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Empirical Review of the Value of Statistical Life: Application in Air Crashes

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ABSTRACT

This study gaudily elucidates on the value of statistical life in air crashes. Value of statistical life is quite predominant in road crashes while limited discussions in air crashes. Since human beings are also lost in air crashes, there is need to discuss on the value of lives lost. Human capital approach has been a procedure often used to estimate the benefits realized from reduced mortality, in which the value of a person's life is determined by this person's market productivity. For several reasons, this approach might be no longer popular. The dominant approach nowadays is based on individuals' willingness to pay (WTP) which assumes that individuals' preferences are the basis for economic welfare. Since air crashes represent a huge economic cost; some of these crashes or crashes may be preventable but not as compared to road accident. There is reducing waste of scarce resources that can be used to increase income and improve welfare. Economists often refer to the monetary value of reducing mortality risks as the value of life which implies that human life can be valued while it should be priceless. Therefore, it should not be interpreted as how many individuals are willing to pay to save an identified life. Hence, human capital approaches to individuals' willingness to pay and to value of statistical life. This study is crucial because of the socio-economic and political worth of air travelers that are being lost during air crashes.

Keywords: *value of statistical life, air crashes, accident*

INTRODUCTION

The transport of persons and goods by different modes including air is an essential element of modern society. On a broader perspective, transportation is the movement of people and goods from one place to the other, through a particular means, and at a particular time with respect to distance covered such that value and utility will be created. It is a derived demand that is rarely demanded to satisfy its own purpose but demanded to satisfy other purposes [1]. At the same time such transport carries highest risks of crashes causing damage to human and resources. It is important to note that air crashes represent a huge economic cost; many of these crashes may be preventable and by preventing them, there is reducing waste of scarce resources that can be used to increase income and improve welfare. The preventability index of road crashes may be higher than that of air crashes because of different dynamics of operations. There are many ways of estimating air crash costs and no consensus exists regarding the best method as put by Sidiq [19] in the case of road accident. While the willingness-to-pay approach has many supporters, and from a theoretical point of view is the best approach, assessing willingness-to-pay empirically has turned out to be very difficult. The study of Sidiq [19] will be further adapted and twisted in this study. Studies have been reported in many countries, but the results vary enormously. In view of this, there is a need for more research concerning how best to elicit willingness-to-pay for improved road safety. The root of the difficulties may, however, run deeper than many researchers are willing to admit. If people do not have clear preferences regarding the provision of road safety, and are easily influenced by the way valuation tasks have been framed, any estimate of the willingness-to- pay for less road crashes is bound to be very imprecise [2].

Modern societies rely on a well functioning transportation infrastructure. Policies taken to maintain and/or improve an infrastructure come at a cost; and the scarcity of resources forces policy makers to prioritize between policies. The use of a common metric for benefits and costs may facilitate the evaluation of different policies, which in turn, enables policy makers to

allocate resources more efficiently. Monetary values often act as this common metric. Another good reason for monetizing non-marketed goods is that this common ground for comparisons makes the prioritization process more transparent to those not directly involved in the process (e.g. the public).

Many of the benefits and costs induced by policies within the transport sector have monetary values. Material expenditures, e.g., for road improvements in order to increase safety and reduce travel time, are easily obtainable since the materials are traded on markets and have market prices. However, many of the costs are not "construction costs" and do not have monetary market prices. For instance, road improvements might increase road traffic, resulting in increased noise and emission levels; in addition, when a new road is constructed recreation areas may be lost, wild life may be adversely affected, etc. Similarly, whereas expected benefits from avoided material damage caused by crashes can be calculated using available market prices, the benefits from a reduced risk exposure and/or a reduced travel time have no market prices [2].

It is obvious that the monetary valuation of traffic safety is not an easy task, because it requires an estimate of the economic value of a statistical life (VOSL). Although various methods and approaches for estimating VOSLs have been put forward, some scholars argue that valuing fatal injuries, and hence human life, is virtually impossible. They maintain that people do not nearly have sufficiently accurate preferences to make a sensible trade-off between road safety and money. The changes in risk levels are so small that making the trade off is very difficult, if not virtually impossible [3].

For this study, there is more concentration on the value-of-life. Economists often refer to the monetary value of reducing mortality risks as the "value of life", it implies that human life can be valued while it should be "priceless" [4]. The expression "value of life" is an unfortunate reduced form of the value of a statistical life (VSL), which defines the monetary value of a (small and similar among the population) mortality risk reduction that would prevent one statistical death and therefore, should not be interpreted as how much individuals are willing to pay to save an identified life [5]. It is concerned with valuation of changes in the level of risk exposure rather than the valuation of the life of a specific individual.

The economic value is essentially the marginal rate of substitution of wealth for risk of death, due to any specific cause. The statistical value of life is then merely the average of a series of observations on the marginal rate of substitution, where the latter is taken as an appropriate estimator of the underlying (unobserved) population mean. This study is carried out to have an in-depth understanding on what value of statistical life really is.

Value of statistical life is quite predominant in road crashes while limited discussions in air crashes. Since human beings are also lost in air crashes, there is need to discuss on the value of lives lost. A procedure often used to estimate benefits from reduced mortality is the human capital approach, in which the value of a person's life is determined by this person's market productivity. For several reasons, this approach might be no longer popular. The dominant approach nowadays is based on individuals' willingness to pay (WTP). This approach assumes that individuals' preferences are the basis for economic welfare. The WTP-approach to value mortality risk reductions was introduced by Dr`eze [6]. Dr`eze's paper was written in French and the concept became widely known only after Schelling (1968)'s seminal paper.

The theoretical foundation of the concept was further developed within the expected utility framework by Jones-Lee [5] and Mishan [7]. A key contributor to the empirical literature on VSL is Viscusi, in particular for his analysis of compensating wage differentials [8]; [9]. To understand the VSL concept, it may be useful to take an example. Suppose that in a city composed of 100,000 identical individuals, there is an investment project that will make the city's roads safer. It is known that on average individuals die every year on these roads, and the project is expected to reduce from 5 to 2 the number of expected fatalities per year [19].

Suppose now that each member of the city is willing to pay $150 annually to benefit from this reduction in mortality risk induced by the project. Then the corresponding VSL would be $150×100,000/3 = $5 million. Indeed $15 million could be collected in this city to save statistical lives, and so the value of a statistical life could be established at $5 million. This example also illustrates why estimates about individuals' VSL can be useful. Suppose indeed that one ignores the WTP of city members from this specific project; but one has some information

about money/risk tradeoffs observed from the city members' choices (or from survey studies) concerning other mortality risks. Then it can be useful to compute an average implicit VSL in this city based on these choice data, and use this VSL to estimate the benefits of this specific risk-reduction road safety project that one wants to evaluate [19].

LITERATURE REVIEW

Willingness to Pay (WTP)

There are several methods that may be adopted in valuing the human costs of air crashes where relevance depends upon the purpose of conducting the costing. If the maximization of national wealth and social welfare become the goal, the gross output or human capital, willingness to pay, court awards, net output, insurance cost, implicit public sector valuation and restitution costs are the most commonly performed [3]. Among these, the human capital method and willingness to pay are generally recommended for most transport related costing [10]; [12]

However, the method of WTP is considered proper in valuation of public goods in line with the view that decision making and resource allocation to public sectors must include public preference and needs [12]. In valuing the willingness to pay to reduce the risk in air crashes, the ex-ante rather than the ex-post approach is more appropriate since reducing the risk should, by right, be an exercise before the crashes occur [11]. WTP is essentially accommodates the tradeoff that individuals are willing to make between money and risk [19].

The common use of WTP is to ask respondents on how much their willingness to pay for a particular price for the reduction or change in the risk is [10]. Respondents are given choices to select or rank according to the different levels of risk reduction and prices charged for a safer condition. WTP has been applied in various fields including marketing, health and environment sectors [19].

Despite a wide acceptance of the WTP method to evaluate life as compared to the Human Capital method, there are few areas of its application which have been thoroughly debated. Most of the arguments circulate around the technical and practicality of the application since WTP involve complex design instruments and concepts which may not be easily presented to the public. Tervonen [3] summarized the arguments against WTP method by stressing on the ability of the public to evaluate tiny changes in their risk and how accurate the design may correspond to actual preference in reality. However, views in favor of WTP advocate that the method can be applied on any kind of commodity and hence the debate on pricing risk reductions is resolved.

The design also allows for diversity in questions and heterogeneity in target population which gives more possibilities to better control the result with more additional information [19]. What is more interesting is the emphasis by Ortuzar et al. [13] that the integration with stated preference choices to elicit the WTP from people makes it even more practical and applicable even to developing countries where the market for the goods under valuation is not readily available.

The Value of Statistical Life

According to Sidiq [19], Economists often estimate the value of statistical life by looking at the risks that people are voluntarily willing to take and how much they must be paid for taking them. These types of studies, which look at a person's actual choices, are known as revealed preference studies [15]. There is a widely shared opinion among economists that the monetary value of safety in public sector cost–benefit analyses should reflect the preferences of those affected by the policy measure [14].

The monetary value of safety should be expressed as the aggregate of the individuals' willingness to pay (WTP) for safety improvements or, alternatively, the willingness to accept (WTA) compensation for increased risk levels. WTP (and WTA) values are individual trade-offs in terms of expenditures for improving safety versus alternative types of consumption. We can therefore conclude that WTP (and WTA) values are explicitly intended to reflect preferences, perceptions and attitudes toward risk of those affected by the decisions in which the values are to be used. This implies that the WTP for a risk decrease can differ among different hazardous situations [17]; [19].

Value of statistical life is useful because humans cannot be bought for any price. However, with a limited supply of resources or infrastructural capital (e.g. ambulances), or skill at hand, it is impossible to save every life, so some trade-off must be made. It is not commonly attached to lives of individuals or used to compare the value of one person's life relative to another person's. It is mainly used in circumstances of saving lives as opposed to taking lives or "producing" lives [15];[19].

METHODOLOGY

According to Viscusi [8] the concept of VOSL in the field of road safety actually looks at the small change in risk after certain perceived improvements are made to the safety rather than the real risk of death and injury. This is also applicable to air crashes. The term indicates the valuation made to statistical life and not real life.

The issue of valuation of human life is addressed using a few basic models;

The Standard Model

The standard single-period VSL model is taken as the most suitable. The individual maximizes his (state-dependent) expected indirect utility which is given by: $VSL \equiv pu(w) + (1-p)v(w)$.

Where:

P is the probability of surviving the period;

u(w) is the utility of wealth (w if he survives the period)

v(w) is the utility of wealth (w if he dies).

The value of statistical life does not measure what a person is willing to pay to avoid certain death, nor what he is willing to face.

The Dead-Anyway Effect and the Wealth Effect

The expression obtained for the VSL is useful for identifying two standard effects.

- First, the dead-anyway effect describes how VSL increases with baseline risk, i.e., how VSL decreases with survival probability. Intuitively, an individual facing a large probability of death has little incentive to limit his spending on risk reduction since he is unlikely to survive.
- Second, the wealth effect describes how VSL increases with wealth. The intuition for the wealth effect is two-fold.

  First, wealthier people have more to lose if they die.

  Second, the utility cost of spending is smaller due to weakly diminishing margin utility (risk aversion) with respect to wealth [19].

Risk Aversion and Background Risks

It is often suggested that the VSL obtained from compensating wage differential studies under-estimates the average VSL in the population because those who choose to work in hazardous industries are less risk averse. This suggestion, however, requires a more precise specification about what we mean by less risk averse. For state-independent utility functions, it is usual to define risk aversion by the coefficient of curvature of the utility function [19].

Multi-Period Models

In more realistic multiperiod models, individuals have preferences over probability distributions of the length of life and over consumption levels at each period of life. We illustrate this using the simplest two period model: VSL max$u(c) + \beta pu(r(w-c))$, where:

β is the discount factor;

r is the interest factor;

c is the consumption in period 1.

P is the survival probability from period 1 to period 2 [17]; [18]; [19].

CONCLUSION

The value of statistical life (VSL) is a very contentious topic that is required to optimize government decisions. It is emanates from the willingness to pay (WTP) for reducing the risk of death. VSL is the economic value that measures the tipping point when society as a whole is willing to pay (WTP) to reduce the statistical risk of death.

Value of statistical life is useful because humans cannot be bought for any price. However, the working effect of the value of statistical life in road accidents may be different from that of air crashes. This is because; air crashes may instantly claim lives of the travelers while that of the road may not be fatal. Hence, their prevention differs. With limited resources or infrastructural capital, or skill at hand in the airport, it is impossible to conduct proper aircraft maintenance check on the aircraft before takeoff. VSL is not commonly attached to lives of individuals or used to compare the value of one person's life relative to another person's. It is mainly used in circumstances of saving lives as opposed to taking lives or “producing” lives.

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