THE COST-PER-LIFE-SAVED CUTOFF FOR SAFETY-ENHANCING REGULATIONS

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This article develops a model of the conditions under which risk regulations that are too expensive have net adverse health effects. Two principal components of this relationship are the implicit value of life and the income elasticity of risky behaviors. Using new empirical estimates for the income elasticity of many of the most consequential risk-related behaviors, our results imply that a $15 million decrease in income is associated with the loss of an additional statistical life. Regulations that cost more than $15 million per expected life saved will have counterproductive effects on individual mortality. (*JEL* L51, I12, J17)

I. INTRODUCTION

Economic studies of the value of life have focused primarily on individuals' risk-money tradeoffs for preventing death. Use of these willingness to pay measures in conjunction with benefit-cost analysis has, however, been resisted by many Federal risk-regulation agencies, which often have more restrictive legislative mandates. As a result, some policy makers have proposed that no risk regulation be adopted if it causes more harm than good in terms of risk effects alone, which is weaker than a benefit-cost test.[1] Because wasteful government expenditures impose an opportunity cost in terms of lives that could have been saved, there is some cost-per-life-saved threshold at which squandering money on ineffective regulations will impose more health opportunity costs than the risk reductions achieved. Thus, bad regulations not only lower utility but can also increase risk. The empirical issue we address in this article is what the cutoff cost-per-life-saved value is beyond which risk regulations have net adverse effects on mortality.

Our general approach is to infer this cutoff value based on a theoretical model incorporating the linkage involving the conventional value of life and the relation of income to risky behaviors.[2] This approach avoids some of the econometric problems associated with direct econometric estimations of the income-mortality relationship.[3]

In section II we present the theoretical model, and section III implements it empirically. As indicated in the concluding section IV, government regulations that spend more than $15 million per life saved on balance kill more people than they save.

* The views contained in this article are the sole responsibility of the authors. Robert Scharff provided superb research assistance.

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1. See *UAW v. OSHA* (United States Court of Appeals for the District of Columbia Circuit, 89-1559); the letter to Nancy Risque Rohrbach, Assistant Secretary for Policy, Department of Labor from James B. MacRae, Jr., Acting Administrator , Office of Information and Regulatory Affairs (March 10, 1992). Also see the *New York Times*, March 16, 1992, p. A13, and November 10, 1994, p. C2, the *Washington Post*, March 17, 1992, and the *Wall Street Journal*, March 20, 1992 for discussion of previous research reported in Lutter and Morrall [1994] and Viscusi [1994].

2. For exploration of the role of income effects, see Viscusi [1978, 1983], Keeney [1990, 1994, 1996], and Wildavsky [1988].

3. This approach was used in Keeney [1990] and subsequently by Lutter and Morrall [1994]. Portney and Stavins [1994] and Smith, Epp, and Schwabe [1994] discuss problems with this approach. Chapman and Hariharan [1994a, 1994b] attempt to reduce the potential biases in the estimates resulting from initial health status, genetic endowments, and endogeneity of income.

Economic Inquiry
(ISSN 0095-2583)
Vol. 37, No. 4, October 1999, 599–608

II. THE THEORETICAL LINKAGES

Our theoretical model will generalize that in Viscusi [1994], which considered only health-enhancing private expenditures, to include expenditures that harm one's health as well. We will begin with that basic case and then generalize it. Let q be the individual's survival probability $q(s,x)$, where s is the safety level (e.g., environmental quality) resulting from the regulation and x is the individual's own investment in health. The level of investment in health x depends on the person's income A. Safety regulations boost the safety level in the area affected by the policy by Δs but lower the individual's financial resources by the cost of the regulation ΔA.

The requirement that a regulation have a net overall safety-enhancing effect is[4]

$$(1)\quad \Delta q = (\partial q/\partial s)\Delta s + [(\partial q/\partial x)(\partial x/\partial s)]\Delta s + [(\partial q/\partial x)(\partial x/\partial A)]\Delta A > 0.$$

The mortality effect, which must be positive for the regulation to be health-enhancing, consists of the direct effect of the regulated safety measure on mortality, the effect of greater regulated safety levels on mortality due to changes in private investments in health x, and the effect of reduced income on health investments and mortality.

Rearranging and collecting terms, the condition for beneficial regulations is that

$$(2)\quad -\Delta A/[\partial q/\partial s + (\partial q/\partial x)(\partial x/\partial s)]\Delta s < 1/(\partial q/\partial x)(\partial x/\partial A).$$

The left side of inequality (2) is simply the cost-effectiveness measure of the money spent per unit risk, or the cost per life saved by the regulation. This amount must be below the term on the right side of equation (2), or else the regulation is counterproductive. The cost-effectiveness cutoff has a convenient interpretation if one assumes that the purpose of personal health investments is to foster a longer life, as it is the marginal value of life (i.e., $1/(\partial q/\partial x)$) divided by the marginal propensity to spend on health, $\partial x/\partial A$. Using the midpoint estimate of the value of life of \$5 million and a marginal propensity to spend on health of 0.1, Viscusi [1994] calculated the cutoff for safety-enhancing regulations as \$50 million. Government regulations imposing costs greater than this amount kill more people than they save based on that analysis.

Equation (2) generalizes directly to include other forms of expenditure $x_i\,(i = 1$ to $n)$, where x_i is the health-enhancing expenditure, and x_2 through x_n are risky behaviors. Doing so leads to the requirement that

$$(3)\quad -\Delta A/[\partial q/\partial s + \sum_{i=1}^{n}(\partial q/\partial x_i)(\partial x_i/\partial s)]\Delta s < 1/\sum_{i=1}^{n}(\partial q/\partial x_i)(\partial x_i/\partial A).$$

The cost per total risk reduced must be below the risk-risk cutoff value for safety-affecting investments, taking into account all expenditures.

Much of the empirical implementation will involve obtaining estimates of the terms in the denominator of the cutoff value of life term on the right side of inequality (3). This expression can be converted into a form that is estimable using readily available data by noting that

$$(4)\quad (\partial q/\partial x_i)(\partial x_i/\partial A) = [(\partial q/\partial x_i)(x_i/q)](q/A)[(\partial x_i/\partial A)(A/x_i)].$$

The three component terms are the elasticity of the survival probability with respect to consumption of x_i, the survival probability divided by income, and the income elasticity of demand for good x_i.

The focus here will be on calculation for risky behaviors x_i. To simplify calculation of the survival elasticity term, note that, if q_i is the probability of not dying from risky behavior i, then the overall survival probability q is

4. Equations (1) and (2) are identical to equations (14) and (16) in Viscusi [1994]. The subsequent development differs.

$$(5) \qquad q = q_b q_1 q_2 \cdots q_n,$$

where q_b is the (maximum) background survival probability not affected by consumption choices, and q_i is the probability of not dying from consuming x_i.[5] Differentiating equation (5) with respect to x_i and simplifying, yields

$$(6) \qquad \partial q / \partial x_i = (q / q_i)(\partial q_i / \partial x_i).$$

We assume that the population risk of death from cause x_i—simply $1 - q_i$, if the population is normalized to unity—is proportional to the number of individuals engaging in risky behavior. This assumption essentially means, for example, that differences in cigarette consumption among smokers of different populations are unimportant relative to differences in the percent of such populations who are smokers. Although x_i is the consumption of the risky behavior i by the representative consumer, in our empirical implementation of the model it refers henceforth to the number of individuals engaging in the risky behavior. Given this assumption of proportionality

$$(7) \qquad l - q_i = \alpha x_i,$$

where α is a constant.

Solving equation (7) for the probability q_i of not dying from cause x_i and differentiating with respect to x_i gives

$$(8) \qquad \partial q_i / \partial x_i = -\alpha.$$

We can substitute this value from equation (8) into equation (6) to give

$$(9) \qquad \partial q / \partial x_i = -\alpha q / q_i.$$

Solving equation (7) for α and using this expression to eliminate the constant α from equation (9) gives

$$(10) \qquad \partial q / \partial x_i = (-q / q_i)[(1 - q_i) / x_i].$$

Returning to the overall summation of risky behaviors, one can substitute equation (10) into (4) and simplify to give

$$(11) \qquad (\partial q / \partial x_i)(\partial x_i / \partial A) = (-q / q_i)[(1 - q_i) / A]\varepsilon_i,$$

where ε_i is the income elasticity of demand for risky behavior x_i.

If we designate good x_1 as the health-enhancing good medical care, with the other x_i's harming health, the empirical formulation of the cutoff value on the right side of inequality (3) is

$$(12) \qquad \text{Cutoff Value} = [1 / (\partial q / \partial x_i)(\partial x_i / \partial A)] + (q / A) \sum_{i=2}^{n} B_i,$$

where

$$(13) \qquad B_i = -[(1 - q_i) / q_i]\varepsilon.$$

III. EMPIRICAL VALUES FOR IMPLEMENTING THE MODEL

Our implementation of equation (12) will focus on population averages. For the safety-enhancing health expenditures x_1, we will use the estimates in Viscusi [1994]. Using the midpoint estimate of the value of life from Viscusi [1993] of $5 million, which is the inverse of $\partial q / \partial x_i$, and the marginal propensity to spend on health value of 0.1, we have the value for safety-enhancing goods of

$$(14) \qquad (\partial q / \partial x_i)(\partial x_i / \partial A) = 0.1 / \$5 \text{ million} = 2 \times 10^{-8}.$$

The major assumption embodied in this for-

5. This formulation is used only for risky behaviors, as health care x_1 may alter the background survival probability. We use the approach discussed above for Viscusi [1994] to estimate life-enhancing activities.

TABLE I
Known Actual Causes of Death in the United States

Causes of Death	Percent of Total Deaths	Death Rate (%)	Number of Total Deaths
Tobacco	19	14–22	400,000
Diet/Activity Patterns	14	14–27	300,000
Alcohol	5	3–10	100,000
Microbial Agents	4	NA	90,000
Toxic Agents	3	3–6	60,000
Firearms	2	NA	35,000
Sexual Behavior	1	NA	30,000
Motor Vehicles (unrelated to alcohol or drugs)	1	NA	25,000
Illicit Use of Drugs	1	NA	20,000
Total	50	NA	1,060,000

Source: McGinnis and Foege [1993].

mulation is that the purpose of health expenditures is to reduce mortality, not reduce morbidity or provide peace of mind.

In our assessment of the most consequential risky behaviors, we draw on the results from McGinnis and Foege [1993], who review the health literature and attribute deaths in the United States to "actual" causes. The actual causes and the associated percentages of total deaths appear in Table I. Smoking, overdrinking, and diet and inactivity are three causes that they estimate are responsible for 38% of deaths. We focus here on these three causes, although McGinnis and Foege attribute another 12% of total deaths to other causes that are at least in part behavioral. They ascribe the remaining half of all deaths to a variety of genetic factors and unknown external causes.

The leading product categories—firearms and motor vehicles—play a comparatively minor role, accounting for a total of 3% of deaths. Moreover, the calculation of the pertinent income elasticities would be problematic. Richer people spend more on cars, but what we need to know for our calculations is how income affects automobile travel and the attendant net increase in risks relative to the other activities or transportation modes the person would have chosen. Given the difficulties in calculating such values, we focus on the most salient components in Table I, leaving these other areas for future refinement.

The first critical set of parameters for determining the risky behaviors component of equation (12) is an estimate of the income elasticities of the risk-taking activities. To estimate comparable values of these elasticities for a standardized data set, we utilize data from the 1990 and 1991 National Health Interview Surveys. Although these data are quite detailed, they do not permit us to analyze the potential role of addictive behavior and the effect of addiction on the income elasticity of demand.

Risky behaviors vary with income for a variety of reasons. A long life is a normal good. Higher wages increase the forgone income associated with death. Fitness and adherence to a nonsmoking regime may be social goods for the affluent, though exercise takes time, for which the value increases with income. Why income effects matter is not of consequence for these estimates, and factors other than a concern with mortality can motivate expenditures.

Table II presents the variable definitions and their means and standard deviations. The key dependent variables from the 1990 National Health Interview Survey pertain to drinking, exercise, and smoking. Each of these variables is a dichotomous variable. The drinking variable pertains to excessive drink-

TABLE II
Variable Definitions: Data from 1990 National Health Interview Survey

Variable	Definition	Mean	Standard Deviation
Dependent Variables:			
Excessive Drinking	D.V. = 1 if person drinks 5 or more drinks per drinking episode; 0 otherwise	0.0596	0.2367
Regular Exercise	D.V. = 1 if person exercises regularly; 0 otherwise	0.4127	0.4923
Smoking	D.V. = 1 if person smokes; 0 otherwise	0.2583	0.4377
Independent Variables:			
Female	D.V. = 1 if female	0.5781	0.4939
Age	Age in years	44.4455	17.9549
Nonwhite	D.V. = 1 if non-white; 0 otherwise	0.1608	0.3674
Married	D.V. = 1 if currently married; 0 otherwise	0.5380	0.4985
Education:	Maximum Schooling		
9–11	D.V. = 1 if = 9–11 years	0.1150	0.3190
12	D.V. = 1 if = 12 years	0.3723	0.4834
Some college	D.V. = 1 if = some college	0.2100	0.4073
College graduate	D.V. = 1 if = college graduate	0.1178	0.3223
Post college	D.V. = 1 if = post college	0.0915	0.2883
Family Income	Thousands of Dollars	33.0293	25.2471
Housekeeping	D.V. = 1 if housekeeping is main activity; 0 otherwise	0.2020	0.4015
In School	D.V. = 1 if school is main activity; 0 otherwise	0.0548	0.2277
Demographic Variables:			
City	D.V. = 1 if person lives in central city; 0 otherwise	0.3367	0.4726
Non-SMSA	D.V. = 1 if person lives outside of SMSA; 0 otherwise	0.2251	0.4176
Northeast	D.V. = 1 if person lives in the Northeast; 0 otherwise	0.1999	0.3999
Midwest	D.V. = 1 if person lives in Midwest; 0 otherwise	0.2607	0.4390
South	D.V. = 1 if person lives in the South; 0 otherwise	0.3231	0.4677
Information Variables:			
Esophagus Risk	D.V. = 1 if person things cigarettes are a major cause of esophagus cancer; 0 otherwise	0.8673	0.3393
Bronchitis Risk	D.V. = 1 if person things cigarettes are a major cause of chronic bronchitis; 0 otherwise	0.8967	0.3044
Lung Risk	D.V. = 1 if person things cigarettes are a major cause of lung cancer; 0 otherwise	0.9595	0.1972
Heart Risk	D.V. = 1 if person thinks cigarettes are a major cause of heart disease; 0 otherwise	0.9203	0.2708
Weight Loss	D.V. = 1 if person thinks best way to lose weight is through exercise; 0 otherwise	0.1673	0.3732
Overweight Risk	D.V. = 1 if being overweight probably or definitely affects one's chances of getting heart disease; 0 otherwise	0.9414	0.2349
Cirrhosis	D.V. = 1 if alcohol consumption probably or definitely affects one's chances of getting cirrhosis of the liver; 0 otherwise	0.9532	0.2113
Mouth Cancer	D.V. = 1 if alcohol consumption probably or definitely affects one's chances of getting mouth cancer; 0 otherwise	0.3992	0.4897
Blood Pressure	D.V. = 1 if alcohol probably of definitely affects one's chances of having high blood pressure; 0 otherwise	0.7663	0.4232

Note: D.V. denotes Dummy Variable.

ing, in particular whether the person drinks five or more drinks per drinking episode. The exercise variable is whether the person exercises regularly, and the smoking variable is whether the respondent smokes. Use of this categorical measure biases downward our estimates of the effect of income on risky behavior, since declines in weight within the categories of more than 30% overweight and less than 30% overweight are both neglected from our analysis.

The explanatory variables include the usual demographic variables as well as a series of information variables. The income measure in the surveys is family income. All subsequent calculations use a comparable income measure. Family income is less likely to be endogenous in a model of health status determinants than would a measure of individual income, thus creating problems of potential bias.[6] These information variables, which appear at the bottom of the variables list for each of the respective survey years reported in Table II, enable us to obtain estimates of the income elasticities that control for differences in respondent information, such as a belief that cigarette smoking causes lung cancer.[7] Thus, the purpose of these estimates is to isolate the independent effect of income on risky behaviors as opposed to the role of health risk information that may be correlated with one's income status. A principal innovation of our study relative to those in the literature is the inclusion of measures of the respondent's knowledge of health risks in assessing the effect of income.[8] Estimates from these regressions are consequently better suited for our purposes than other estimates of income elasticities of demand for smoking or overdrinking, for example, that do not include informational controls.[9] Dummy variables for geographic regions control regional differences, and are significant, but are not reported.

Table III reports the three logit regressions pertaining to the demand for risky behaviors. Higher levels of income have a negative effect on excessive drinking, a positive effect on regular exercise, and a negative effect on cigarette smoking. These effects all reflect a positive effect of income on good health habits.

The pertinent income elasticity estimates for each of the three risky behaviors appear at the bottom of Table III. In terms of the absolute magnitude, the elasticities range from a low of 0.14 for regular exercise to a high value of –0.22 for both excessive drinking and cigarette smoking. The cigarette smoking elasticities for the probability of cigarette smoking obtained using these estimates are comparable to the estimated cigarette smoking elasticities found in the large literature on smoking behavior.[10]

Implementation of equation (12) requires a careful interpretation of the one-period model that underlies it. For the most important causes of death, risky behaviors undertaken today affect survival probabilities only in the relatively distant future. Thus, we believe that it is most meaningful to interpret the period as a relatively long interval. We apply the model to a 35-year-old person, who on average would expect to live to 78 years of age.[11] Thus, the period is from age 35 to age 78, that is, the interval that the median 35 year old would survive. The survival probability q is thus set equal to 0.5. The average income level is the 1990 sample income level of $33,029 (in 1990 dollars, or $38,500 in 1995 dollars) for the family, which we have divided by 1.86 to determine the personal income

6. Efforts to estimate a simultaneous model of income status and health habits were not successful because of the absence of suitable instruments.

7. Information of various kinds, such as schooling, may have an important effect on health-related decisions. See Kenkel [1991].

8. In estimating price elasticities, Kenkel [1993] reports some income effects that are negative and significant. The most recent detailed assessment of drinking behavior is that of Kenkel [1996].

9. The extensive literature on smoking income elasticities is surveyed in Viscusi [1992b]. A recent study of cigarette demand is that of Wasserman, Manning, Newhouse, and Winkler [1991].

10. For a survey of the income elasticity estimates, see Viscusi [1992b].

11. See the *Statistical Abstract of the U.S. 1993* (p. 86). Note that age 35 is also close to the average age of the workers on which the estimates of willingness to pay for mortality risk reduction is based. See Viscusi [1992a, 1993] and Thaler and Rosen [1976].

12. We estimate 1.86 to be the average number of adults per household as follows: based on the 1993 *Statistical Abstract of the United States*, there were 943,112 households in 1991. There were 252,177 people, of whom 76,415 were younger than age 21. Thus, the average number of adults per household is 175,762/94,312 = 1.86. In adjusting household income for family size we divide it by 1.86 before calculating the income mortality effect.

level.[12] Income levels assume 43 years of income, which is the life expectancy of a 35 year old.

The assumptions for q_i and ε_i and the resulting B_i are outlined in Table IV. To ensure consistency, the values $1 - q_i$ are all from McGinnis and Foege [1993]. They represent their best estimates of the percentage of total annual deaths attributable to these causes. The use of these estimates in this context is tantamount to an assumption that the deaths attributable to these causes occur between the ages of 35 and 79.

Table IV gives estimates of $(q/A)\sum_{i=2}^{n} B_i$ of 4.7×10^{-8}. Combining these estimates into equation (12) indicates that the implied value of the income loss associated with one additional premature mortality is about $14.3 million.

These analyses do not adjust for differences in the prematurity of death. As some of these deaths occur much earlier than others, some such adjustment may be appropriate. To undertake such an adjustment, we calculate the life-years lost per premature death from each of these risky behaviors relative to the life-years lost per premature death from all causes.[13] Using these measures of prematurity of death, we adjust the survival probabilities so that they reflect differences in prematurity of death. Adjustments for prematurity of deaths attributable to diet and inactivity, and overdrinking are conducted similarly. The net effect of these adjustments is relatively small. After making these adjustments, the implied income loss associated with one additional fatality is $15.3 million.

IV. CONCLUSION

Direct estimates of the income-mortality relationship indicate that a loss of income of typically $12 million or less will lead to the loss of a statistical life.[14] Because of the statistical controversies pertaining to estimation of this relationship, many economists have questioned whether these estimates are reliable. Moreover, since some of the direct estimates of the income-mortality linkage suggest that the decrease in income that will generate the loss of a statistical life is below many estimates of the implicit value that people are willing to pay to save a life, these findings appear to be mutually inconsistent.

In an attempt to recognize the interrelationship of these key parameters regarding lifesaving activity, Viscusi [1994] developed a methodology in which the implicit value of life is coupled with the income elasticity of demand for medical care. That approach suggested a best point estimate of the income loss that will generate the loss of a statistical life as $50 million.

The approach taken in this article is similar in its underlying approach, except that it is more comprehensive, as it also encompasses the role of risky behaviors that result from the most consequential risk-taking actions in our lives. Estimates based on risky behaviors suggest that an income drop of $15 million will lead to the loss of a statistical life. Similarly, an increase in income of this amount will save an additional statistical life. These numbers incorporate in their theoretical structure existing estimates of the value of life. Our estimates also embodied a variety of assumptions and approximations, but it is noteworthy that the point estimate value we generate is similar to some of the values obtained with direct estimates of the income-mortality relationship.

This finding has fundamental consequences for regulatory policies, which continue to be guided by restrictive legislative mandates rather than benefit-cost criteria. In the absence of striking reasonable tradeoffs between the costs for risk reduction and the benefits, society has embarked on risk-regulation efforts that often have a price tag of $100 million or more per statistical life (see Morall [1986]). These efforts may appear to be overzealous or, at the very least, appear to be relatively wasteful expenditures in the promotion of a good cause. The findings in this paper indicate that the problem is more than one of profligacy. By diverting resources that could have been used for more worthwhile expenditures, many of which are related to individual health, these wasteful government programs may have a deleterious effect on health status.

13. These calculations are discussed in an appendix available from the authors.

14. See, among others, Keeney [1990], Lutter and Morrall [1994], and Viscusi [1994] for discussion of this evidence.

TABLE III
Logit Estimates of Health-Related Behaviors
(Logit Coefficients and Asymptotic Standard Errors)

	Dependent Variables		
Independent Variables	**Excessive Drinking (Drinks)**	**Regular Exercise (Exercise)**	**Smokes Cigarettes (Smoking)**
Female	−1.4214	−0.2622	−0.2959
(Female = 1)	(0.0564)*	(0.0251)*	(0.0283)*
Age	0.002	−0.0508	0.1207
	(0.0100)	(0.0041)*	(0.0052)*
Age squared	−0.0005	0.0004	−0.0015
	(0.0001)*	(0.0000)*	(0.0001)*
Nonwhite	−0.6943	−0.1852	−0.2374
(Nonwhite = 1)	(0.0796)*	(0.0338)*	(0.0372)*
Married	−0.3879	−0.2373	−0.3546
(Yes = 1)	(0.0526)*	(0.0260)*	(0.0290)*
Family income	−0.0074	0.0074	−0.0089
	(0.0012)*	(0.0006)*	(0.0007)*
Education:			
9–11	0.0312	0.2006	0.4317
(Some High School)	(0.1145)	(0.0572)*	(0.0568)*
12	−0.158	0.4826	0.0172
(High School Graduate)	(0.1042)	(0.0499)*	(0.0513)
College	−0.3548	0.8211	−0.2688
(Some college)	(0.1117)*	(0.0533)*	(0.0566)*
Graduate	−0.8341	1.0503	−0.8857
(College graduate)	(0.1299)*	0.0585)*	(0.0676)*
Postgraduate	−1.198	1.2287	−1.0286
(Graduate school)	(0.1551)*	(0.0617)*	(0.0751)*
Housekeeping	−0.2333	0.128	−0.0173
(Yes = 1)	(0.0968)*	(0.0329)*	(0.0375)
In school	−0.0826	0.3325	−0.6626
(Yes = 1)	(0.0925)	(0.0548)*	(0.0695)*
Northeast	0.264	−0.4103	0.0997
	(0.0769)*	(0.0356)*	(0.0414)*
Midwest	0.4622	−0.1523	0.2434
	(0.0691)*	(0.0331)*	(0.0381)*
South	0.1285	−0.1681	0.1677
	(0.0700)*	(0.0318)*	(0.0368)*
City	−0.0096	0.0049	−0.0064
	(0.0565)	(0.0272)	(0.0308)
Non-SMSA	−0.0483	−0.024	−0.1051
	(0.0626)	(0.0307)	(0.0345)*
Heart Risk	0.0244	0.0718	−0.1837
(Yes = 1)	(0.1041)	(0.0506)	(0.0521)*
Esophagus risk	0.0815	0.1711	−0.2997
	(0.0820)	(0.0414)*	(0.0432)*
Bronchitis risk	−0.1277	0.1115	−0.2365
	(0.0895)	(0.0478)*	(0.0497)*
Lung risk	0.3725	0.2801	−0.2507
	(0.1786)*	(0.0860)*	(0.0818)*

TABLE III continued
Logit Estimates of Health-Related Behaviors
(Logit Coefficients and Asymptotic Standard Errors)

Independent Variables	Dependent Variables: Excessive Drinking (Drinks)	Regular Exercise (Exercise)	Smokes Cigarettes (Smoking)
Weight loss (Exercise best = 1)	0.0627 (0.0587)	0.3531 (0.0302)*	0.0077 (0.0345)
Overweight risk (Causes heart disease = 0)	−0.1061 (0.1070)	0.238 (0.0578)*	0.0104 (0.0592)
Cirrhosis (Caused by Alcohol = 1)	0.2095 (0.1410)	0.247 (0.0711)*	0.6477 (0.0765)*
Mouth cancer (Caused by Alcohol = 1)	−0.3537 (0.0527)*	0.0026 (0.0242)	−0.3441 (0.0281)*
Blood pressure (Caused by Alcohol = 1)	0.1288 (0.0595)*	0.1741 (0.0286)*	0.1522 (0.0323)*
Income Elasticity	−0.2294	0.1437	−0.2171
N	34969	34969	34969
NHIS Data Used	1990	1990	1990

*Statistically significant at the 5% level using a one-tailed test.

TABLE IV
Summary of Several Key Parameter Values

Risky Behavior	Annual Percentage of Deaths $1-q_i$	Income Elasticity $\lvert\varepsilon_i\rvert$	Risky Behavior Elasticity Term— Equation (13) B_i
Smoking	.19	.22	.0516
Overdrinking	.05	.23	.0121
Diet and Inactivity	.14	.12	.0195
			$\sum_{i=2}^{n} B_i = .083$
			$(1/A)\sum_{i=2}^{n} B_i = 4.7 \times 10^{-8}$

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