A RAND NOTE

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The Taxes of Sin

Do Smokers and Drinkers Pay Their Way?

Willard G. Manning, PhD; Emmett B. Keeler, PhD; Joseph P. Newhouse, PhD; Elizabeth M. Sloss, PhD; Jeffrey Wasserman, PhD

We estimate the lifetime, discounted costs that smokers and drinkers impose on others through collectively financed health insurance, pensions, disability insurance, group life insurance, fires, motor-vehicle accidents, and the criminal justice system. Although nonsmokers subsidize smokers' medical care and group life insurance, smokers subsidize nonsmokers' pensions and nursing home payments. On balance, smokers probably pay their way at the current level of excise taxes on cigarettes; but one may, nonetheless, wish to raise those taxes to reduce the number of adolescent smokers. In contrast, drinkers do not pay their way: current excise taxes on alcohol cover only about half the costs imposed on others.

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POOR health habits, such as smoking and heavy drinking, carry costs not only for smokers and heavy drinkers, but for everyone else as well. Concern about these costs has prompted not only health-promotion efforts, but also proposals to increase both federal and state excise taxes on cigarettes and alcohol. For such taxes to be at an economically efficient level, they must at least cover the costs to others that arise from smoking and heavy drinking. We term the costs to others *external* costs, in contrast to those borne by the smoker or heavy drinker, which we term *internal* costs.

Some external costs are obvious, for example, the damage caused by drunk driving and passive smoking; others are more subtle, for example, the higher medical costs of smokers that are financed by health insurance premiums and payroll taxes. Such premiums and payroll taxes are the same for smokers and nonsmokers (unlike individual life insurance premiums). As a result, nonsmokers may subsidize smoking.

Our purpose in this article is to quantify external costs. Earlier estimates of the costs of smoking and drinking[1,2] (Office of Technology Assessment, unpublished data, 1985) are not suitable for analysis of taxes because they do not always distinguish between internal and external costs, nor do they calculate the lifetime costs of poor health habits.

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METHODS

External Costs and Their Estimation

We illustrate our conceptual framework in terms of smoking, but the same principles apply to our analyses of drinking.

Table 1 illustrates the division between the internal and external costs of smoking. In the case of alcohol abuse, we also consider the costs of motor-vehicle accidents and criminal justice.

One goal of an economically efficient tax on smoking or tobacco is to have the smoker bear the costs that he imposes on others when deciding whether or how much to smoke. Costs imposed on other family members, however, are difficult to classify as internal or external because it is not clear whether those costs would, in any event, be taken into account by the smoker. If they would be, then they are internal costs. Although our base-case estimates classify such costs as internal, we show the effect of treating certain costs borne by other family members as external.

A simple example that considers only medical costs may clarify the division between internal and external cost. Suppose a worker has a group health insurance policy that pays 75% of his medical bills, and suppose that smoking a pack of cigarettes per day raises medical bills by $6000. The amount the worker pays, $1500 ($0.25 \times 6000 = 1500$), is a component of internal costs. Because the smoker does not pay higher premiums that reflect his or her higher costs, the remainder of the cost, $4500, is a component of external costs.

To estimate external costs, we should not contrast the medical and other expenses of smokers to nonsmokers, because nonsmokers differ from smokers in other ways that affect the various components of cost such as medical expenses. For example, according to the 1983 National Health Interview Survey (NHIS), those who never smoke are 1.5 times more likely than current smokers to have more than a high school education. Rather, we contrast smokers to a hypothetical group of "nonsmoking smokers," people who are like smokers in age, sex, education, drinking habits, and several other ways described herein, except that they have never smoked.[3] To test how sensitive our estimates are to differences between smoking and not smoking, however, we also contrast medical and other costs of smokers to those of actual nonsmokers.

Our methods estimate lifetime costs by tracking expenditures for two hypothetical cohorts of men and women from age 20 years to death. One cohort smokes; the other does not. We develop life tables for each cohort showing the probability of surviving to each age from age 20 years. These tables come from applying estimates of the relative risk of smoking to the 1980 life tables of the US population.[4] Relative risk was estimated by applying the 1984 Centers for Disease Control health risk appraisal program[5] to the ever smokers in our sample twice—once with their actual smoking status and once with their smoking status changed to "never smoked."

In judging any policy that has long-term effects, it is important to discount future costs, thereby making costs that occur at different times commensurate. A dollar received today is worth more than a dollar received 15 years from now (even without inflation). A current dollar can be invested and earn interest so that at the end of 15 years it will be worth more than $2 (at 5%). Because the proper rate of discount is controversial, we have computed results for rates that span the range between 0% and 10%.

The expected net external costs per pack are the sum of the immediate costs

per pack and the cumulating lifetime costs per pack. We assume that the costs of fires, motor-vehicle accidents, and criminal justice are immediate; ie, each cigarette or ounce of ethanol has a certain probability of causing such costs in the immediate period after purchase, but once the cigarette is smoked or the alcohol consumed, the probability drops quickly to zero. For such costs, we divide estimated national annual costs by the annual packs (or excess ounces). The cumulative net lifetime external costs are given by the following:

$$\sum_{t=20}^{95} \delta^{t-20} \times P(A|H)_t \times C(H)_t$$

$$-\sum_{t=20}^{95} \delta^{t-20} \times P(A|NH)_t \times C(NH)_t$$

where δ indicates the annual discount factor $(1/[1+r])$ if r is the discount rate; $P(A|H)$, the probability of surviving from age 20 years to at least age t years, conditional on smoking; $C(H)$, the annual costs minus taxes and premiums for smokers of age t; $P(A|NH)$, the probability of surviving from age 20 years to at least age t years, conditional on not smoking; and $C(NH)$, the annual costs minus taxes and premiums for smokers of age t years if they had never smoked.

The external costs come from collectively financed programs, including health insurance, pensions, sick leave, disability insurance, and group life insurance. These programs are financed by taxes and premiums that do not differentiate between smokers and nonsmokers. Because smokers have shorter life expectancies, they will pay less of the taxes and premiums that finance these programs. To simplify the calculation of how much smokers and nonsmokers pay annually to finance these programs, we assume that each pays the same proportion of earnings, where the proportion is just enough to finance these programs.[6] The discounted, expected lifetime costs per pack are calculated by dividing the lifetime costs by the expected number of packs smoked in a lifetime.

In estimating the external costs of smoking and drinking, we relied on self-reported consumption. Because people underreport their consumption, we have corrected for the difference between actual and reported use. The reported number of packs per day was multiplied by 1.5, and reported alcohol consumption was multiplied by 2.5.[7,8] Our figures for pension income have been corrected for a 21% rate of underreporting.[9]

Our estimates are based on data from a number of sources. The primary source for those under age 60 years is The RAND Corporation's Health Insurance Experiment (HIE), because of its detailed information regarding habits and the medical reasons for the utilization of medical care.[10,11] Because persons aged 62 years or older at the time of enrollment were excluded from the HIE sample of 5809 persons, we used data regarding persons greater than age 59 years from a 1983 supplement to the NHIS. It included information regarding health habits, health care use, and work loss in a sample of 22 418 persons. In addition, we compared the 1983 NHIS results for nonelderly persons with those from the HIE. We have inflated all cost data to 1986 dollars using the consumer price index.

We estimated differences in spending for medical care services between those with and without each habit. Such differences, of course, may or may not be caused by the habit. We addressed this ambiguity in two ways. First, we controlled for the confounding characteristics described in the next section. Second, although our base-case estimates include all medical services except maternity services and well care, we examined their sensitivity to considering only costs that arise from diagnoses thought to be directly related to smoking and excessive drinking, such as cancer of the lung and cirrhosis of the liver.

In addition to medical expense, we estimated the difference in days lost from work between persons with and without each habit, controlling for the confounding variables described herein. The collectively financed cost of days lost from work was computed by multiplying the daily wage by 0.38, the employers' average share of the cost of work loss through covered sick leave.[12]

When estimating the cost of drinking, we controlled for smoking status, and conversely. Had we not done so, we would have attributed some of the costs of smoking to drinking if smokers tend to drink heavily. We classified persons as former cigarette smokers, current cigarette smokers, current pipe or cigar smokers, and never smokers based on their responses to a smoking history questionnaire filled out at the time of enrollment in the study. We classified persons as abstainers, former drinkers, and current drinkers based on responses to the same questionnaire. We collapsed information regarding the current drinkers' consumption of beer,

Table 1.—Costs of Smoking

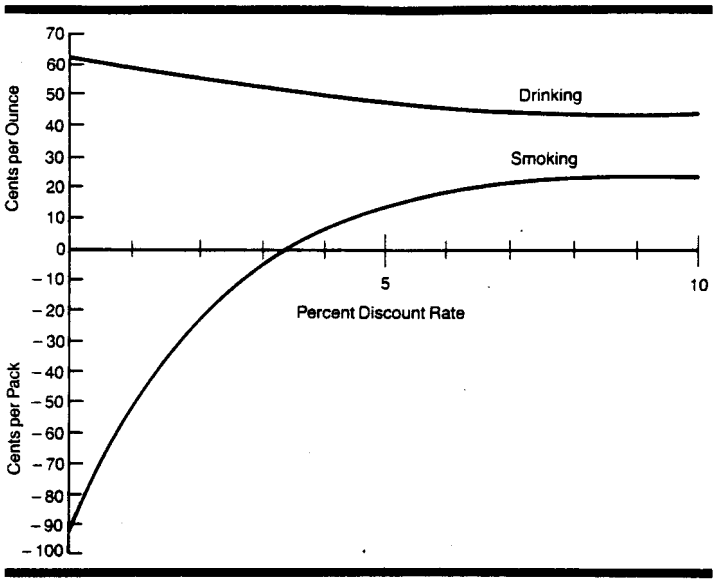
Type	Internal	External
Premature death	Smoker and family*	Coworkers and others*
Pain and suffering	Smoker and family*	Coworkers and others*
Medical costs	Copayments	Insurance reimbursements
Sick leave	Uncovered sick loss†	Covered sick loss†
Disability	Foregone income not replaced by disability insurance	Disability insurance
Group life insurance	Negligible	Death benefit
Pension	Defined-contribution plans	Social Security and defined-benefit plans
Wages	Foregone disposable income	Taxes on earnings
Other costs	Property loss due to fires paid by person	Insured property loss due to fires
Tobacco products	Cigarette purchases	. . .‡

*Premature mortality and suffering among family members and coworkers is caused by passive smoking. We classify costs borne by other family members as internal costs.
†By *covered*, we mean subject to some kind of insurance or income-replacement plan.
‡Excise taxes on cigarettes could be considered negative external costs. If they are so defined, the object of our exercise would be to determine if external costs were zero, rather than equal to the current excise tax.

Table 2.—External Costs per Pack of Cigarettes*

External Costs	Discount Rate 0%	5%	10%
Costs per pack, $			
Medical care†	0.38	0.26	0.18
Sick leave	0.01	0.01	0.01
Group life insurance	0.11	0.05	0.02
Nursing home	−0.26	−0.03	0.00
Retirement pension‡	−1.82	−0.24	−0.02
Fires	0.02	0.02	0.02
Taxes on earnings to finance above programs, $	−0.65	−0.09	−0.02
Total net costs per pack, $§	−0.91	0.15	0.24
Life expectancy at age 20 y per pack, min	−137	−28	−6

*The number of packs of cigarettes are corrected for underreporting. Costs (in 1986 dollars) per pack are calculated by dividing by the discounted number of packs smoked.
†Includes all but maternity, well, and dental care.
‡Includes disability insurance.
§The sum of costs minus taxes on earnings, eg, costs at 5% equals $0.15 = 0.26 + 0.01 + 0.05 - 0.03 - 0.24 + 0.02 - (-0.09)$.



External costs of poor health habits at alternative discount rates.

Table 3.—Sensitivity of External Costs (in 1986 Dollars) per Pack to Assumptions at 5% Discount Rate

External Costs	Base Case*	All Data From National Health Interview Survey	Comparison With Never Smoker	Lower Bound†	Total Costs‡
Costs per pack, $					
Medical care	0.26	0.26	0.30	0.15	0.36
Sick leave	0.01	0.05	0.04	0.01	0.03
Group life insurance	0.05	0.05	0.06	0.05	0.05
Nursing home	−0.03	−0.03	−0.02	−0.03	−0.03
Retirement pension§	−0.24	−0.24	−0.20	−0.38	−0.24
Fires	0.02	0.02	0.02	0.02	0.02
Taxes on earnings per pack, $	−0.09	−0.09	−0.09‖	−0.05	−0.93¶
Total net costs per pack, $#	0.15	0.20	0.28‖	−0.15	?**

*Effect of changing current and former smokers to never smokers, with other characteristics held constant.
†Narrow definition of medical effects, with no effects of smoking on early retirement.
‡Includes internal costs.
§Includes disability insurance.
‖Value shown is nonsmoking smokers' differential; never smokers actually pay $0.51 cents more earnings tax than smokers per pack because of higher earning rates, but it is implausible that their higher earning rates are causally related to smoking, and we have assumed they are not.
¶Earnings, not taxes on earnings.
#Sum of costs minus taxes on earnings.
**Loss of life and pain and suffering by smoker and family not included; see text.

wine, and spirits into a single variable—monthly consumption of ethanol in ounces. Within the category of current drinkers, *heavy drinkers* include those who report an average of two or more drinks daily (five or more actual drinks daily, with allowance for underreporting). Because light drinking may not be harmful, we calculate the cost per ounce in excess of two reported drinks per day.[13-16] Thus, the drinking analogue of nonsmoking smokers are "controlled" heavy drinkers; ie, we estimate the effect of hypothetically reducing the consumption of those with more than two reported drinks per day to two reported drinks per day.

Our base-case analysis also controlled for health insurance coverage, age, sex, race, education, the use of seat belts, family income, exercise, self-assessed measures of physical, mental, and general health, and family size. We included education and seat belt use to measure attitudes that may differ between those with varying health habits—attitudes that may affect work loss and use of medical services independently of smoking and drinking.

Pensions and Other Costs

In addition to the costs of medical care and work loss, we calculated the other components of cost shown in Table 1. Data regarding pension and disability payments by age, sex, and education status come from the *Current Population Survey*. That survey is also the source of earnings data, which we use to calculate taxes to finance the programs. Our estimate of annual property loss from fires that are associated with cigarette smoking is $340 million (in 1986 dollars).[2] Because of fire insurance, we have assumed these costs are entirely external, but our estimates are not sensitive to this assumption.

Our estimates of certain annual external costs of alcohol abuse are as follows: property damage from motor-vehicle accidents, $3.6 billion, and from fires, $507 million; criminal justice, $3.1 billion; and social programs, $54 million.[16]

It is extremely difficult, and to some distasteful, to place a dollar value on the innocent lives lost due to fires, passive smoking, or drunk driving. Nevertheless, it is often necessary, implicitly or explicitly, to place a value on lives lost when judging the merits of alternative policies, for example, policies leading to air pollution control or increased automobile safety. For this analysis, we include an explicit value for the lost lives to avoid the systematic undercounting of the costs to society that would occur if we included only the differences in use of medical care, sick leave, etc.

To define a value for innocent lives lost because of fires, passive smoking, and drunk driving, we used a method based on the willingness to pay for a small change in the probability of surviving.[17] This yields a value of $1.66 million per life (around $10 per hour, using years of life expectancy discounted at 5%), considerably more than the value of lost earnings. We believe earnings are an inappropriate measure of the value of life, in part, because they attribute a relatively low value to those who are out of the labor force.[18]

RESULTS

Smoking

External Costs per Pack of Cigarettes.—If costs are not discounted, each pack of cigarettes increases medical costs by $0.38, but saves $1.82 in public and private pensions due to a 137-minute reduction in life expectancy. Overall, there is a net savings of $0.91 per pack in undiscounted costs (Table 2).

Results change markedly if costs are discounted at 5%, largely because pension costs change from −$1.82 (at 0%) to −$0.24 (at 5%) per pack. Pensions are received late in life, so discounting dramatically decreases the differential between smokers and nonsmoking smokers. Using a 5% discount rate, the

total external costs per pack are $0.15, and they rise to $0.24 per pack at a 10% discount rate. The main reason these results are so much lower than, for example, the estimate from the Office of Technology Assessment of $2.17 per pack (unpublished data, 1985) is our exclusion of changes in lifetime earnings from smoking, which are internal costs.

Sensitivity of Costs to Assumptions.—Clearly, the magnitude of any subsidy from nonsmokers to smokers is sensitive to the discount rate, especially below 5% (Figure). Table 3 shows the effect of varying other assumptions. For comparison, the first column repeats the results from Table 2 for a 5% discount rate. To test how sensitive the results are to the data source selected, we used NHIS data for young as well as old persons (Table 3, column 2). Medical costs per pack do not change, but covered sick leave costs rise to $0.05 per pack, and the total net costs rise from $0.15 to $0.20 per pack.

To test how sensitive the results are to different assumptions about how smoking affects health, we contrast smokers with actual never smokers, rather than nonsmoking smokers (Table 3, column 3). The results are relatively insensitive to this modification also; external costs rise to $0.28 per pack. This figure probably overstates the true costs because it treats all the differences between smokers and never smokers, except wages, as causally related to smoking, whereas smokers may have different patterns of medical use and retirement for reasons unrelated to smoking. As another test, we restricted medical costs to those arising from diagnoses thought to be related to poor health habits; medical costs fell $0.11 (Table 3, column 4). The estimates described herein assumed that a cohort of nonsmoking smokers would retire in a manner similar to people who never smoked. However, we also computed effects on taxes and pensions, assuming that the pattern of retirement among nonsmoking smokers would be the same as among smokers; ie, quitting would not affect age of retirement (Table 3, column 4). Combining these assumptions leads to a lower boundary of −$0.15 (at a 5% discount rate) on costs per pack.

Finally, the last column in Table 3 gives total costs; that is, it includes the portion of costs that are financed by the person. It does not, however, include the costs of premature mortality and suffering, which is why a question mark appears in the lower right corner of the table.

Other Costs of Smoking.—Our estimates of the costs of smoking in Table 2 do not include the adverse effects of passive smoking on those outside the smoker's family. Passive smoking causes an estimated 2400 lung cancer deaths per year, and it has also been linked to reduced lung function among children of smokers, a higher incidence of respiratory problems for children and others, as well as the displeasure of consuming unwanted cigarette smoke.[19] Most of these costs are within the family and are internal or external costs depending on the extent to which the smoker considers the welfare of others in his family when he smokes. The figures in Table 2 assume that such costs are internal. If, however, we treat the costs of the 2400 deaths as entirely external and use an estimate of willingness to pay for lower mortality of $1.66 million per life,[17] external costs per pack would rise $0.14.

Because deaths in smoking-related fires are also almost entirely within the family, we have treated the costs as internal and did not include them in our estimates. However, if we were to treat the costs of such deaths as external, some 1600 people in 1984 (J. Hall, oral communication, Aug 13, 1987), we would increase the external costs of cigarettes by $0.09 per pack of cigarettes.

The smoker loses 28 discounted minutes of life expectancy (at a 5% discount rate) for each pack smoked (Table 2), which accounts for $0.93 of discounted wages (many of the lost minutes occur when not working). Using our estimated willingness to pay for lower mortality of $10 per hour, the 28 minutes is worth approximately $5. Although we consider the $5 an internal cost, it may nonetheless be relevant to an economically efficient tax, a point we will come to later.

Table 4.—External Costs of Heavy Drinkers per Excess Ounce*

External Costs	Discount Rate 0%	5%	10%
Medical and pension costs per excess ounce, $			
Medical care†	0.26	0.10	0.05
Sick leave	0.06	0.05	0.04
Group life insurance	0.02	0.02	0.02
Nursing home	−0.01	‡	‡
Retirement pension§	−0.04	0.03	0.02
Taxes on earnings, $	−0.35	−0.06	−0.02
Net medical and pension costs per excess ounce, $	0.63	0.26	0.15
Motor-vehicle accidents and criminal justice costs per excess ounce, $			
Lives of nondrinkers	0.58	0.58	0.58
All other costs‖	0.35	0.35	0.35
Total net costs per excess ounce, $¶	1.56	1.19	1.08
Life expectancy at age 20 y per excess ounce, min	−20	−8	−4

*Costs (in 1986 dollars) per excess ounce are calculated by dividing by the discounted number of excess ounces.
†Excludes maternity, well, and dental care, and medical care costs to others caused by drunk driving.
‡Indicates figure is less than 0.005.
§Includes disability insurance.
‖The $0.35-cent figure includes certain internal costs, such as the property damage in motor-vehicle accidents paid by the alcoholic driver in deductibles or other copayments and higher premiums but excludes the external costs associated with the effects of alcoholism on spouses and children (eg, their use of insured mental health services) and those associated with the increased risk of alcoholism for these dependents.
¶Sum of costs minus taxes on earnings.

Heavy Drinking

External Medical and Pension Costs per Excess Ounce of Alcohol.—Using undiscounted values, each excess ounce of alcohol, ie, those consumed in excess of two reported drinks per day, has external medical and pension costs of $0.63 and causes a loss of 20 minutes of life expectancy (Table 4, column 1). At a 5% discount rate, external medical and pension costs per excess ounce fall to $0.26. In contrast to smoking, heavy drinking increases all categories of costs (at a 5% discount rate), even pensions, because the large effects of early retirement, which triggers pension and disability payments, outweigh the shorter life of drinkers. At a 10% rate of discount, medical and pension costs fall to $0.15 per excess ounce.

Before discussing the other costs of drinking shown in Table 4, we describe the sensitivity of our estimates of medical and pension costs to different assumptions (Table 5). For convenience, the first column of Table 5 repeats the results from Table 4 for a 5% discount rate. Medical and pension costs are not sensitive to the source of data (Table 5, column 2), nor do they change much if we compare heavy drinkers with actual abstainers and light drinkers rather than hypothetical controlled drinkers (cutting back to two reported drinks per day among those consuming more than that amount) (Table 5, column 3), nor do they change when drinking is not treated as a cause of disability retirement (Table 5, column 4).

Restricting medical costs to those arising from diagnoses thought to be related to poor health habits makes virtually no difference to our estimates (Table 5, column 4), implying that the

Table 5.—Sensitivity of Medical and Pension Costs (in 1986 Dollars) per Excess Ounce of Ethanol to Assumptions, 5% Discount Rate

Costs	Base Case*	All Data From National Health Interview Survey	Abstainers and Light Drinkers	Lower Bound†	Total Costs‡
Medical and pension costs, $					
Medical care per excess ounce§	0.10	0.11	0.07	0.11	0.16
Sick leave	0.05	‖	0.10	0.05	0.13
Group life insurance	0.02	0.01	0.04	0.02	0.02
Nursing home	‖	‖	−0.01	‖	‖
Retirement pension¶	0.03	0.05	−0.15	−0.05	0.03
Taxes on earnings, $	−0.06	−0.06	−0.14#	−0.03	−0.64**
Net medical and pension costs per excess ounce, $††	0.26	0.23	0.20	0.15	?
Life expectancy at age 20 y per excess ounce, min	−8	−7	−19	−8	−8

*Effect of changing heavy drinker to controlled drinker, with other characteristics held constant.
†Narrow definition of medical effects, with no effect on early retirement.
‡Includes internal costs.
§Excludes maternity, well, and dental care.
‖Indicates figure is less than 0.005.
¶Includes disability insurance.
#We have used the earnings of abstainers and light drinkers to compute taxes. These earnings are considerably higher than for drinkers, even after controlling for education. To the extent that these earnings differences are not caused by drinking, we should use drinkers' earnings; in that case, the −0.14 figure would be −0.03.
**Earnings, not taxes on earnings.
††Sum of costs minus taxes on earnings.

medical costs shown in the first column are largely due to differences in medical use that are related to habits. In contrast, the external costs of smoking are sensitive to the definition of relevant medical costs, suggesting that the broader definition of smoking effects may overstate medical costs and total external costs.

Other External Costs.—Although our estimates include the additional probability that a drinker will be killed in a traffic accident, they do not account for the deaths of innocent bystanders and nondrinking passengers in such accidents. The Department of Transportation estimates that about 7400 of the 22 400 people who died in alcohol-related traffic accidents in 1985 were not drinking.[1] Based on a willingness to pay for a human life of $1.66 million and the estimated volume of drinking from the 1983 NHIS, the value of the 7400 lost lives is $0.58 per excess ounce of ethanol (Table 4, bottom). This figure is low because it does not include medical, disability, and suffering costs of surviving nondrinking victims of alcohol-related accidents. On the other hand, the figure is high to the extent that not all drinking-related accidents are caused by alcohol.

In addition, there are annually $7.2 billion of other costs described previously herein, principally costs of the criminal justice system and property damage in alcohol-related motor-vehicle accidents. These costs add another $0.35 per excess ounce.

Sensitivity of Results

Although $0.15 per pack of cigarettes and $1.19 per excess ounce of alcohol are our best estimates of the external economic costs of smoking and heavy drinking, the values are sensitive to four factors: discount rate, value assigned to lives lost in drunk driving–related accidents, amount of underreporting, and treatment of persons who die of causes related to passive smoking and fires.

Discount Rate.—The sensitivity to the discount rate is more pronounced with smoking, where the estimated external costs would be almost $0.20 lower per pack if we used a 3% rather than a 5% discount. The sensitivity of drinking costs to discounting is much less. For smoking, consumption starts early, but deaths come much later than in the case of drinking. The shorter the time between consumption and death, the less sensitive the estimates are to discounting.

Dollar Value of Life.—Because the assumed value of life is on the low end of estimated values, our estimates of drinking costs are conservative.

Underreporting.—Assuming that the reported level of consumption were closer to the actual level of consumption would raise our estimates of the external cost, because we would inflate the level of reported packs and ounces by a smaller factor when computing costs per pack and ounce. For example, had we assumed respondents reported 60% of their actual alcohol consumption, we would only have multiplied reported ounces by 1.67 (100/60) rather than 2.5 (100/40) to estimate actual ounces, and the estimated cost per excess ounce would be 50% (2.5/1.67 = 1.5) higher. In the case of alcohol, our cost estimate is conservative because the 40% figure we used is at the low end of the estimates found in the literature.[8]

Within-Family Costs.—We ignored costs of $0.23 per pack associated with deaths caused by passive smoking and fires because we assumed they were in the family and taken into account by the smoker. Defining these costs as external would more than double our estimated external cost of smoking.

Our estimates are relatively insensitive to other assumptions. Because the external costs of drinking are dominated by costs associated with drunk driving, such costs are relatively insensitive to discounting (Figure). The choice of data used to estimate effects (HIE vs NHIS) has little effect on the results.

Our estimates of the external costs of alcohol were made per excess ounce, but excise taxes apply per ounce, not per excess ounce. Forty percent of total consumption represents ounces in excess of two reported drinks per day (five actual drinks per day, given our estimate of underreporting). To convert our figures per excess ounce to figures per ounce, one should multiply them by 0.4, reducing the estimated cost of $1.19 per excess ounce to $0.48 per ounce.

Our estimate of the external cost of smoking, $0.15 per pack, is well below the current average (state plus federal) excise and sales taxes of $0.37 per pack ($0.32 of the $0.37 are excise taxes).[20] However, the $0.37 tax rate approximately equals the estimated external cost of $0.38 if we were to treat all lives lost to passive smoking and fires as external costs. By contrast, our estimate of the external cost of alcohol, $0.48 per ounce, is well above the current average (state plus federal) excise and sales taxes of $0.23 per ounce.[21] (The average excise tax is taken across distilled spirits, wine, and beer, where the excise taxes are $0.25, $0.03, and $0.09 per ounce of ethanol, respectively.) Thus, smokers probably pay enough taxes to cover the net costs they impose on others, but heavy drinkers do not.

We noted in the introduction that economically efficient excise taxes should at least cover external costs. By this criterion, taxes on alcohol are too low; whether cigarette taxes are high enough depends on one's appraisal of three other arguments for taxation of cigarettes and alcohol. (Each of these arguments would further strengthen the case for increasing alcohol taxes.)

The first argument takes cognizance of the regret expressed by most smokers and their attempts to quit. Smoking tends to start in adolescence or early adulthood, at a time when individuals are not well informed and may not appreciate the consequences of their actions.[22] Cigarettes (and alcohol) are addictive, so it is more difficult to quit than to avoid starting the habit. Because over 85% of smokers begin smoking before age 20 years[22] and some evidence

suggests that the proportion of those under 20 years of age who smoke is sensitive to taxes,[23,24] higher taxes may decrease the number of individuals who become addicted.

Some may see this argument as paternalistic, but it is not, if judged by the tastes of the individual attempting to quit; those tastes arguably determine the economically efficient tax. If the loss in life expectancy of 28 minutes per pack is relevant to economic efficiency because of later regret, an economically efficient tax would be on the order of $5 per pack, the estimated value of the 28 minutes.

A second and related reason to tax cigarettes is that many adults do not appreciate the risks. Despite the warning labels on cigarettes, 20% to 25% of adult smokers say they do not know the risks of smoking.[22] A higher tax would deter initiation of smoking, thus compensating for any undervalued risk.

A third reason to tax addictive commodities is that such taxes are likely to lead to a relatively small change in behavior among those already addicted. Suppose, for example, there were no external costs, no ignorance, and no regret associated with smoking. From the point of view of raising revenue, it may still be wise to tax cigarettes because it is preferable to tax items for which behavior does not change; there is less induced inefficiency.[25] This argument could also justify higher cigarette taxes than at present.

Despite the uncertainties surrounding our estimates, in the case of alcohol, the difference between the actual tax and external costs is so large that, in our view, a strong case can be made for an increase in federal alcohol taxes. The tax increase should occur at the federal level, not the state level, to prevent bootlegging across state lines. The case is especially strong for raising taxes on beer and wine, which, as noted previously herein, are much lower (per ounce of ethanol) than taxes on distilled spirits. Strategies such as banning advertising or promoting negative advertising may be complementary.[22]

To the degree that external costs of alcohol abuse stem from people who drink in bars and restaurants and then drive home while intoxicated, there is a case for an additional tax on alcohol sold by the drink. We have not tried to ascertain what proportion of external costs stem from alcohol consumed in bars and restaurants relative to that consumed in homes.

Ideally, society would tax drunk drivers to force them to pay the external costs of drunk driving rather than tax alcohol. To some extent, society does so with fines, suspension of driving licenses, jail sentences, and civil liability. However, the present legal system does not make, nor could it reasonably make, drunk drivers bear fully the external costs of their actions, especially in those cases where there is a loss of innocent lives.[26] For example, liability insurance partially shields drunk drivers.

We close by considering two arguments against higher excise taxes. First, tobacco and alcohol taxes constitute a larger proportion of the income of the poor than of the well-to-do.[27,29] However, alcohol and tobacco taxes each supply only 1% of federal revenues. As a result, rather small changes in the individual income tax structure could readily compensate for the effect of increased excise taxes on the distribution of income, if that were deemed desirable. Drinkers and smokers would still pay more, but low-income individuals, as a group, need not pay more.

Second, light drinkers may argue that they impose few or no external costs, but would unfairly pay a higher tax burden. There are two responses. First, suppose that a given amount of revenue to finance government expenditure must be raised from various taxes, including excise taxes on alcohol. As a group, persons whose consumption of alcohol is below the population average of 1.7 reported drinks (over four actual drinks) per day will benefit from shifting more of the tax burden to alcohol taxes and away from other taxes (eg, payroll taxes). In fact, of adults who drink, three fourths drink less than this amount. Second, to the degree that higher taxes deter alcohol abuse, the resulting decrease in external costs will offset increases in the tax burden of light drinkers.

Because excise taxes must be proportional to consumption and because the external costs of smoking and drinking are not proportional to consumption, there will not be, in practice, a tax that does not leave someone subsidizing someone else. The task of determining how such subsidies will flow falls to our political institutions. We hope our estimates contribute to more informed decisions.

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