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ECONOMIC EVALUATION

MOTHER'S WILLINGNESS TO PAY FOR HER OWN AND HER CHILD'S HEALTH: A CONTINGENT VALUATION STUDY IN TAIWAN

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SUMMARY

We use the contingent valuation (CV) method to estimate mothers' willingness to pay (WTP) to protect themselves and their children from suffering a minor illness—a cold—in Taiwan. WTP is specified as a hedonic function of the duration and severity of the cold (measured alternatively by symptoms experienced and the Quality of Well-Being (QWB) index) and of respondents' socioeconomic characteristics. The average mother is willing to pay more to protect her child than herself from suffering a cold. Median WTP to avoid the average mother's and child's colds are US$37 and US$57, respectively. Adjusting for the greater duration and severity of the average mother's cold suggests that WTP to prevent comparable illnesses is approximately twice as large for the child as for the mother. We also find that mother's WTP is about 20% greater to prevent a son's than a daughter's illness.

KEY WORDS — contingent valuation; willingness to pay; morbidity; altruism

INTRODUCTION

We estimate the values to Taiwanese mothers of protecting themselves and their children from suffering a minor illness—a cold—and examine how the values depend on the severity and duration of the cold. Values are elicited using contingent valuation (CV). We find that willingness to pay (WTP) to prevent a cold is positively associated with the severity of symptoms and their duration. Moreover, mothers' altruistic WTP to protect their children from a cold is approximately twice as large as their private WTP to protect themselves from a cold of equivalent duration and severity. That is, mothers value their children's health more than their own.

Several previous studies have estimated the value to an individual of preventing her own minor illness, but few studies have examined WTP to protect another person's health [1,2]. Viscusi *et al.* [3] used CV to estimate WTP to prevent the risk of injury associated with household pesticides. They found that WTP to reduce risks to one's children exceeds WTP to reduce risks to oneself but could not distinguish the effects of parental altruism and injury severity. Agee and Crocker [4] estimated parental WTP to reduce the risk of neurological impairments due to childhood exposure to lead using a revealed-preference approach based on the parents' decision to obtain chelation therapy for their child. They did not examine WTP to reduce risks of neurotoxicity to

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adults (which are much smaller than risks to children).

Several studies have used CV in USA populations to estimate WTP to reduce one's own minor illness [5–11]. These studies estimated values for 1-day avoidance of various symptoms between US$12 and US$154 (1993 dollars). Johnson *et al.* [12] combined five CV studies of short-term morbidity in a meta-analysis using the Quality of Well-Being (QWB) index to control for severity. They estimated WTP for avoiding 1 day of various symptoms as US$19–72. The only previous study for a developing country (Taiwan) is by Alberini *et al.* [13]. They estimated the median WTP to avoid recurrence of the average respondent's most-recent episode of acute illness (5.3 days, 2.2 symptoms) as approximately US$40.

The remainder of the paper is organized as follows. The next section presents the survey method and data. The third introduces the empirical models and the fourth section presents the WTP estimates. The conclusion is in the last section.

DATA COLLECTION

The data were collected in a December 1995 in-person survey conducted in four areas representing diverse regions of Taiwan: Metropolitan Taipei, Kaushung, Miaoli, and Yunlin. Taipei is the capital and largest city in Taiwan. It is located near the northern tip of the island. Kaushung and Miaoli are sites of major petrochemical complexes. Kaushung is a major industrial city in southwest Taiwan and Miaoli is in a northern rural area. Yunlin is located on the central west coast of the island and is relatively unpolluted. The sample is a stratified random sample. Primary schools were randomly selected within each region and 700 of the 4500 students enrolled in these schools were randomly selected. Professionally trained interviewers went to the selected students' homes to interview each student's mother. Results from a focus group and two pretests confirmed that Taiwanese mothers are more knowledgeable about their children's health than are fathers and are much more likely to be the one accompanying a child who visits a doctor. Interviews were completed with 650 mothers. Deleting the observations with missing income and other socioeconomic variables leaves 598 observations that are used in the analysis.

The survey instrument includes questions on socioeconomic characteristics, health status, mother's and child's most recent colds, and valuation. Our hypothetical market good is prevention of one of the most common illnesses, a cold, which is easily understood by respondents. We asked each respondent to describe her own and her child's most recent cold, including the duration and symptoms experienced. The respondent was then asked to value prevention of a cold with the characteristics she had described. Alberini *et al.* [13] used a similar approach. In contrast, most previous studies have specified the symptoms to be valued [5,7,14,15]. The older approach may not account for averting behaviour (e.g. taking medicine to reduce symptom severity) and may pose double-counting problems when evaluating an illness that includes multiple symptoms.

After asking the respondent to describe her own and her child's most recent cold, we asked her to value prevention of a similar cold. For her own illness, the following question was asked (the question for the child's illness is similar):

> When you get a cold, your loss includes: (1) increased medical expenditures, (2) spending time visiting the doctor or hospital, (3) poor working performance, (4) missing leisure time and daily activities. We are now going to ask you a hypothetical question. Suppose you were told that, within the next few days, you would experience a recurrence of the cold episode you have described for us. Assume you can purchase a special preventive medicine to avoid getting this cold again. How much are you willing to pay for this medicine? Bear in mind if you purchase this medicine, you have to give up some other use of this money. For example, you may reduce your expenditures for recreation or education.

WTP was elicited using binary-choice questions. Each respondent was randomly assigned to one of three initial WTP values (NT$300, 700 and 1000). (The 1995 exchange rate was 27.265 New Taiwanese dollars per US$.) Each respondent received the same initial bid for the mother and child questions. The use of a common initial bid limits the effect of any starting-point bias on the difference between values for the mother's and child's illness but risks anchoring the value for preventing the child's illness on the value of preventing the mother's illness. As in [13], two follow-up questions were asked yielding a triple-bounded binary-choice format. Adding a single follow-up to an initial dichotomous-choice question substantially improves statistical efficiency [16].

EMPIRICAL MODELS

WTP to avoid a cold is modelled as a linear function of the respondent's characteristics and the severity of the cold. The model is estimated by the maximum-likelihood method under the assumption that WTP is lognormally distributed [17]. Alternative distributional assumptions (log-logistic, exponential, and Weibull) are rejected in favour of the log-normal distribution using a likelihood-ratio test.

The explanatory variables are defined and summary statistics reported in Table 1. Socioeconomic characteristics include income, education, and age. The effect of income is anticipated to be positive. Education and age may also affect the respondent's WTP for health, although the direction of the effects is not apparent *a priori*.

Overall health status is represented by a dummy variable indicating whether the individual had a chronic disease (Chronic). Respondents with chronic disease are expected to exhibit higher WTP to avoid a cold if the marginal disutility of poor health is increasing [18]. Whether or not the respondent exercises habitually is represented as a dummy variable (Exercise). This variable may be interpreted as another indicator of health (healthier people are more likely to exercise) or as a proxy for the respondent's health preference (people with a stronger preference for health are more

Table 1. Definitions of variables and basic statistics

Variable	Definition	Mean (S.D.)
Log(income)	Log of monthly household income (NT$)	10.846 (0.466)
Edu	Years of education	9.098 (3.493)
Exercise	Dummy = 1 if respondent exercises habitually	0.293
Chronic	Dummy = 1 if respondent has chronic disease	0.253
Work	Dummy = 1 if respondent has a full-time job	0.698
Taipei	Dummy = 1 if respondent is a resident of Taipei	0.463
Miaoli	Dummy = 1 if respondent is a resident of Miaoli	0.144
Kaushung	Dummy = 1 if respondent is a resident of Kaushung	0.256
Yunlin	Dummy = 1 if respondent is a resident of Yunlin	0.137
Mother		
M_Days	Duration of recent cold in days	6.478 (7.634)
M_QWB	The QWB Health-State Index	0.656 (0.068)
M_Headache	Dummy = 1 if respondent had headache	0.572
M_Cough	Dummy = 1 if respondent had cough	0.615
M_Fever	Dummy = 1 if respondent had fever	0.120
M_Doctor	Dummy = 1 if respondent visited a doctor	0.726
M_Wkloss	Dummy = 1 if respondent lost work days	0.120
Child		
C_Days	Duration of recent cold in days	5.395 (4.474)
C_QWB	The QWB Health-State Index	0.769 (0.079)
C_Headache	Dummy = 1 if respondent's child had headache	0.341
C_Cough	Dummy = 1 if respondent's child had cough	0.701
C_Fever	Dummy = 1 if respondent's child had fever	0.319
C_Doctor	Dummy = 1 if respondent's child visited a doctor	0.802
C_Schloss	Dummy = 1 if respondent's lost school days	0.179
C_Boy	Dummy = 1 if respondent's child is male	0.505

Note: S.D. values for dummy variables are omitted since they can be calculated from $(m-m^2)^{1/2}$, where m is the fraction in the sample. The first character M_ or C_ indicate the variables of mother or her child.

likely to exercise). Consequently, there is no prediction for the sign of its coefficient. The child's sex is introduced in the child WTP equation to measure gender differences in the intrahousehold distribution of resources. Mothers may have differential preferences with respect to investments in boys and girls. Dummy variables for the respondent's place of residence, Taipei, Kaushung, and Miaoli, are used to capture regional differences in preferences, the cost of living, and other factors.

WTP for symptom relief consists of two terms: the monetary cost and disutility of any actions taken to mitigate the illness and the disutility of illness after mitigation [19]. We include variables to represent each component in the regression. Because all respondents have national health insurance which covers most of their medical expenses, expenditures do not vary greatly. As an alternative, a dummy variable indicating whether the respondent visited a doctor (Doctor) is used to represent mitigating behaviour.

The disutility of illness should increase with severity and duration. Duration is measured by (the logarithm of) the number of days of illness (LogM_days, LogC_days). Severity is measured by a dummy variable indicating whether the mother missed work or the child missed school (M_Wkloss and C_Schloss) and, alternatively, by dummy variables representing the occurrence of specified symptoms (headache, cough, fever) and by the QWB index (M_QWB, C_QWB). The QWB is a health-state index that rates the respondent's health state from 0 to 1, where 0 represents death and 1 represents perfect health. This rating scale provides a simple technique for assigning numerical values to each symptom. To our knowledge, it has never been administered in a developing country and so its validity in such countries is untested. We follow Johnson *et al.* [12] in using the community-based weights in Kaplan *et al.* [20] for our analysis. The QWB value is based on the symptoms reported in the questionnaire as the most serious. For example, QWB values are 0.743 for fever and mild cough, 0.682 for severe cough, 0.756 for headache, 0.83 for runny nose, and 0.769 for sinus congestion.

EMPIRICAL RESULTS

Regression estimates are reported in Table 2. As anticipated, the results indicate that WTP increases with the duration and severity of illness. The coefficients of log duration, 0.173–0.206 for the mother and 0.157–0.166 for her child, suggest that the increase in WTP is much less than proportionate to the increase in duration. Both variables are significantly different from zero (WTP increases with duration) and also from one (WTP is less than proportionate to duration). Other studies also find that WTP is less than proportionate to the duration of illness [5,7,13].

Severity of the illness is captured by several variables: whether the respondent missed work or her child missed school, whether she or her child went to the doctor, and alternatively dummy variables for selected symptoms (headache, cough, and fever) in specifications (1) and (3) and the QWB index in specifications (2) and (4). The coefficients on work- and school-loss and doctor visits have the expected positive sign (except for the variable indicating the child was taken to the doctor) but are not significantly different from zero.

The signs of the estimated coefficients on the symptom variables are consistent between mother and child equations although most are not significantly different from zero. These estimates suggest that WTP increases with headache and cough and, contrary to expectation, decreases with fever. The coefficients of the QWB variables (M_QWB and C_QWB) are both negative and statistically significant, suggesting that QWB provides a useful measure of severity. Although the magnitudes of the coefficients on the symptom variables are similar in mother and child equations, the estimated coefficient on QWB is much larger for the mother than the child which suggests that the QWB is a more accurate indicator of severity for adults than for children.

To determine whether the effects of illness duration and severity on WTP differ between mother's and child's illness, we use a likelihood-ratio test for equality of the illness coefficients between comparable specifications. The χ^2 statistic for comparing duration, symptom, doctor-visit and work- or school-loss coefficients in specifications (1) and (3) is 30.84 (six degrees of freedom). For comparing duration and QWB coefficients in specifications (2) and (4) the value is 30.31 (two degrees of freedom). Both values are much larger than the appropriate critical values so the hypothesis of parameter homogeneity in own and child WTP equations is rejected.

Table 2. Estimated WTP equations based on triple-bounded responses

Variable	Mother		Child	
	(1)	(2)	(3)	(4)
Intercept	1.846 (1.267)	3.488 (2.017)	3.156 (2.108)	4.844 (1.348)
Log(income)	0.403 (2.918)	0.447 (3.241)	0.321 (2.260)	0.341 (2.377)
Edu	−0.029 (1.517)	−0.028 (1.461)	0.017 (0.915)	0.013 (0.685)
Exercise	−0.160 (1.236)	−0.146 (1.123)	−0.235 (1.824)	−0.215 (1.651)
Chronic	0.355 (2.725)	0.404 (3.130)	0.313 (2.279)	0.329 (2.405)
Work	−0.204 (1.517)	−0.173 (1.344)	−0.238 (1.836)	−0.242 (1.849)
Taipei	0.395 (2.013)	0.398 (2.032)	0.134 (0.648)	0.189 (0.918)
Miaoli	0.555 (2.103)	0.553 (2.096)	0.158 (0.598)	0.123 (0.463)
Kaushung	0.667 (3.364)	0.706 (3.642)	0.500 (2.472)	0.442 (2.193)
Mother				
Log(M_Days)	0.173 (2.094)	0.206 (2.639)		
M_QWB		−2.493 (1.904)		
M_Headache	0.193 (1.645)			
M_Cough	0.067 (0.545)			
M_Fever	−0.205 (1.126)			
M_Doctor	0.182 (1.292)			
M_Wkloss	0.227 (1.258)			
Child				
Log(C_Days)			0.157 (1.682)	0.166 (1.826)
C_QWB				−0.285 (2.011)
C_Headache			0.222 (1.740)	
C_Cough			0.218 (1.587)	
C_Fever			−0.306 (2.310)	
C_Doctor			−0.063 (0.386)	
C_Schloss			0.094 (0.598)	
C_Boy			0.217 (1.874)	0.207 (1.776)
σ	0.999	1.006	1.039	1.052
Log likelihood	−621.58	−623.49	−641.21	−644.01
Median WTP (US$)	37.30	37.50	57.60	57.00
95% confidence interval (US$)	24–57	25–55	36–91	38–85

Note: Absolute value of asymptotic t-statistics in parentheses. Dependent variable: log(WTP).

We next consider the effects of socioeconomic variables on WTP. Family income has the expected positive sign and is significantly different from zero for all specifications. The estimated income elasticities are about 0.4 for mother herself and 0.3 for her child. These elasticities are not significantly different from each other (the t-statistic for a difference between them is 0.59). Our elasticity estimates are comparable to previous estimates. Loehman and De [14] found income elasticities of 0.3 for minor coughing and sneezing/eye irritation complex and 0.6 for severe shortness of breath. Alberini *et al.* [13] estimated that the income elasticity of WTP to avoid an acute illness episode is about 0.3. In contrast, Brien *et al.* [15] found that the effects of income on WTP to avoid seven specified symptoms were very small or even negative, and not statistically significant.

None of the education coefficients are significantly different from zero. Turning to the health-status variables, the coefficients of Chronic are positive and statistically significant in all specifications. Respondents with chronic disease have 37–50% higher WTP in both own and child equations. Although we expect respondents with chronic disease to have higher WTP for themselves, it is not clear that this preference should also be reflected in WTP to prevent their child's illness unless it serves as an indicator of sympathy. The coefficient of the Exercise dummy is negative in all equations and significant in the

child equations. Habitual exercise reduces WTP to prevent the child's illness by about 20%. The child's sex dummy is statistically significant and indicates that mothers' WTP is about 20% higher for a son than for a daughter. Perhaps reflecting cultural differences, this result differs from the finding that Brazilian mothers prefer to devote resources to improving the nutritional status of their daughters [21].

The regional dummy variables are statistically significant in the mother equations but only the Kaushung dummy is significant in the child equations. The coefficients indicate that residents of Kaushung and Miaoli, the two locations with large petrochemical complexes, have higher WTP than those of the other two areas, Taipei and Yunlin.

WTP estimates

We calculate the median WTP for mother and child at the corresponding sample averages of the independent variables (i.e. the predicted WTP equals $\exp(\bar{x}\hat{\beta})$ where $\bar{x}$ is the sample mean of the regressors and $\hat{\beta}$ is the estimated coefficient vector). As reported in Table 2, WTP to prevent a recurrence of the cold is about US$37 for the mother and US$57 for her child. These figures represent WTP to avoid a cold of 6.5 days (mother) or 5.4 days (child). The values exceed the corresponding mean out-of-pocket costs (US$20.11 and US$22.49, respectively), consistent with theory [22] and other empirical estimates [6,23].

The estimate for the mother's illness is comparable to the Alberini *et al.* [13] estimate for Taiwanese adults' own WTP to avoid a similar illness episode, about US$40 for an average duration of 5.3 days and 2.2 symptoms. The illness episodes valued in Alberini *et al.* [13] appear to be quite similar to the mother's illness valued here. Sixty-nine percent of respondents in the previous study described their illness as a cold. Compared with the current study, the average duration of the episodes was slightly shorter (5.3 versus 6.5 days), a smaller fraction of respondents visited a doctor (54% versus 73%) or experienced headache (39% versus 57%), and a slightly larger fraction of respondents experienced fever (15% versus 12%).

The average mother's illness is longer than the average child's illness. Based on the QWB score, it is also more severe. Adjusting for these differences yields an even larger difference in WTP. WTP to prevent a child's illness as long and severe as the average mother's illness is estimated as US$74.90 and US$70.50 using the symptom-specific and QWB equations (regressions (3) and (4)), respectively. These values are 1.9–2.0 times larger than the mother's WTP to prevent her own illness. Conversely, the average mother's WTP to prevent an illness as long and severe as the average child's illness is estimated as US$29.40 and US$22.60 (using symptoms and QWB, regressions (1) and (2), respectively). WTP to prevent the child's illness is 2.0–2.5 times larger than these values. Both adjustments suggest that mother's WTP to prevent her child from suffering a cold is about twice as large as her WTP to prevent herself from suffering a cold of comparable duration and severity.

The comparison of adjusted values using symptom-specific and QWB regressions suggests some consistency between these two methods of accounting for severity. Consistent with the larger estimated coefficient on QWB for the mother's illness than the child's, the adjustment of WTP to avoid the child's illness is larger using the symptom-specific model and the adjustment for the mother's illness is larger using the QWB model.

We test for the effect of starting-point bias on estimated WTP by adding dummy variables representing the initial bid to specifications (1) and (3) (these models are not presented). Compared with our highest initial bid (NT$1000), we find no evidence of starting-point bias using our intermediate initial bid (NT$700) but a statistically significant effect using our smallest initial bid (NT$300). The magnitude of the effect is modest: estimated WTP is about 25% smaller for both mother's and child's cold using the smallest rather than the largest initial bid. The estimated coefficients and absolute t-statistics of the dummy variables for the small and intermediate initial bids are -0.317 (2.269) and -0.003 (0.024) for the mother's illness and -0.277 (1.949) and -0.077 (0.555) for her child's illness.

CONCLUSION

Most previous CV studies of acute illness have used data for industrialized countries and have asked respondents to value a specified set of symptoms. Our study uses data from a developing

country and estimates values for an illness described by the respondent. The illness we value—a cold—is one of the most familiar acute illnesses and is presumably relatively easy for a respondent to recall.

Our results are consistent with the expected increasing disutility of illness: respondents express higher WTP to avoid an illness of greater duration or severity as measured by symptoms or the QWB index. The regression analysis suggests a strong relationship between family income, health status, and WTP. The average mother's WTP for her child is higher than for herself. Median estimates of the mother's WTP to avoid a recurrence of the average cold are US$37 for herself and US$57 for her child; adjusting for differences in average duration and severity yields an even larger difference. We also find evidence of gender preference: mothers are willing to devote more resources to the health of their sons than their daughters. These measures of health values provide a foundation for evaluating public health or environmental regulations that may influence the prevalence of minor morbidity in a developing country.

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