Altruism and Willingness to Pay for Reducing Child Mortality[♦]

Kenji Takeuchi,[*] Atsuo Kishimoto,[**] and Takahiro Tsuge[***]

January 2008

[♦] An earlier draft of this paper was presented at the Third World Congress of Environmental and Resource Economists held in Kyoto, July 3–7, 2006. Helpful comments from Vic Adamowicz, Kenshi Itaoka and Alan Krupnick are gratefully acknowledged. A part of this study was supported by the Global Environmental Research Fund (RF-077) of the Ministry of Environment, Japan.

[*] Graduate School of Economics, Kobe University, Japan; takeuchi@econ.kobe-u.ac.jp

[**] National Institute of Advanced Industrial Science and Technology, Japan

[***] Faculty of Economics, Konan University, Japan

Abstract

This paper estimates the value of statistical child's life from the societal perspective toward the child mortality. A double-bounded dichotomous choice contingent valuation is applied to Japanese citizens through a web-based survey to elicit the willingness to pay (WTP) for policy proposal directed at the improvement of child safety. We examine how paternalistic and nonpaternalistic altruism can affect the WTP by from the responses to questions on motivation for payment. The dummy variable for paternalistic motivation is significant and that for nonpaternalistic motivation is insignificant. The result may imply that the concern for double counting might not be as serious as anticipated.

Keywords: Altruism, Willingness to Pay, Contingent Valuation, Child Mortality

JEL codes: D64, J13, J17, Q51

1. Introduction

Economists have invested considerable efforts into evaluating the health benefits of environmental policies. Many papers estimating the willingness to pay (WTP) for reducing mortality have been published in academic journals. Based on techniques devised in these studies, the official value of a statistical life for policy evaluation has been announced in some developed countries. However, in most cases, these steps are primarily aimed at reducing the risk of adult mortality, with sufficient attention has not being paid to the evaluation of child mortality.

Applying the present valuation techniques to assess child mortality is difficult. It would be inappropriate to directly ask children to state their WTP for reducing their own health risk, since they are immature and incapable of making a deliberate decision. Further, their incomes are limited by the restrictions on work opportunity.

Since eliciting the WTP of children is difficult, alternative approach is necessary. The US Environmental Protection Agency (2003) investigates the societal, adults-as-children, and parental perspective, and recommends

the last two perspectives for representing children's health values. A report by the Organisation for Economic Co-operation and Development concludes that it is appropriate to utilize a parental perspective for theoretical and practical reasons (OECD 2006).

This paper relies on the societal perspective for evaluating the reduction in risk to children and estimates the WTP based mainly on altruistic motivations. We regard child safety as a component of public welfare and investigate the extent to which people are willing to sacrifice their own wealth to enhance it. There are several reasons to believe that this approach is relevant.

First, because of the decreasing fertility rate in Japan, the number of children has been on the decline. This implies that human resources are increasingly becoming scarce. The total fertility rate in Japan is 1.26 in 2005. This phenomenon of a declining fertility rate is common in many developed countries and East Asian countries.

Second, it is from the findings of several surveys that people are concerned about child safety. For example, a public opinion poll by the Japanese Cabinet Office reveals that 75% of the respondents chose "yes"

on being asked if they were worried about the possibility that children in their community would become victims of an act of crime (Japanese Cabinet Office 2006). Only 16% of the respondents were parents of children attending primary school. Moreover, a survey conducted by Nikkei-BP Consulting shows that 89% of the respondents experienced anxiety about child safety (Nikkei-BP Consulting 2005). Further, 65% of the respondents had children: thus a significant number of people harbored concerns with regard to this issue.

Third, there have been an increasing number of reports in the Japanese mass media on crimes and accidents wherein the victims were children; this has resulted in people demanding an increase in child safety. In 2001, an amendment of the traffic law was passed, and a penalty for dangerous driving was instituted. One of the reasons that led to this amendment was an accident wherein two infant sisters traveling in a car were killed by a drunken truck driver. A survey conducted by the Cabinet Office indicated that 86% of the respondents indicated “considerable coverage on television or in newspaper” as a reason for their anxiety about child safety.

These facts suggest that many individuals view child safety as a component of public welfare and expect it to be enhanced by policies that reduce the risks for all children. Focusing only on the parents' WTP would decrease the true benefit of a public policy that protects children from environmental degradation. To account for this aspect, this paper implements a contingent valuation (CV) study to evaluate the WTP of individuals who are mainly motivated by altruistic concern.

The remainder of the paper is organized as follows. In Section 2, we review the methodology to monetize the value of the reduction in risk to children. Section 3 introduces our survey design and estimation results. Section 4 discusses the policy implications of the results. Section 5 outlines the conclusion.

2. Methodological Review

2.1. Perspectives to Pertaining to the Valuation of Child Mortality

Scapecchi (2006) reviews studies on the valuation of risk to

children and raises three possible perspectives related to child mortality; that of child, parents, and society. The child perspective focuses on the monetary equivalent that a child is willing to sacrifice to improve his/her health and safety status. This is an ideal approach if one assumes that individuals are the best judge of their welfare. However, there are some problems in applying this assumption to child mortality. First, children are immature and cannot make a deliberate judgment by understanding information related to health and safety risks. Second, many children are dependenton the income of their parents and face budget constraints that cannot be increased according to their discretion.

The parental perspective attempts to capture the quantum of parents' WTP in order to reduce their children's risk. It can be presumed that choices made by parents provide reliable data since they can conjecture the preference of their children. Within this approach, there are studies employing the utility maximization model (Viscusi et al. 1987; Carlin and Sandy 1991; Liu et al. 2000; Jenkins et al. 2001), the household production model (Joyce et al. 1989; Agee and Crocker 1996), and the intra-household distribution model (Mount et al. 2001).

Lastly, the societal perspective regards the reduction in risk to children as a component of public welfare, and attempts to capture the extent of people's WTP. It assumes that an individual's WTP is motivated by altruistic concerns, in addition to parental concern. However, in this case, the possibility of double counting occurring during the aggregation of altruistic benefits exists; this is pointed out as a major problem in the adoption of the societal perspective (US EPA 2003, p.13).

2.2. Altruism and Double Counting

There are two types of altruism, namely paternalistic and nonpaternalistic. Let us express the utility of an individual with paternalistic altruism as

$$U_i = U_i(x_i, q_j), \tag{1}$$

and that of one with nonpaternalistic altruism as

$$U_i = U_i(x_i, U_j(x_j, q_j)), \quad (2)$$

where U denotes the utility of individual i or j; x, the consumption level of private goods by individual i or j; and q_j, the risk reduction to individual j.

Paternalistic altruism is represented by the utility function that contains the amount of reduction in risk to other people as an argument. An individual is supposed to be willing to pay some amount when there is a risk reduction to others, regardless of the others' utility level. In contrast, the utility function of nonpaternalistic altruism involves others' utility. If others experiencing reduction in risk pay as much as they are willing to pay, their utility level does not change; thus there is no change in the utility level of altruistic individuals too. Double counting can occur when the WTP values based on nonpaternalistic motivations are added to the children's WTP (or WTP by parents as a proxy of them) for reducing their own mortality (Lazo 1997; McConnell 1997).

In the survey, we queried respondents on their motivations to pay for the reduction in risk to others. Investigating the difference between the WTP values based on paternalistic and nonpaternalistic altruism, this paper

considers the extent to which double counting will occur.

3. Contingent Valuation

3.1. Survey Design

A sample of Japanese citizens aged between 20 to 69 years answered the questionnaire that was posted on a website. These citizens were registered monitors of a survey company. The responses were collected in September 2006. Among 2,000 people invited to the survey by e-mail, 731 finished through the questionnaire and 697 completely filled answers to the questions used in this study.

Our survey design is based on the double-bounded dichotomous choice type of CV (Hanemann et al. 1991). First, we explained the recent trends in the mortality rate of children aged 0 to 9 years in Japan. Then, the respondents were queried about whether or not they would agree to the proposal of introducing a policy to reduce child mortality, which would make their household bear an additional expense (Figure 1). If the answer

to the first question is “yes” (“no”), the question is repeated with higher (lower) suggested price.

<Figure 1 is about here>

We employed the eight patterns of survey questionnaires, depending on the amount of risk reduction (1% and 10%) and the suggested price. Different subsamples responded to these versions of the questionnaire.

<Table 1 is about here>

3.2. Analysis

The random utility model is assumed as given in equation (3).

$$\begin{aligned} U_{ik} &= V_{ik} + \varepsilon_{ik} \\ &= \beta' x_{ik} + \varepsilon_{ik} \end{aligned} \tag{3}$$

Here, k takes the value of 1 or 0, depending on whether or not the respondents agreed to the policy proposal. That is, if the answer to the proposal is "yes", k takes the value of 1; otherwise, it is 0. V_{ik} denotes the observable part of the utility and ε_{ik} is the random, unobservable part of the utility. The probability of answering "yes" to a policy proposal is the probability of the utility when the number of positive responses is higher than that of negative responses.

$$\begin{aligned} P_i^1 &= \Pr(U_{i1} > U_{i0}) \\ &= \Pr(V_{i1} - V_{i0} > \varepsilon_{i0} - \varepsilon_{i1}) \end{aligned} \tag{4}$$

Assuming that the random part is independently and identically distributed with a type-I extreme-value distribution (Gumbel distribution), the probability of positive response to a suggested price can be expressed by the following equation (McFadden 1974).

$$P_n^1 = \frac{e^{V1}}{e^{V1} + e^{V0}} = \frac{1}{1 + e^{V0-V1}} = \frac{1}{1 + e^{-x_i\beta}} \tag{5}$$

In a double-bounded dichotomous choice CV, there are four patterns of responses to the first and second questions, namely Yes-Yes, Yes-No, No-Yes, and No-No. The probability of each pattern takes the following form;

$$
\begin{aligned}
P_i^{YY} &= 1 - F\left(T_i^h\right) \\
P_i^{YN} &= F\left(T_i^h\right) - F\left(T_i\right) \\
P_i^{NY} &= F\left(T_i\right) - F\left(T_i^l\right) \\
P_i^{NN} &= F\left(T_i^l\right)
\end{aligned}
$$

where T_i represents the suggested price for individual I; T_i^h the suggested price when the individual answers "yes" to the first question, T_i^l the suggested price when the individual answers "no" to the first question. $F(.)$ denotes the cumulative distribution function, and we assume logistic distribution for estimation. Then, the log-likelihood function can be expressed as follows;

$$
\ln L = \sum_i \left(\delta_i^{YY} \ln P_i^{YY} + \delta_i^{YN} \ln P_i^{YN} + \delta_i^{NY} \ln P_i^{NY} + \delta_i^{NN} \ln P_i^{NN} \right), \qquad (6)
$$

where δ_i^{YY}, δ_i^{YN}, δ_i^{NY}, and δ_i^{NN} are dummy variables that takes the value of 1 when the responses are Yes-Yes, Yes-No, No-Yes, and No-No, respectively. Further, the parameters that maximize equation (6) are estimated.

3.3. Results

Table 2 presents a summary of the descriptive statistics of our sample. Tables 3 and 4 present the results of the logit model estimation when the reduction in risk is 1% (50 children) and 10% (500 children), respectively. Model 1 is a simple regression that contains only a constant term (CONSTANT) and a natural logarithm of the suggested price (LOGPRICE). The sign of the coefficient for the constant is positive and that of suggested price is negative, as expected.

<Table 2, 3, and 4 are about here>

The equation in Model 2 contains sociodemographic characteristics

such as gender (GENDER), age (AGE), log of income (LOGINCOME), and whether or not the respondents have a child (CHILD). The coefficients for GENDER, LOGINCOME and CHILD are positive, although significances are different between the sizes of risk reduction.

The positive sign of GENDER indicates that males are willing to pay for child safety more than females are. The positive sign of LOGINCOME is as expected, and it implies that individuals with higher income agree more with the policy proposal. The positive sign of CHILD implies that individuals with children have higher WTP for child safety.

Model 3 includes two dummy variables in response to the question pertaining to altruistic motivation. The question regarding paternalistic motivation is as follows.

The reason I am willing to pay some amount for the policy is that I feel happy with the amount of reduction in child mortality.

If respondents answer “yes” to this question, the dummy variable for paternal altruism (PATERNAL) takes the value 1. With regard to our

sample, 73.75% of the respondents answered “yes” to this question. There is no possibility of double counting for the WTP that is based on this type of motivation, since the respondents express concerns regarding the size of risk reduction and not the utility of others.

Another altruistic motivation is the nonpaternalistic one, and the corresponding question is as follows;

The reason I am willing to pay some amount for the policy is that I feel happy for parents who are happy due to the reduction in risk to their children.

If respondents answer “yes” to this question, the dummy variable for nonpaternalistic altruism (NONPATERNAL) takes the value 1. 53.37% of respondents answered “yes”; therefore, nonpaternalistic motivation is not negligible. They can be considered as having a nonpaternal type of motivation for their WTP. When aggregating the benefit across individuals, this amount should be calculated with care since there is a possibility of double counting exists.

The estimation results in Tables 3 and 4 show that the coefficient for PATERNAL is positive and significant. This implies that the WTP for reducing risk to children is higher for individuals who feel paternalistic altruism than for those who do not. On the other hand, the coefficient for NONPATERNAL is not significant in any estimated model.

The result shows that the presence of nonpaternalistic altruism in respondents does not affect the extent of the WTP. This does not necessarily imply that double counting is avoidable, since we are not decomposing the WTP to the different types of motivation and proving that the total contribution of nonpaternalistic altruism is zero. However, our interpretation of the result is that well-informed respondents expect that others are also forced to pay some amounts to the proposed program. Then it can be expected that the WTP based on nonpaternalistic motivation will become zero. If this conjecture is reasonable, the problem of double counting may not be very serious.

Table 3 and 4 also shows point estimates of WTP. For Model 3 of the 1% (50 children) case, the median, mean, and truncated mean WTP at the highest bid are 8,065, 20,833, and 14,552 Japanese yen (1 US dollar is

approximately equal 110 yen). For Model 3 of the 10% (500 children) case, the corresponding values are 12,216, 24,738, and 18,243 Japanese yen. The 95% confidence interval for the median WTP is [6,567 yen – 9,904 yen] for the 1% case, and [10,608 yen -14,066 yen] for the 10% case. Moreover, the intervals do not overlap, despite being very close to each other.

4. Consideration

4.1. Lexicographic Preferences

At times, ethical motivation as altruism has a significant impact that directs respondents' thoughts to the moral aspect of the issue (Spash 2000). One such example is lexicographic preferences. If lexicographic preferences prevail, people will agree to a policy proposal that reduces child mortality, regardless of the costs incurred. This potentially creates a bias in response to the CV question and can lead to overestimation of the economic benefit of a policy.

In our dataset, 8.8% of the respondents chose that "I am prepared to

pay for child safety, regardless of the costs" as a reason for their responses to CV question. These answers can be regarded as a revelation of lexicographic preferences in the sense that they have a strong restriction on individual choices. If we exclude these respondents from the samples, the reestimated median WTP becomes 6,679 yen (1% reduction) and 10,572 yen (10% reduction). These values are 1,300 yen - 1600 yen less than the corresponding values estimated with the full sample. The inclusion of these respondents to sample for estimation leads to significant changes in the result.

4.2 Value of a Statistical Child's Life

Using the WTP for child safety, we can calculate the value of saving one statistically-equivalent child. If we divide the median WTP by the number of children saved, it amounts to 24 yen – 161 yen per household. Multiplying these WTPs per household by the total number of households in Japan (approximately 48 million), it amounts to 1.17 to 7.74 billion yen. This amount, which can be termed as the value of a statistical child's life

based on altruistic WTP, is much larger than the 350 million yen that Tsuge et al. (2005) estimated as the value of statistical life for Japanese adult.

5. Conclusion

Considering child safety as a component of public welfare, this paper estimated the WTP for improving child safety. Two types of altruism —paternalistic and nonpaternalistic— that are motivating the WTP were examined. While the existence of paternalistic motivation can lead to a higher WTP, nonpaternalistic motivation does not exhibit any significant effect. This can be explained as the result of a reasonable assumption by respondents regarding the cost borne by others.

The paper further considered the impact of the moral aspect of evaluating child safety. Moreover, 8.8% of the respondents exhibited potential lexicographic preference, and the inclusions of these samples had a notable impact on the estimation of the WTP.

Evaluation of child mortality is difficult, and there are many topics that should be elaborated through further research. First, it would be

interesting to compare the WTP between the public goods settings and private goods settings. Second, with regard to the above point, a theoretically consistent assessment is necessary for employing values obtained through different methodologies for child mortality valuation.

Third, studies on the reduction of morbidity risk to children are scarce. Since the seriousness of a disease is different for adults and children, the values estimated for adults may not be applicable to children. Furthermore, some diseases are limited to children only, that is, adults are not afflicted with some diseases. The societal perspective has potential to be applied to the valuation of child morbidity.

References

Agee MD, TD Crocker (1996) Parental altruism and child lead exposure: Inferences from the demand for Chelation therapy. Journal of Human Resources 31(3), 677–691.

Carlin PS, R Sandy (1991) Estimating the implicit value of a young child's life. Southern Economic Journal 58(1), 186–202.

Dockins C, RR Jenkins, N Owens, NB Simon, LB Wiggins (2002) Valuation of childhood risk reduction: The importance of age, risk preferences, and perspective. Risk Analysis 22(2), 335–346.

Hanemann WM, J Loomis, B Kanninen (1991) Statistical efficiency of double-bounded dichotomous choice contingent valuation. American Journal of Agricultural Economics 73, 1255–63.

Japanese Cabinet Office (2006) Special opinion survey on prevention of crimes involving children. (in Japanese)

Jenkins RR, N Owens, LB Wiggins (2001) Valuing reduced risks to children: The case of bicycle safety helmets. Contemporary Economic Policy 19(4), 397–408.

Joyce TJ, M Grossman, F Goldman (1989) An assessment of the benefits of air pollution control: The case of infant health. Journal of Urban Economics 25, 32–51.

Lazo JK, GH McClelland, WD Schulze (1997) Economic theory and psychology of non-use values. Land Economics 73(3), 358–371.

Liu JT, JK Hammitt, JD Wang, JL Liu (2000) Mother's willingness to pay for her own and her child's health: A contingent valuation study in

Taiwan. Health Economics 9, 319–326.

McConnell, KE (1997) Does altruism undermine existence value? Journal of Environmental Economics and Management 32(1), 22–37.

McFadden, D (1974) Conditional logit analysis of qualitative choice behavior. In: Zarembka P (ed). Frontiers in Econometrics, Academic Press, pp.105–142.

Mount T, W Weng, W Schulze, L Chestnut (2001) Automobile safety and the value of statistical life in the family: Valuing reduced risks for children, adults and the elderly. Report to the US EPA.

Nikkei-BP Consulting (2006) Child safety, keyword questionnaire No.1. (in Japanese) http://www.nikkeibp.co.jp/sj/2/research/11/

OECD (Organisation for Economic Co-operation and Development) (2006) Economic Valuation of Environmental Health Risks to Children.

Scapecchi P (2006) Valuation differences between adults and children. In: OECD. Economic Valuation of Environmental Health Risks to Children, pp.79–119.

Tsuge T, A Kishimoto, K Takeuchi (2005) A choice experiment approach to the valuation of mortality. Journal of Risk and Uncertainty 31(1),

73–95.

US EPA (Environmental Protection Agency) (2003) Children's Health Valuation Handbook. EPA 100-R-01-002.

Viscusi WK, WA Magat, J Huber (1987) An investigation of the rationality of consumer valuations of multiple health risks. Rand Journal of Economics 18(4), 465–479.

Viscusi WK, JE Aldy (2003) The value of a statistical life: A critical review of market estimates throughout the world. Journal of Risk and Uncertainty 27(1), 5–76.

Figure 1 CV question for 10% reduction

The government is proposing a safety policy to reduce child mortality. If it is implemented, the number of children dying will be reduced by 10 % (500 children) from the current situation (approximately 5,000 children). However, the implementation of this policy would involve cost. Let us assume that this cost will be collected from all citizens in Japan.

Do you agree to the proposal, if the additional cost to your household is [x] Japanese yen every year?

1. Agree
2. Do not agree

Table 1 Versions of survey instruments

Version	Risk Reduction	First Bid (Yen)	Second Bid (Yen)	Second Bid (Yen)
1	1 % (50 children)	2,000	1000	5,000
2	1 % (50 children)	5,000	2000	10,000
3	1 % (50 children)	10,000	5000	50,000
4	1 % (50 children)	50,000	10000	100,000
5	10 % (500 children)	2,000	1000	5,000
6	10 % (500 children)	5,000	2000	10,000
7	10 % (500 children)	10,000	5000	50,000
8	10 % (500 children)	50,000	10000	100,000

Table 2 Descriptive statistics

Variable	Note	Sample Average	Japan Average
GENDER	male=1, female=0	0.54	0.49
AGE	years	45.4	43.3
INCOME	one million yen	672.5	563.8
CHILD	0-9 years old In household	0.22	Not available

Table 3 Estimation results for 1% reduction (n=332)

	Model 1	Model 2	Model 3
CONSTANT	8.214 ***	5.089 ***	4.800 ***
	(0.569)	(1.082)	(1.106)
LOGPRICE	-0.912 ***	-0.960 ***	-1.007 ***
	(0.063)	(0.066)	(0.071)
AGE		0.013	0.006
		(0.008)	(0.008)
GENDER		0.578 ***	0.690 ***
		(0.210)	(0.218)
CHILD		0.691 **	0.614 **
		(0.293)	(0.310)
LOGINCOME		0.406 ***	0.413 ***
		(0.146)	(0.150)
PATERNAL			1.116 ***
			(0.272)
NONPATERNAL			0.300
			(0.249)
Median WTP	8,188	8,315	8,065
Mean WTP	22,709	22,045	20,833
Truncated WTP	14,815	14,879	14,552
Log Likelihood	-457.947	-446.313	-430.294
AIC	919.895	904.626	876.588

*=significant at 10%, **=significant at 5%, and ***=significant at 1%.
Numbers in parenthesis are standard errors.

Table 4 Estimation results for 10% reduction (n=365)

	Model 1	Model 2	Model 3
CONSTANT	10.541 ***	9.634 ***	9.170 ***
	(0.660)	(1.203)	(1.234)
LOGPRICE	-1.120 ***	-1.132 ***	-1.165 ***
	(0.071)	(0.072)	(0.073)
AGE		0.014 *	0.011
		(0.007)	(0.008)
GENDER		0.166	0.183
		(0.196)	(0.199)
CHILD		0.188	0.196
		(0.228)	(0.231)
LOGINCOME		0.040	0.053
		(0.148)	(0.152)
PATERNAL			1.270 ***
			(0.276)
NONPATERNAL			-0.288
			(0.234)
Median WTP	12,208	12,303	12,216
Mean WTP	25,331	25,301	24,738
Truncated WTP	18,251	18,330	18,243
Log Likelihood	-487.519	-484.992	-474.185
AIC	979.038	981.983	964.370

*=significant at 10%, **=significant at 5%, and ***=significant at 1%.
Numbers in parenthesis are standard errors.