

*Despite its prima facie callousness, determining the value of a human life is necessary for good public policy.*

# What Is a Life Worth?

BY IKE BRANNON

**A**N UNPLEASANT BUT NECESSARY JOB of policymakers is to place a value on saving a human life. Because society has limited resources that it can spend on health and safety improvements, it should obtain the greatest benefit for each dollar spent, and ascertaining an appropriate value is necessary to that effort. As one would expect, the correct numerical value to place on a life, typically called the value of a statistical life, or VSL, is a matter of great controversy.

Hundreds of analyses using widely varying methodologies have been conducted to determine this value. Despite their differences, most of the studies center on one basic idea: The VSL should roughly correspond to the value that people place on their lives in their private decisions. Though most people may say they will spare no expense to avoid a possibly fatal risk, their spending patterns dictate otherwise; we do not all drive armored trucks to work, but instead drive somewhat less safe — and considerably less expensive — cars. Our willingness to accept some risk in exchange for a more easily affordable vehicle suggests there is some limit to how much we will spend to protect our lives.

This article will examine how economists assign a number to the value of a statistical life, and will consider criticisms of both their methodologies and the very concept of a VSL.

## DIFFERENT METHODS

Economists and other researchers have used a variety of analyses to determine the value of a statistical life. Below are some of the most common methods, along with some problems frequently ascribed to them.

**REVEALED PREFERENCES METHOD** Two jobs can differ in any number of ways: One can be in a nicer city, or it can be in a

more pleasant working environment, or it can have better fringe benefits, or it can offer better opportunities for advancement than the other job. Or, it can be safer. To estimate the value of a statistical life, economists can exploit the difference in pay between two jobs and determine how much of that difference stems from the difference in the risk of injury or death. Then, the researchers simply multiply that number by the inverse of the risk difference and call the result the value of a statistical life.

For example, if I make \$40,000 and my twin brother makes \$42,000 at a job that is identical to mine in all respects except for a 1 percent greater chance of death, then an economist assumes that the \$2,000 difference is a premium my twin brother requires to accept the riskier job. If he requires \$2,000 for a 1 percent greater risk, then I can infer that he is placing a value on his life of  $\$2,000 \times (1 \div 0.01)$ , or \$200,000.

There are problems with this approach. University of Wyoming professors Jason Shogren and Tommy Stamland argue that nearly all revealed preference studies are biased upwards to some degree. They observe that the wage at a particular job is just enough to entice the marginal worker. The other workers require less money to accept the risk. Thus, the “average” VSL is well below the “marginal” VSL obtained with this method.

Another problem is the need to decide the relevant time period over which fatality rates should be measured when assessing risk. Should we use the actual death rate for an occupation over the previous year or the previous five years? Death rates fluctuate quite a bit from year to year (think about the death rate for commercial pilots in 2001 as compared to 2000), and this choice can crucially affect the estimated VSL. Also, do we use the actual death rates or the workers’ perceived chances of death? After all, wage premiums are presumably based on perceived risk, not actual risk, and the two can diverge.

Another consideration is that most occupations do not really carry a risk associated with work. Should we include those occupations as well in our economy-wide estimate of a risk pre-

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mium? And is it all right to assume that we can merely multiply the risk premium by the inverse of the risk assumed? Economists who have studied this issue in depth have found that if the risk doubles, the risk premium does not necessarily double. Alan Krupnick of Resources for the Future shows that in most instances the VSL imputed from comparing the difference in wages associated with a 0.1 percent to a 0.6 percent risk would be higher than the VSL imputed from comparing the wage differences between a 1.1 percent and 1.6 percent risk. This non-linearity in our valuation of risk reduction may simply be the result of sorting — those people facing higher risks in their job do not require the same amount of money to assume an incrementally higher level of risk. The fact that we see evidence of the same phenomenon when we calculate a VSL using the contingent valuation approach (described below) leads some to theorize that it may be more complicated than mere sorting.

Researchers who estimate a VSL using the revealed preference method have come up with a wide range of values, from roughly zero (or even negative) to over \$100 million.

**CONTINGENT VALUATION METHOD** Economists also estimate the value people place on their lives by just asking them. Of

called “protest” vote in which someone insists that no amount of money would entice him to accept a higher risk. If the project consisted of 100 subjects and one person insisted his life is worth \$100 billion, should it be included in the final average? Should researchers throw out that observation, or truncate the sample, or use a median rather than a mean to dampen the rogue subject’s response? On this matter, there is no consensus other than that the high value should not remain in the estimate.

Critics also question whether people accurately perceive the actual changes in the small differences presented to them in the surveys. A majority of people suffer from innumeracy and have trouble distinguishing a three in 10,000 risk from a seven in 10,000 risk. For those people (and maybe the rest of us as well), their answers are little more than guesswork. Should we include their answers? Would an estimate of VSL be reflective of society if the mathematically challenged were not included?

**CONSUMER MARKET BEHAVIOR METHOD** A small literature has developed in recent years that infers our implicit valuation of life from our product choices rather than our labor-market choices. For example, we know that antilock brakes reduce the incidence of crashes and death. If we can say for certain that

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course, this approach is a little bit more sophisticated than that because the likely answer to the question, “How much money would you need to allow us to kill you?” would be an infinite amount of money. In a contingent valuation estimation of the value of a statistical life, the economist surveys a number of people and asks each person the amount of money that he would require to accept a marginally higher chance of dying in the near future. Generally, the subject answers yes or no to a series of questions; for example, the opening question might be, “Would you accept \$1,000 to move from a one in 10,000 chance of death to a five in 10,000 chance of death?” If the answer is yes, then the next question might be whether the person would accept \$800 to assume the higher risk, and so on until the person says he would refuse the money for the risk. After surveying a few hundred people in this manner, the researcher imputes the implicit value that each subject places on the value of a life, as is done in the revealed preference method (multiplying the final dollar figure by the inverse of the additional risk taken) and averages the valuations.

Of course, problems exist in this approach as well. First, many economists dislike it because of its subjectivity. All of the questions are hypothetical, so why should the answers given by the subjects actually reflect the tradeoffs that they are willing to make? Indeed, a problem endemic to such studies is the so-

buying a car with that option reduces the probability of death by one in 100,000 and the option costs \$300, then we can infer that the person is placing an implicit valuation on his life of at least  $\$300 \times 100,000$ , or \$30 million.

Again, there are many criticisms of this approach. People purchase thousands of devices that improve safety to some degree. If the VSL estimated from, say, buying a bicycle helmet is vastly different than the VSL derived from the decision on whether to buy antilock brakes, then how can we interpret those numbers?

Another question is whether we separate safety characteristics from other product attributes. A bicycle helmet that costs \$80 and is slightly safer than a \$40 helmet may also be more comfortable, more stylish, or available at a store closer to the consumer’s house. How are we to determine the extent to which the buyer’s decision was influenced by safety considerations?

Many of the criticisms of the revealed preference studies also can be made here. Do consumers accurately perceive the safety improvements inherent in a purchase? Is it sensible to compare VSLs obtained from different products that have different levels of risk reduction?

**META-ANALYSIS METHOD** Enough studies have been done that a number of meta-analyses have been performed on the existing studies in order to find some “representative” value of

a statistical life. Meta-analyses can vary wildly in sophistication; the basic difference between a meta-analysis and a simple averaging of a range of studies is that the meta-analysis attempts to control or adjust for the exogenous factors that could potentially affect the estimated VSL. For example, from revealed preference studies we know that the extent of the assumed risk affects the resultant VSL. A typical worker who assumes a one in 1,000 chance of death on a job has a lower VSL than an identical worker with a one in 10,000 chance of death. A sophisticated statistical meta-analysis can take into account the relative differences in risk assumed in different studies and “wash out” the effects of those differences on the final VSL.

Meta-analysis may seem like a good tool to establish a consensus, but in reality it is very difficult to perform well. For starters, a meta-analysis can only be done on similar studies that employ the same statistical estimation technique; a revealed preference study cannot be in a meta-analysis with a contingent valuation study. In addition, if studies within a particular method differ greatly in their approaches, it may not be possible to combine all reputable studies using the same method in a single meta-analysis.

**FORENSIC ECONOMICS METHOD** When estimating the value of a statistical life for regulatory purposes, economists are most comfortable with calculating a number that is the by-product of decisions that people make every day that manifest their willingness to pay for increased safety. Outside of the realm of regulation, economists often place a value on a life after a tragic death has resulted in the loss of future income to a household. For such matters, the procedure of calculating the value of a lost life is fairly straightforward: The economist calculates the present value of the future stream of income that would have accrued to the decedent, adjusted for taxes, consumption, and the cost of living for his community.

This approach may seem straightforward, but it is dependent on a number of contestable assumptions. For example, what assumptions should be made about lifetime income growth and retirement age for the deceased? Is it correct to use population averages or should we consider certain factors that might have influenced income growth and retirement age, such as education or the age of children of the deceased? As anyone who followed the travails of the special administrator of the government’s official 9/11 survivors fund can attest, this approach can invite any number of controversies and is far from providing a value for a life that is free from criticism.

**QALY AND VSLY** A common critique of the role of VSL in regulatory analysis is that it fails to distinguish between the life saved of someone young as opposed to someone close to the end of a life. For instance, many would argue quite sensibly that a society should be willing to pay more for a regulation that saves the lives of 10 young children than for one that saves the lives of 10 senior citizens.

There are two variants of the VSL that make such adjustments: the quality-adjusted life-year (QALY) and the value of a statistical life-year (VSLY). Both attempt to calculate the value of one additional year of life saved, with the former adjusting for

the quality as well as the amount of life saved, and the latter adjusting the value of a life-year saved by discounting life-years saved in the future, as is commonly done in finance. Both approaches seem intuitively more appealing to many policymakers than VSL calculations. John Graham, the administrator of the Office of Information and Regulatory Affairs, has expressed a preference for using such measures to complement or even replace the VSL when performing cost-benefit analysis.

Both the QALY and the VSLY are fundamentally different than the VSL. The VSL is in essence a metric derived from decisions made by people either directly in a survey or observed indirectly in their market choices. Its use in cost-benefit analysis makes perfect sense.

Neither the VSLY nor the QALY are calculated in that way — no one is observing the behavior of anyone when arriving at this metric. They are applicable only in the context of cost-effectiveness analysis, where the researcher is merely trying to rank a number of different policies or treatments. For instance, if researchers are trying to decide which of a number of different medical procedures should be done, they may decide that the hospital feels that only procedures that cost less than \$100,000 per year of life saved, or QALY saved, make sense.

Thus, if a hospital performs a bone marrow transplant that prolongs the life of a patient by one year, and analysts estimate that the patient is at 80 percent of his previous life quality for the remaining year, then they would conclude that 0.8 of a life year was saved. If the procedure costs less than \$80,000, then they would conclude that it was cost effective under the \$100,000 rule (which, incidentally, is a rule of thumb that quite a few hospitals have been known to use).

In the case of a VSLY, let us assume that we have a regulation that prolongs the life of a young person by two years, on average, at the end of his life, as might be the case with bans on smoking inside of restaurants. It is not appropriate to compare that regulation to a regulation that prolongs the life of a person by one year today. The VSLY requires the regulator to discount the two years saved 50 years down the road so as to fairly compare it to the life-year saved today. In this case, using a seven percent discount rate (to reflect the cost of capital) we would find that the life-years saved 50 years down the road are only worth 0.07 of a life-year saved now, just as two \$1 bills received 50 and 51 years in the future would only be worth seven cents to someone today.

### IS THERE A CONSENSUS?

While the estimated VSLs vary wildly between studies, a broad consensus is beginning to coalesce around a fairly narrow range of values, thanks to a number of very influential studies.

Economists Janusz Mrozek and Laura Taylor published a meta-analysis of a large number of revealed preference studies that was almost universally praised by researchers in the field for its thoroughness and inclusiveness. After controlling for all possible factors that could bias or influence the VSL, they estimated a number between \$2 million and \$3 million.

More recently, Kip Viscusi of Harvard, in his own meta-analysis, concluded that the number was closer to \$7 million. Viscusi is one of the leading authorities in the field as the edi-

tor of the *Journal of Risk and Uncertainty*, the preeminent journal in risk analysis, as well as the author of numerous books and articles on risk analysis. Given his stature, this paper has been taken very seriously by regulators. But Viscusi analyzes occupational deaths not by occupation but by industry. That distinction is important; grouping workers by industry essentially treats the risks faced by secretaries that work for a mining company identical to the risks faced by miners, a result that obscures the true risk premium received by workers. There is not necessarily any systematic bias in his analysis as a result, but the studies he considers generally have higher standard errors.

On the contingent valuation front, Alan Krupnick, Maureen Cropper, and a number of economists affiliated with Resources for the Future conducted a series of sophisticated surveys in the United States, Canada, and Asia that received kudos from other researchers for sophistication and rigor. The resulting series of papers, which have just begun to be published, conclude with a number surprisingly close to the Mrozek and Taylor value, with a range of between \$2 million and \$3 million.

A paper by John Leeth of Bentley University and John Ruser of the Department of Commerce may prove to be the last word when it comes to revealed preference studies. They obtained an incredibly complete and disaggregated data set on death and injury rates broken down by occupation, as well as a complementary data set with wage and employment data for the same disaggregated occupations. Leeth and Ruser estimate a VSL in the range of \$2.6 to \$4.7 million.

### WHAT ARE THE FEDS USING?

Scholars have spent many years researching and arguing about the correct approach to determining the value of a statistical life, and the field is only now beginning to gravitate toward a fairly narrow range of numbers. But the federal government has been doing cost-benefit analyses of various regulations for decades and, as a necessary component of those analyses, has assumed different values in order to compare costs to benefits. So what values do the feds use?

The Department of Transportation uses a figure of \$3 million, which it left unchanged after a 2002 review of the literature. Transportation officials cited the Mrozek and Taylor research as a significant influence of its decision.

The Environmental Protection Agency currently uses a mean value of \$6.3 million for its cost-benefit analysis, with an interval between \$1 million and \$10 million. While some degree of flexibility is to be applauded (as I will explain below), in reality every regulation issued by the EPA that spent less than \$8 million to save a life has been approved. The EPA commissioned a large number of studies on the matter a few years ago, in an effort to establish a reliable, uncontroversial number to use in its analyses. Unfortunately, that work has led to nothing of the sort.

Having different agencies use different valuations may seem illogical, but there is a hint of logic in this. Cass Sunstein of the University of Chicago has argued that people place different values on avoiding different types of risks — for instance, people fear dying of AIDS or in a plane wreck much more than dying in an automobile accident. Hence, it may make some sense for different authorities to apply different VSLs to different risks.

### CONCLUSION

It is not uncommon for well-meaning people to object strenuously to placing a value on a human life, judging such a practice to be callous and demeaning of the value of existence. Is not every life worth an infinite value to the person living it? Lisa Heinzerling, a Georgetown University professor and the co-author of a book critical of the use of VSL, claims that the difficulty in estimating such an amorphous entity as the value of a statistical life leaves policymakers in the position of being easily manipulated by the wonks who attempt to estimate VSLs in the first place. It would be much better, she argues, to have “informed public debate drawing on moral, philosophical, and societal considerations beyond market-based assessments.”

While more informed debate on regulatory matters might make sense, it is also necessary to realize that society cannot spend an infinite amount of money to protect and extend each person's life, and some choices have to be made in the realm of health and safety regulation. We have to decide to what extent we are willing to expend resources to prevent unnecessary death rather than improve education, increase handicap access, or ensure a cleaner environment. To resist placing a dollar value on a statistical life is to abdicate any sense of rational decision-making in the regulatory realm. **R**

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