26.1)	55	8.24 (29.7)	51	4.54 (5.18)	182	11.5 (34.3)	55	10.6 (39.5)	51	5.61 (6.31)
Late	109	4.59 (11.4)	25	4.99 (3.84)	25	4.99 (3.84)	109	5.23 (12.3)	25	5.41 (4.60)	25	5.41 (4.60)
Location												
Northern America	119	8.88 (16.0)	32	6.77 (6.57)	31	6.98 (6.55)	119	10.8 (18.8)	32	8.86 (9.10)	31	9.14 (9.11)
Northern Europe	72	5.67 (3.80)	25	4.35 (3.14)	25	4.35 (3.14)	72	6.61 (4.58)	25	5.32 (4.09)	25	5.32 (4.09)
Western Europe	56	23.0 (47.3)	19	13.5 (28.5)	18	7.09 (5.18)	56	29.0 (59.5)	19	17.2 (37.7)	18	8.72 (6.63)
Other	154	17.3 (80.8)	35	11.5 (39.6)	31	3.08 (6.66)	154	25.3 (12.1)	35	16.0 (53.8)	31	4.32 (10.1)

Table 4. Conditional means of VSL and VSL-Income adjusted for various categories of studies in 2016 US dollar ($x10^6$)

Type Variable	Variable	All Set		Best Set		Best + Trimmed Set	
		Unweighted	Weighted	Unweighted	Weighted	Unweighted	Weighted
Income and Risk	Log(GDP per capita)	1,010*** (0,096)	0,941*** (0,097)	0,950*** (0,207)	0,936*** (0,193)	0,791*** (0,204)	0,769*** (0,219)
	Log(baseline risk)	-0,089** (0,039)	-0,075* (0,039)	-0,022 (0,060)	0,009 (0,054)	-0,033 (0,046)	-0,008 (0,045)
	Log(risk change)	-0,057 (0,046)	-0,108** (0,046)	-0,018 (0,078)	-0,069 (0,070)	0,007 (0,060)	-0,037 (0,059)
Format of VSL	Willingness-to-accept	0,669*** (0,133)	0,684*** (0,126)	0,752*** (0,264)	0,721*** (0,223)	0,238 (0,244)	0,130 (0,225)
Private vs. Public safety	Public	-0,127** (0,064)	-0,140** (0,063)	-0,121 (0,114)	-0,174* (0,104)	-0,120 (0,089)	-0,112 (0,090)
Stated vs Revealed pref.	Revealed preferences	-0,264*** (0,085)	-0,262*** (0,090)	-0,219 (0,141)	-0,301** (0,143)	-0,306*** (0,111)	-0,221* (0,120)
Indiv. Vs Household	Household	0,037 (0,056)	0,020 (0,054)	0,085 (0,103)	0,050 (0,090)	0,032 (0,085)	0,019 (0,082)
Scope Test	Yes	0,103 (0,065)	0,091 (0,063)	-0,010 (0,121)	-0,104 (0,104)	-0,081 (0,095)	-0,137 (0,089)
Journal	Risk & Uncertainty	-0,139* (0,082)	-0,166** (0,082)	-0,136 (0,144)	-0,204 (0,130)	-0,087 (0,119)	-0,027 (0,116)
	Accident & Analysis	-0,124 (0,102)	-0,029 (0,107)	-0,143 (0,159)	-0,072 (0,149)	-0,118 (0,121)	-0,014 (0,124)
Time	Late	-0,549*** (0,100)	-0,739*** (0,107)	-0,548*** (0,180)	-0,700*** (0,173)	-0,359** (0,142)	-0,551*** (0,148)
	Early Late	-0,312*** (0,096)	-0,489*** (0,105)	-0,361** (0,162)	-0,452*** (0,162)	-0,238* (0,128)	-0,444*** (0,139)
	Late Early	-0,212* (0,111)	-0,438*** (0,119)	-0,179 (0,190)	-0,358* (0,185)	-0,170 (0,150)	-0,418** (0,161)
Location	Northern America	0,272** (0,109)	0,389*** (0,110)	-0,050 (0,208)	0,091 (0,198)	0,258 (0,175)	0,254 (0,182)
	Northern Europe	-0,035 (0,100)	0,019 (0,099)	-0,100 (0,186)	-0,089 (0,171)	0,026 (0,152)	0,013 (0,159)
	Western Europe	0,310*** (0,104)	0,459*** (0,105)	0,110 (0,185)	0,261 (0,167)	0,241 (0,153)	0,336** (0,154)
Fixed effect	Constant	1,801*** (0,450)	2,087*** (0,450)	2,620*** (0,910)	2,778*** (0,837)	3,206*** (0,868)	3,405*** (0,919)
	Estimates	397	397	111	111	105	105
	R^2	0.533	0.580	0.442	0.529	0.469	0.516
	RMSE	0.458		0.463		0.351	

Table 5. Estimation results for a meta-analysis on ln(VSL-Income Adjusted) for different types of studies, weighted and unweighted

Type Variable	Variable	All Set								Best Set								Best + Trimmed Set							
		Unweighted		Weighted		Unweighted		Weighted		Unweighted		Weighted	
Income and Risk	Log(GDP per capita)	1,093***	(0,092)	1,074***	(0,095)	1,000***	(0,197)	1,017***	(0,184)	0,848***	(0,195)	0,854***	(0,203)
	Log(baseline risk)	-0,074*	(0,038)	-0,060	(0,037)	-0,024	(0,060)	-0,000	(0,053)	-0,041	(0,046)	-0,021	(0,044)
	Log(risk change)	-0,005	(0,045)	-0,072	(0,046)	0,010	(0,078)	-0,062	(0,073)	0,020	(0,060)	-0,039	(0,060)
Format of VSL	Willingness-to-accept	0,690***	(0,130)	0,691***	(0,123)	0,644**	(0,254)	0,622***	(0,216)	0,140	(0,224)	0,123	(0,203)
Stated vs Revealed pref.	Revealed preferences	-0,226***	(0,078)	-0,206***	(0,079)	-0,154	(0,132)	-0,149	(0,127)	-0,233**	(0,102)	-0,151	(0,103)
Type enhancement*	Road related	-0,069	(0,066)	-0,073	(0,064)	-0,176	(0,118)	-0,155	(0,104)	-0,135	(0,094)	-0,099	(0,088)
	Behaviour	0,131**	(0,066)	0,135**	(0,064)	-0,036	(0,124)	-0,015	(0,113)	-0,057	(0,096)	-0,012	(0,094)
	Other	0,287**	(0,131)	0,470***	(0,138)	-0,096	(0,251)	0,386	(0,295)	-0,102	(0,192)	0,445*	(0,244)
Time	Late	-0,481***	(0,100)	-0,706***	(0,105)	-0,526***	(0,177)	-0,761***	(0,169)	-0,369***	(0,140)	-0,601***	(0,143)
	Early Late	-0,308***	(0,094)	-0,516***	(0,099)	-0,417***	(0,158)	-0,592***	(0,154)	-0,299**	(0,125)	-0,526***	(0,130)
	Late Early	-0,238**	(0,108)	-0,506***	(0,113)	-0,226	(0,177)	-0,487***	(0,170)	-0,209	(0,139)	-0,457***	(0,144)
Location	Northern America	0,188*	(0,098)	0,283***	(0,096)	-0,108	(0,196)	0,013	(0,182)	0,231	(0,165)	0,257	(0,164)
	Northern Europe	-0,121	(0,091)	-0,077	(0,090)	-0,158	(0,179)	-0,140	(0,162)	-0,022	(0,147)	0,013	(0,146)
	Western Europe	0,319***	(0,101)	0,459***	(0,101)	0,084	(0,183)	0,219	(0,167)	0,196	(0,148)	0,302**	(0,146)
Fixed effect	Constant	1,689***	0,406	1,698***	(0,424)	2,551***	(0,851)	2,415***	(0,807)	2,977***	(0,830)	2,936***	(0,873)
	Estimates	397		397		111		111		105		105	
	R^2	0.530		0.591		0.430		0.526		0.455		0.533	
	RMSE	0.459				0.464				0.352			

Table 6. Estimation results for a meta-analysis on ln(VSL-Income Adjusted) for different types of studies, weighted and unweighted by changing the variable "Public" by "Type enhancing"

Type Variable	Variable	All Set		Best Set		Best + Trimmed Set	
		Unweighted	Weighted	Unweighted	Weighted	Unweighted	Weighted
Income and Risk	Log(GDP per capita)	0,930*** (0,137)	1,055*** (0,133)	0,826*** (0,256)	1,083*** (0,244)	0,564** (0,218)	0,823*** (0,247)
	Log(baseline risk)	-0,002 (0,041)	0,037 (0,040)	0,001 (0,069)	0,023 (0,062)	-0,044 (0,050)	-0,014 (0,052)
	Log(risk change)	-0,221*** (0,057)	-0,261*** (0,054)	-0,112 (0,099)	-0,123 (0,089)	-0,032 (0,073)	-0,067 (0,074)
Format of VSL	Willingness-to-accept	0,550*** (0,161)	0,465*** (0,149)	0,927** (0,360)	0,757** (0,310)	0,091 (0,363)	0,009 (0,356)
Private vs. Public safety	Public	-0,426*** (0,089)	-0,524*** (0,086)	-0,183 (0,192)	-0,375** (0,180)	-0,305** (0,141)	-0,366** (0,150)
Risk Description	Victims in population	0,361*** (0,083)	0,538*** (0,082)	-0,028 (0,158)	0,180 (0,145)	0,087 (0,120)	0,186 (0,124)
	Visual explanation	0,107 (0,090)	0,123 (0,085)	0,078 (0,190)	0,038 (0,165)	0,016 (0,135)	0,001 (0,133)
	Further explanation	0,177 (0,153)	0,344** (0,147)	0,111 (0,252)	0,275 (0,224)	-0,244 (0,200)	-0,151 (0,202)
Payment Vehicle	Tax	0,471*** (0,122)	0,436*** (0,115)	0,362 (0,254)	0,256 (0,223)	0,209 (0,181)	0,138 (0,180)
	Toll	0,053 (0,128)	-0,052 (0,122)	0,146 (0,223)	0,068 (0,200)	0,247 (0,159)	0,157 (0,162)
	Donation	0,413*** (0,142)	0,390*** (0,135)	0,312 (0,263)	0,304 (0,236)	0,422** (0,188)	0,343* (0,191)
	Other	0,497*** (0,091)	0,449*** (0,086)	0,568*** (0,192)	0,495*** (0,178)	0,325** (0,145)	0,318** (0,151)
Time	Late	-0,791*** (0,113)	-0,743*** (0,106)	-0,833*** (0,222)	-0,697*** (0,196)	-0,585*** (0,165)	-0,547*** (0,163)
	Early Late	-0,543*** (0,111)	-0,427*** (0,106)	-0,834*** (0,219)	-0,555*** (0,205)	-0,480*** (0,167)	-0,402** (0,171)
	Late Early	-0,468*** (0,131)	-0,378*** (0,124)	-0,567** (0,255)	-0,290 (0,233)	-0,382* (0,192)	-0,272 (0,196)
Location	Northern America	-0,003 (0,135)	0,110 (0,134)	-0,182 (0,246)	-0,111 (0,248)	0,254 (0,199)	0,168 (0,230)
	Northern Europe	-0,104 (0,134)	-0,265** (0,130)	0,058 (0,235)	-0,169 (0,219)	0,190 (0,183)	-0,029 (0,201)
	Western Europe	0,235* (0,127)	0,153 (0,120)	0,217 (0,225)	0,058 (0,202)	0,304* (0,174)	0,141 (0,183)
Fixed effect	Constant	1,845*** (0,619)	1,273** (0,604)	3,011*** (1,105)	1,888* (1,047)	4,071*** (0,935)	2,950*** (1,050)
	Estimates	298	298	84	84	78	78
	R^2	0.688	0.740	0.600	0.620	0.652	0.623
	RMSE	0.416		0.457		0.323	

Table 7. Estimation results on ln(VSL-Income Adjusted) for different types of studies, weighted and unweighted on SP studies only

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