

THE VALUE OF LIFE AND ACCIDENT COSTING: A WILLINGNESS TO PAY STUDY AMONGST YOUNG MOTORCYCLISTS IN MALAYSIA

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Abstract: The number of road accidents involving motorcyclists in Malaysia is on the increase and the young riders tend to be disproportionately represented in the accident statistics. Unfortunately, studies conducted for the purpose of evaluating the cost of road traffic accidents is almost none existent in this country. This paper is an attempt to overcome the lack of reliable estimates of accident costs in Malaysia by evaluating the value of statistical life among motorcyclists using the willingness to pay (WTP) method. Special attention is given to the value of life of young riders. Following results from subsequent analysis, this study recommends adopting a value of about RM1.2 million as an estimate for the mean value of a statistical life for public policy analysis involving motorcycle safety. A further check on the reliability and consistency of the results was performed by regressing the marginal rate of substitution of wealth for risk of death against several demographic variables. Results of the regression analysis appear to be generally consistent with findings from other similar studies.

Key Words:

Value of Life, Willingness to Pay, Accident Cost.

1. INTRODUCTION

Numerous studies have identified that age is a risk factor for both motorcycle crashes and injuries. In the United States, Kraus *et al.* (1975) in their study to identify the inter-relationship of 20 factors associated with motorcycle collision injuries, found that age was the single most significant factor and 15 to 24 year-olds faced the highest risks. In a related New Zealand study, Begg *et al.* (1994) also observed that mortality and morbidity rates were high among young riders. Fatality rates increased dramatically for males after the age of 14 years, peaking around the 20 to 24 years age group before declining rapidly thereafter. In the United Kingdom, the Transport Research Road Laboratory (TRRL) team found that the casualty and accident involvement rate per kilometer traveled by the youngest riders (aged 16 and 18

years) was about 2.8 times higher than the average for the whole population of motorcyclists (Broughton 1988).

Studies on motorcycle accidents in Malaysia are relatively scarce. Radin *et al.* (1995) found that the accident risk faced by motorcyclists is 20 times greater than car users and motorcyclists and pillion riders constituted almost 60% of fatal road traffic crashes in 1994. The Royal Malaysian Police reported that male riders in the 16-20 years age group consistently account for a high number of motorcycle casualties. Nor Ghani *et al.* (1998) confirmed the over-representation of young riders in the accident statistics by noting that even though the 16 and 17 age groups form only 4% of the total riding population, they account for around 11% of national accident fatalities.

In view of the alarming statistics on fatalities among the young riders, safety measures targeted to this age group ought to be given priority by policy makers. Such measures, however, can be costly and thus requires cost-benefit evaluation. One basic ingredient of any cost-benefit analysis involving safety intervention is the valuation of benefits of fatalities avoided. Unfortunately, estimates of the value of life of motorcycle riders are not currently available in Malaysia. This study intends to overcome this problem by conducting a willingness to pay (also known as the contingent valuation) survey among motorcycle riders, with particular attention to the young riders, in order to come up with a reliable estimate of the value of life for policy analysis. In addition, this study also tries to determine the impact of demographic and behavioral factors such as age, gender and attitude towards risk on the value of life. The results of this study can be used by behavioral researchers, transport planners and policy makers to propose relevant measures to curb the escalation in fatalities and injuries among young riders.

2. METHOD

2.1 Contingent Valuation

There are several methods that can be used to estimate the value of life saved from increased traffic safety. A popular method that has often been used over the last ten years is the contingent valuation method. This method appeals to researchers because it can be used for valuing a good (e.g. a small reduction in fatality risk) in the absence of existing market data. In addition, it also allows for valuation to be done for any population subgroup and provides for some flexibility in the specification of the good to be valued by the respondents. However, despite its above-mentioned strength, this method suffers from a problem most common to all hypothetical research; i.e. the possible existence of biases with survey instrument and interview (Kannerman and Knetsch, 1992). This study tries to minimize some of these biases using several questionnaire design and interview strategies such as thorough explanation on the concept of risk probabilities and risk reductions of traffic accidents. Other strategies are also discussed in subsequent sections.

2.2 Questionnaire Design

The questionnaires contained questions (with multi parts) that falls into three broad categories:

1. Valuation questions that are used to provide estimates of the relevant marginal rates of substitution of wealth for a small reduction in the probability of fatal accidents.
2. Behavioral questions that are meant for measuring the degree of applied risk-taking through habitual practices on the road.
3. Personal questions that are used to solicit information on age, income, ownership, size of engine, and other details.

This survey only focused on own risk and does not consider possible willingness to pay (WTP) for other people's safety as had been done in the UK and also in New Zealand (Jones-Lee *et al.* 1985; Miller and Guria, 1991). The exclusion is in line with theoretical works that raise doubt whether WTP-based values of safety intended for use in public sectors decision making should take any account at all of people's willingness to pay for others' safety. (Jones-Lee *et al.* 1992; Bergstrom 1982)

The valuation design of this study closely follows the one proposed and used by Jones-Lee *et al.* (1983). Jones-Lee's study was really the point of departure in valuation design since it was the first ever attempt to elicit willingness to pay from the general public for the ultimate goal of putting monetary value on human life. The study noted that ensuring respondents' understanding of the valuation questions is of paramount importance. To ensure good understanding of the valuation questions and to minimize confusion over the concept of probabilities, it was decided that only one (as oppose to several) type(s) of valuation question was to be posed to the respondents but with multi parts to ensure consistency in valuation. This decision was partly influenced by the realization that motorcyclists in Malaysia tend to come from the less educated population group.

The following valuation question was presented to the respondents: "Suppose you have a choice from 2 express bus services that are available to provide transportation to your intended destination. Both bus services are similar in all aspects except for their safety records. The fare fixed by Company A is RM 20.00 and you are informed that past safety records show that there is a 2 in every 200,000 chance (trips) that no passenger survives a fatal accident involving buses from Company A. The safety records were sourced from the Road Transport Department. On the other hand, Company B provides a better service in terms of safety but requires you to pay a higher fare. How much would you be willing to pay for services provided by Company B if its safety record is:

- a. 0 fatal accidents per 200,000 trips (100% reduction in risk)
- b. 1 fatal accidents per 200,000 trips (50% reduction in risk)

Respondents were also advised that they could tick (X) if they were unwilling or unable to pay extra for the better services provided by Company B.

Consistency Checks

A consistency check on the values respondents attached to the risk reductions was also embedded in the valuation section of the questionnaire. This check is required to ensure that the values elicited by respondents are consistent with the decrease/increase in risk mentioned. The different levels of risk in the 2 questions are to detect inconsistent values. Even though this may cause screening out of responses but this procedure can ensure reliability and credibility of responses.

In order to ensure realistic valuation, interviewers were cautioned to remind respondents of their ability to pay so that they would state reasonable amounts. They were asked to consider their budget, as their income should also cover all their essential needs other than road safety.

However they should avoid considering costs incurred if they were involved in accidents like medical, loss of output etc.

Pilot Test

Prior to the main survey interviewers were selected amongst university students and were given training on the conduct of good and reliable interviews. Later a pilot test of 50 questionnaires was conducted in the vicinity of National University of Malaysia. Review of the pilot test suggests that the language (Bahasa Malaysia) adopted for the questionnaires can be a problem to respondents who are non-Malays. Hence, a sufficient number of Chinese and Indian interviewers were therefore appointed to overcome language difficulties amongst respondents of other races.

Main Study

The main study was conducted during the months of October and November 1997. Respondents were chosen amongst motorcyclists via simple random sampling in selected districts in all the 13 states of Malaysia. A total of 2030 persons participated in the interview over the two-month's period.

3. RESULTS

3.1 Characteristics of the samples

After some preliminary checks, out of the 2030 respondents, 140 had to be discarded from further analysis. Of this figure, 43 respondents did not provide answers to both the valuation questions. Another 94 respondents, on the other hand, provided illogical answers by stating that they were willing to pay less than RM20 for a better service which would have implied a negative marginal rate of substitution (MRS) of wealth for safety. Three other respondents had to be omitted after consistency checks revealed that they were willing to pay more for a higher risk service and not otherwise, leaving a total of 1890 questionnaires for further analysis.

Two other problems were identified during the process of analyzing the data set. Firstly, quite a few respondents were found to be unwilling to pay more for better safety. This can be seen when 162 and 645 respondents refused to pay even a little bit more for a 100% reduction and 50% reduction in risk respectively. Secondly, there were also many respondents who stated very high WTP not proportionate to their income. A too high valuation other than genuinely reflecting excessive care towards risk could also be due to misunderstanding of the questions, or even protest responses.

To overcome these problems, 4 sets of data were compiled to allow examination of the impact of problematic valuations and extreme outliers on the data set. The first data set includes all the 1890 cases while the second omits those respondents who refused to pay even a little bit extra for better safety (i.e. zero WTP). The third removes extreme outliers where RM40 and RM 20 were used as the cut off points for 2/200,000 and 1/200,000 risk reductions respectively. Such high valuations would have implied an MRS of about RM4 million; a value that could be considered excessive. The fourth set combines the restrictions imposed on both the second and third data sets by disregarding zero bid as well as excessive and extreme valuations.

3.2 The Marginal Rate of Substitution of Wealth for Risk of Death (MRS)

Table 1 summarizes the estimates of marginal rates of substitution of wealth for self-only risk of death implied by the amount respondents disclosed they would be willing to pay for risk reduction. The estimates are computed from the responses of the two valuation questions. The figures are presented in means, median and trimmed means values. (a) and (b) refer to the two levels of risk reductions offered to the respondents as stated in the preceding section. Trimmed mean was computed by removing a further 5% of the respondents on both ends of the willingness to pay distribution. Extreme WTP were responses that implied MRS exceeding RM4 million.

The table shows that all the means are significantly higher than the medians, which attests to a positively skewed distribution. This could be due to the influence of outliers in the upper tails of the distribution. However, notice that the 4th data set provided a more balanced MRS for both risk reductions.

With regard to which of the central tendencies to be chosen, Miller and Guria (1991) suggested the median as the best estimate if the survey does not weed out high values. Otherwise, the mean is more reliable. Jones Lee *et al.* (1992) too recommends the use of mean value for he argued that it is more consistent with social cost benefit analysis.

Table 1: Contingent valuation estimates of MRS between data sets

Set	Data set	Cases	Mean	Median	Trimmed Mean
1	All respondents (a)	1890	1.24 x 10 ⁶	1.00 x 10 ⁶	1.09 x 10 ⁶
	All respondents (b)	1890	0.99 x 10 ⁶	0.60 x 10 ⁶	0.81x 10 ⁶
2	Remove 0 WTP (a)	1728	1.36 x 10 ⁶	1.00 x 10 ⁶	1.20 x 10 ⁶
	Remove 0 WTP (b)	1245	1.50x 10 ⁶	1.00 x 10 ⁶	1.34 x 10 ⁶
3	No extreme WTP (a)	1815	1.06 x 10 ⁶	1.00 x 10 ⁶	1.00 x 10 ⁶
	No extreme WTP (b)	1778	0.74 x 10 ⁶	0.60 x 10 ⁶	0.66 x 10 ⁶
4	Remove 0 and extreme WTP (a)	1653	1.16 x 10 ⁶	1.00 x 10 ⁶	1.11 x 10 ⁶
	Remove 0 and extreme WTP (b)	1133	1.16 x 10 ⁶	1.00 x 10 ⁶	1.11 x 10 ⁶

The estimated mean figures from the four sets ranges from a minimum of RM600,000 to the maximum of RM1,500,000. If a single VOSL is to be chosen, than mean value from the 4th set of RM1.2 million would perhaps be the most appropriate for motorcyclists in Malaysia. The value is selected in view of the fact that the VOSL computed from the 4th set is free from problems associated with extreme values and zero bids. In addition, notice that the 4th set provides the most consistent VOSL values between type (a) and type (b) valuation questions.

3.3 The MRS of Young Motorcyclist

A motorcyclist is considered young if his or her age is between 15 to 20 years old. Since, the young motorcyclists are the focus of this study, Table 2 below shows the breakdown and the

difference in MRS between the young and the more senior riders.

Table 2: Contingent valuation estimates of MRS between age groups

	Age groups	Cases	Mean	Median	Trimmed Mean
WTP implied by type (a) risk reduction question	15-20	967	1.21×10^6 *	1.00×10^6 *	1.17×10^6 *
	>20	686	1.09×10^6 *	1.00×10^6 *	1.04×10^6 *
WTP implied by type (b) risk reduction question	15-20	676	1.19×10^6	1.00×10^6	1.13×10^6
	>20	457	1.12×10^6	1.00×10^6	1.06×10^6

* The difference between the two age groups are statistically significant at 95% confidence level

Table 2 clearly indicates that young motorcyclists value their lives more than their more senior counterparts in both risk questions. Although there are no statistically significant difference between the two age groups for type (b) question, the opposite is true for the type (a) question. If the mean valuation in WTP for type (a) risk question is used as the basis of comparison then the value of a statistical life is RM1.21 million for the young riders compared to RM1.09 million for the more senior motorcyclists. This finding lends no support to the common notion that young motorcyclists are willing to take on more risk (and therefore get over represented in accident statistics) because they value their lives less than riders in the older age group. Such conclusion is, however, premature since the regression analysis below shows that this result is not as robust as it first appears.

3.4 Factors Influencing the WTP Values

The relationship between the WTP values and the underlying influencing factors can be investigated by means of a regression analysis. Previous studies on the value of statistical life have empirically confirmed several demographic variables that are likely to influence WTP value. They are age, gender, income and exposure to traffic risk (Ulf *et al.*, 1995, Jones-Lee *et al.*, 1993, and Desaignes *et al.*, 1995). Apart from these standard variables, additional variables (race and risk related behaviors such as tendencies to over speed and not wearing helmet) were included to determine if they too may have a significant and systematic influence on WTP values.

Prior to regression analysis an exploratory pair-wise correlation analysis was conducted among the variables. It was found that that no independent variable is highly correlated with the WTP values. It was later discovered that there were high correlations amongst several independent variables, in particular between injury experienced and accident involvements. Two other highly correlated independent variables worth mentioning are age and 'have children' variables.

Results of the regression analysis are presented in Table 3. Surprisingly, variables that have been shown time and again to influence valuation in other studies were insignificant in this study such as income and gender. As expected injury experience or accident exposure significantly and positively influence WTP values. However, respondents that had experienced minor injuries in the past seems to be willing to pay less, other things equal. This

finding appear to suggest that experience with minor injury may have influence rider's perceived risk of death from accident although the observed relationship may well have been due to an unmeasured factor that correlates well with the experience with minor injuries.

Notice also that willingness to pay rises with age; suggesting that controlling for the other effects, older people have higher valuation of their lives relative to younger individuals. This result seems to contradict the earlier finding that on average younger riders are willing to pay more to avoid a given reduction in the risk of death. The apparent contradiction between the two results are likely to be due to the fact that the relative values of life was determined in the preceding section without controlling for the effects of other influencing factors.

Table 3: Results of Regression Analysis

Cases	1653		1133	
Adjusted R ²	0.24		0.32	
Variables	Coefficient	t-statistic	Coefficient	t-statistic
Age	3434.4	0.892	8760.5	2.016*
Gender(male=1)	-4685.1	-0.102	16345.95	0.307
Income	10986.6	0.440	24933.4	0.870
No helmet (always ride without helmet=1)	89168.97	2.138*	72116.5	1.487
Have children(yes=1)	-245185	-2.995*	-279762	-2.926*
Experience injury minor (yes=1)	-114809	-2.694*	-162960	-3.313*
Experience serious injury (yes=1)	197575.4	2.728*	201485.5	2.553*
Race (Malay=1)	221354.1	2.068*	292984.3	2.091*-
Race (Chinese=1)	76260.3	0.698	161919.5	1.137
Race (Indian=1)	136904	0.914	181992.1	0.961
Over-speed (always=1)	-11748.4	-0.217	-75101.4	-1.250
Constants	921097.9	7.044*	722743.7	4.418*

*Statistically significant at 95% confidence level

4. SUMMARY

This paper provides estimates of the value of life among motorcyclists in Malaysia with particular attention given to the young riders. The willingness to pay method (also known as the contingent valuation method) was adopted in the questionnaire design, survey methodology and the valuation analysis. Various techniques were implemented right from the questionnaire design stage in order to increase the validity of the result. The value of life found under different assumptions ranges from RM600,000 to RM1.5 million and it was

argued that adopting a value of RM1.2 million per fatality avoided for policy analysis is perhaps the most appropriate. Although it was initially determined that the young riders were willing to pay more for a given reduction in fatality risk (implying higher valuation of their lives relative to the more senior counterparts), subsequent regression analysis proved that this result is not robust.

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