

SMOKING AND OTHER RISKY BEHAVIORS

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To better understand the causes of smoking behavior, this paper examines the differences in risk-taking behavior by smokers in other domains. Smokers are less likely to perform preventive health activities such as seatbelt use, flossing, and checking their blood pressure. They choose riskier jobs, are more likely to be injured on their jobs controlling for objective measures of risk, are more likely to have an accident at home, and are more likely to have an accident overall. These choices do not stem from any greater economic payoff to smokers taking risks. Indeed, smokers are willing to work at hazardous jobs for less pay per unit risk than nonsmokers. On average, smokers place a monetary value on the risk of job injury that is roughly half that of nonsmokers. The greater risk taking of smokers reflects a broad pattern of behavior and is not restricted to smoking decisions.

Introduction

Smoking is perhaps the riskiest activity that people undertake voluntarily on a large scale. The smoking rate for adults age 18 and over was 25% in 1993.¹ The risks faced by these smokers is substantial, as the estimated overall lifetime mortality risk to a smoker ranges from one-sixth to one-third.² In contrast, workers on the job face an annual fatality risk on the order of 5 per 100,000, and even workers in risky jobs such as construction only face a risk of 15 per 100,000.³ Annual death risks from motor-vehicle accidents are on the order of 1 per 6,000.⁴

It is puzzling why such a large proportion of the U.S. population continues to engage in this very risky activity. Does this segment of the population simply value the pleasure derived from smoking more highly, or is there some other systematic difference in their risk-taking activity that leads them to smoke? Although smoking rates among adults have declined substantially since the landmark 1964 government report on smoking and lung cancer, the smoking rate among teens has recently increased. This trend leads to a concern that the smoking rate for adults will likewise increase if the current cohort of teens

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continue to smoke at the same rate. Knowing why people smoke would be an important instrument in smoking intervention policies.

The demographic factors correlated with smoking are well known. Smoking is most prevalent among lower educated individuals. Adult men have historically been more likely than women to smoke, although that disparity is eroding. Blacks have historically been more likely than whites to smoke, although that gap too is eroding as younger blacks have smoking rates below younger whites.

What is less understood is whether smoking is a behavioral choice independent of other risk-taking activities, whether smoking leads to other risky behaviors, or whether there is some exogenous characteristic that makes one more likely to smoke, as well as likely to take on other risky activities. Understanding the extent of the smoking-related differences in other risky behaviors is instructive in that it can help us to better understand the character of the choices that lead to smoking behavior.

Risk taking behavior takes various forms, such as incurring financial risks or endangering one's life. From an economic standpoint, financial risks and health risks are different in character. Although health hazards may, of course, have financial implications, they also have a distinctive aspect in that they often affect one's ability to enjoy life and to derive pleasure from monetary expenditures. The focus of this paper will be on patterns of health risk-taking behavior of smokers.

To shed some light on the rationality of the smoking decision, we focus primarily on smoking as it relates to employment risks of smokers and nonsmokers. In particular, we explore the link between smoking, job risks, and compensating differentials for job risks. This approach allows us to examine the monetary consequences of smokers' behavior. Are smokers more willing to take job risks? If so, to what extent can these differences be traced to demographic factors as opposed to smoking status *per se*? Do these patterns suggest consistency in risk-taking behavior, and, if so, can we draw any inferences as to whether these choices are sound? For example, are people simply being consistent in their mistakes or is their behavior evidence of some underlying rational choice process?

Section II of the paper outlines the potential theoretical rationale for smokers exhibiting different proclivities to other risky behaviors. Although the role of all such factors may not ultimately be resolved, it is nonetheless important to understand the various causative economic influences that may be at work. Section III describes the data set discussed throughout the remainder of the paper, and provides a profile of smokers' risky behaviors, including job risks as well as other health-related activities. Section IV examines smokers' choices with respect to hazardous jobs and other health-related activities. Section V summarizes information on wage-risk tradeoffs and the implicit values of injuries, which are affected by smoking status. Section VI concludes the paper.

Theoretical Basis for the Relationship of Smoking to Other Risky Behaviors

If asked to explain why someone smokes, an economist will almost invariably propose a model that specifies the costs and benefits of smoking. Specifying such a model enables researchers to isolate the various components

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that enter into the decision process, and potentially identify those factors that are most amenable to intervention. We begin by setting up a simple model of why people might smoke. Although we use smoking for concreteness in the following example, a similar model could be used to examine any other single risky behavior. After describing this simple framework, we discuss how various risky behaviors may be correlated with each other.

A Simple Model of Risk-Taking

Consider a two period framework. In period 1 the person chooses whether or not to smoke, incurring a potential risk of death from smoking in period 2. Because of the limited time horizon, we abstract temporarily from the dynamics associated with “addictive” behavior, which we will discuss below. We also abstract from health consequences other than death.

Utility is a measure of the “satisfaction” that an individual derives from smoking or not smoking. Let the utility of smoking be $U(\text{Smoke})$ and the utility of not smoking be $U(\text{Don't Smoke})$. Smoking raises the likelihood of premature death, with corresponding utility which we'll set to zero with no loss of generality. Let p be the person's assessed risk of smoking, and β be the discount factor, or $1/(1+r)$, where r is the rate of time preference. The rate of time preference is the interest rate individuals use in comparing the value to them of current versus future utility. Individuals who value immediate gratification highly will have a high rate of time preference and a low discount factor. If a person acts as if tomorrow will never come, the value of β will be zero.

A person will choose to smoke if the discounted expected utility of smoking exceeds that of not smoking for two periods, or

$$U(\text{Smoke}) + \beta [(1-p) U(\text{Smoke}) + p \cdot 0] > U(\text{Don't Smoke}) (1+\beta) \quad (1)$$

Equation 1 reduces to the condition that smoking is desirable provided that

$$\frac{U(\text{Smoke})}{U(\text{Don't Smoke})} > \frac{1+\beta}{1+\beta(1-p)} \quad (2)$$

If the risk of death p were 1, then smoking for one period would need to be just as enjoyable as living without cigarettes for two periods. If p were 0 then people would smoke as long as the utility of smoking exceeded the utility of not smoking, because we have abstracted away other health consequences in this simple model.

Three distinct mechanisms can contribute to smoking behavior. First, it could stem from tastes, which would be reflected in the form of the individual's utility function. A high value of the utility of smoking relative to the adverse outcome of death will foster smoking behavior. Such a difference does not necessarily represent biases in perceptions or differences in rates of time preference. However, if people do not fully understand how bad the ill health outcome will be, or if they form their preferences based on erroneous information, they may give too little weight to the ill health state, which will make them more likely to smoke.

Second, the decision to smoke could stem from differences in their relative weights for present and future utility, i.e., their rates of time preference r and its corresponding discount rate β . People who do not value the future highly and have a low value of β will be more likely to smoke. Some differences in discount rates across people are quite rational and reflect legitimate differences in tastes and ability to borrow money in financial markets. It may also be the case that people think irrationally about the future. Temporal myopia is a term that indicates systematic neglect of the future. The possibility of temporal myopia is of particular concern regarding teen smokers.

Third, smokers may underestimate the risk p . If smokers believe the risk of an adverse health effect is less than it actually is, their incentive to smoke will be too great. Evidence regarding risk perceptions, however, suggests that people are more likely to overestimate the risk of smoking. One of the most well established results in the irrationality literature is that people tend to overestimate the level of highly publicized risks.⁵ The risk magnitude influences perceptual biases as well, as people tend to overestimate small mortality risks. Whether smoking is a small risk depends on whether the smoker is thinking of the lifetime risk or the risk per cigarette when making the smoking decision. Evidence in Viscusi (1992) indicates that both smokers and nonsmokers overestimate the lifetime mortality risk of smoking.

The Possibility of Addiction

Complications such as addiction require a more elaborate multi-period analysis. Quitting smoking is clearly hard, involving transactions costs the U.S. Surgeon General formerly labeled "habituation" and now designates as "addiction" because of the adverse physical effects of smoking cessation. Models of rational addiction hypothesize that people initiate smoking with knowledge that they will develop a smoking habit. Welfare losses only arise due to unanticipated changes in the smoking decision problem, such as learning that smoking is riskier than one thought initially, that quitting smoking is harder than originally anticipated, or that the value of staying healthy is greater than was anticipated. These concerns have become potentially salient in the policy debate over curbing youth smoking.

The Correlation of Smoking and Other Risky Behaviors

Based on the framework above, a correlation between smoking and other risky behaviors may arise if individuals use a similar decision model for other behaviors. The preference-related parallels are most direct. People who highly value being healthy when they make the decision regarding smoking may place a similarly high value on the healthy state when deciding, for instance, whether to wear a seatbelt or whether to take a risky job. Similarly, in terms of rates of time preference, a greater weight on present rewards will make one more willing to engage in various risks with longer-term health consequences.

Thus, finding a positive correlation between risky behaviors suggests that people have tastes and rates of time preferences that are correlated over risky activities. Observing a positive correlation does not, however, rule out the

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- possibility that choices are flawed by a failure to weight the future adequately or recognize the importance of maintaining one's health.

- The role of the third factor—risk perceptions p —is less clear-cut. The magnitude of the risk varies widely among activities considered risky, and the risk an individual faces in any given activity is not necessarily exogenous to the individual's own behavior. For instance, skiing is considered risky, but is much less dangerous for individuals who do not ski in treed areas.

As noted earlier, people systematically overestimate the magnitude of small mortality risks. Risk of death from failing to wear a seatbelt or from a job injury are quite small, so we would expect people to overestimate such risks relatively more than they overestimate the mortality risk of smoking. This factor would weaken the correlation between smoking and other risky activities. Second, risks have other attributes as well. In the case of seatbelt use, the risk issue for the individual is the risk reduction that will occur because of precautionary behavior rather than a fixed risk level associated with an activity. Evidence suggests that people will tend to undervalue the improvements associated with precautions even though they regard motor vehicles as being very risky—or what Viscusi (1998) terms the “precautionary behavior paradox.” Because of these and other differences across risk categories, such as the degree of publicity received, it is likely that perceptual biases vary across risks.

In multi-period models there is an additional rationale for a positive correlation of risky activities. The typical tradeoff is between the benefits derived from the pursuit of some risky activity and future welfare. However, future welfare is governed by one's expected utility in each period. If other mortality risks are also high, the future expected utility lost from being killed by, for example, smoking will be less. For instance, if you live in an area with a high murder rate, you may expect that your probability of surviving long enough to die from smoking to be lower than if you live in a murder-free community. Other risks consequently reduce the expected additional consequences associated with smoking, leading to a positive correlation among risky activities. The well established precedent in the economics literature is that workers' implicit value of life and injury decreases as the level of the baseline risk rises because less is at stake once one's life is already at risk.⁶

A more controversial learning phenomenon that suggests a causal link between smoking with other risky behaviors is known as the “gateway effect.” Experimentation with cigarettes and alcohol may lead to trying marijuana and then to trying other drugs.⁷ The social efficiency of this gateway influence depends largely on what it entails. Are people rationally discovering the true risks of these activities, in which case economists would regard it as desirable? Or is it the case that experimentation simply reflects a willingness to undertake forbidden types of behavior and that people become bolder once they realize the legal sanctions are not great? Within such frameworks, undertaking risky behavior with a low cost (e.g., smoking marijuana) is more sensible than starting with the high cost activities (e.g., using heroin) if one wants to learn about the welfare consequences of these costs. A danger, of course, is that short-term learning may not capture long-term consequences. Moreover, after one learns that the activity imposes substantial personal costs, the difficulty of giving up

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addictive behavior may make abandoning the behavior less likely than if the risk consequences were known in advance.

Another source of positive correlation may be complementarities in consumption or peer group influences. It is widely believed, for example, that smoking enhances the pleasure of drinking alcohol, and alcohol similarly enhances the enjoyment from smoking. Such a relationship, if true, would give rise to a fairly conventional complementarity in consumption analogous to cake and ice cream. Similarly, coworkers in blue-collar jobs may find smoking more acceptable than do mostly nonsmoking coworkers in white-collar positions. More controversial peer group influences may arise for younger age groups, such as teenagers, who may view smoking as a means of social acceptance or demonstrating defiance of conventional norms.

Wage-Risk Tradeoffs

Endangering one's health typically is not desirable in and of itself. Nobody would claim that people smoke simply to endanger their lives. Presumably, there is some offsetting benefit associated with the enjoyment of smoking that makes bearing the risk worthwhile.⁸ However, it is clearly difficult to measure commodity attributes such as "enjoyment." It is particularly difficult to establish comparable measures across individuals. The price people are willing to pay for a product captures this influence but also other concerns, such as the desire to avoid associated health risks.

To assign a common quantifiable measure to risk-taking behavior, economists have used evidence from the labor market to infer the additional pay workers require to take on additional job risks. This wage-risk tradeoff value then provides a measure of the value placed on risky behavior. By analyzing the wage-risk tradeoff it is possible to isolate the relative attitudes the person has with respect to risk and money, where this relative valuation serves as the measure of the valuation of risks to one's health.

The underlying theory for this analysis dates back over two centuries to Adam Smith, who observed that workers would demand a compensating differential for jobs that were risky or otherwise unpleasant. These wage-risk tradeoffs are occasionally incorporated explicitly in collective bargaining agreements, but this practice is not the norm. More typically, economists statistically estimate equations regarding the determinants of worker wages, holding constant other aspects of the worker and that person's job.

Here we will consider how the wage-risk tradeoff varies with smoking status. The supporting statistical studies ascertain an annual wage premium in return for some risk level associated with their job. Rather than attempt to summarize the implications of such an analysis with two statistics—the risk level and the associated compensation—it is more convenient to focus on the implied rate of tradeoff between the two. More specifically, in the case of job injuries the matter of interest is the implicit value of a statistical injury, or simply the value of a job injury. This amount can be viewed as the ratio of the job risk compensation to the size of the risk, or the compensation per unit risk.

What this measure actually means is widely misunderstood, particularly by non-economists who equate the economic value of job injuries with some

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accounting concept, such as lost earnings. Suppose a worker receives \$800 per year to incur a risk of job injury of 1 in 20. There are two ways to conceptualize the value of an injury. First, consider 20 such workers on identical risky jobs. On average one of them will be injured per year, and they will receive in additional compensation \$16,000 per year. The value of a statistical injury is consequently \$16,000, which is the total amount of compensation needed to make a large group of workers bear a small injury risk that will produce one expected injury to their group. The second perspective on this measure is that it is the value of the injury per unit risk, or \$800 divided by the risk 1/20, or \$16,000.

If \$16,000 were the injury value for a worker group, it would only imply that this is the rate per injury at which compensation must be paid to make them willing to bear small risks. To induce workers to face the certain risk of injury, more compensation than \$16,000 would be required. The U.S. Federal government currently uses these implicit values of injury and life (for risks of mortality) to value improvements in safety.

In the example above, we assume all workers require the same compensation per unit risk. However, the actual compensation any individual worker requires could vary with respect to the same three factors that determine risk-taking behavior discussed in Section II—tastes, discount rates, and risk perceptions. In general, these factors are not directly observable. However, observing that someone smokes allows us to make inferences about their risk attitudes. In particular, smokers reveal that they are more willing to incur risks of ill health. As a consequence, we would expect smokers to be in riskier jobs, and we would expect smokers to require less compensation than nonsmokers to bear any specific level of job risk. We examine these possibilities below.

Smokers' Risk-Taking Profile

Our primary goal is to examine the relation between job risk, wages, and smoking. However, it is worthwhile to examine other risk-taking behavior and the correlation of other risky behavior with smoking.

To examine the link between smoking, job risks, and other personal risks, we use data from the 1987 National Medical Expenditure Survey (NMES). The NMES is a nationally representative survey of about 14,000 households, providing data on about 30,000 individuals. These data provide detailed information on demographic and labor market characteristics. In addition, this survey is a rich source of data on medical conditions and health status. Of particular interest for our purposes is the information on smoking status and accidents requiring medical treatment or time off from work. Although many large scale surveys contain some of these variables, the NMES uniquely contains all of this information. For instance, information on smoking and on-the-job injuries is available in various years of the National Health Interview Survey (NHIS), but the labor market information included in the NHIS is too limited to allow reliable estimation of wage equations.

Although smoking is by far the most risky personal activity that most people might select, smoking hazards are not immediate so that the risk outcome is not immediately apparent. Many other sources of substantial personal risk lead to acute accidents or raise the likelihood of suffering nearer-term adverse health

consequences. Although these risk behaviors are usually not as large as smoking risks, they nevertheless provide observable measures of significant risk-taking behavior. We examine both preventive risk activities and the outcome of risk-taking behavior as indicated by injuries.

The indicators of preventive behavior that we examine here are seatbelt use, whether the individual checks their blood pressure regularly, and whether the individual flossed their teeth the preceding day. Seatbelt use lowers the probability of dying in a car accident. Checking blood pressure allows for early intervention into the prevention of heart disease, and teeth flossing protects the health of teeth and gums. Each of these activities take very little time but may be considered too inconvenient by individuals who are less concerned with their health. Another indicator of risk perceptions available on the data set is the response to whether the individual considers themselves to be more than an average risk taker. The responses range from 1 to 5, where 1 indicates the respondent disagrees strongly with the statement, and 5 indicates strong agreement.

To measure the level of risk of the worker's job, we use information from the U.S. Bureau of Labor Statistics (BLS) that provides information on risk levels by industry. We match to each worker the industry risk level corresponding to the worker's three-digit industry. We examine three BLS measures of industry job risk. The first measure is the incidence rate of lost workday cases (work loss rate), which consists of injuries or illnesses severe enough to lead to the loss of at least one day of work. The second measure is the incidence rate for cases that result in restricted activity without days away from work (restricted rate). Although these injuries are less severe than those resulting in days away from work, they are not minor. Injuries are recorded only if the injuries and illnesses prevented the worker from performing their regular job. The OSHA guidelines explicitly exclude injuries requiring only first aid treatment even if administered by a doctor or nurse. The total injuries and illnesses incidence rate is the sum of the work loss rate and the restricted rate. The third measure is the total number of days away from work or with restricted activity per 100 workers, which we refer to as lost workdays.

In addition, we examine the outcome of own risk-taking behavior as indicated by the number of accidents the individual had in the preceding year that resulted in a period of disability or required medical treatment. Thus the accidents will not merely be routine events requiring only first aid treatment, and are comparable to the types of accidents reported in the BLS data. We consider four measures of own injuries. We examine two indicators of injuries at work: whether the worker had any accident at work, and whether the worker had a work accident that led to a lost work day. The third risk measure indicates whether the worker had an accident of any kind that led to work loss. The final measure is whether the worker had an accident at home.

We restrict the sample to workers aged 18 to 65 who report hourly wages between \$2 and \$100. We also require information on three-digit industry code to match the BLS risk measures to individuals. Because the BLS does not report injury rates for private household workers or for agricultural workers on farms with fewer than 11 employees, private household and agricultural workers are

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excluded from the sample. We also eliminate observations with missing values on the key variables in the analysis, such as smoking, job tenure, and work experience.

The resulting sample consists of 9,987 individuals. Of these, 29.8 % were current smokers. This smoking rate is just above the average for U.S. adults. The national rate for all adults age 18 and older was 28.8 percent in 1987 (U.S. Bureau of the Census 1997: 145). The slight difference in the smoking rate in this study and the overall smoking rate is attributable to our sample that is restricted to workers aged 18 to 65.

Table 1 summarizes the principal risk differences by smoking status. The smoking rate differs by gender, with 27.6% of the women smokers and 32.1% of the men. Men are more likely than women to be employed in the relatively more risky blue-collar jobs. The proportions of men and women in blue-collar jobs are 60% and 32% respectively. Because of differences in both the types of jobs and smoking behavior by gender, we stratify the sample by gender to avoid compounding job risks and smoking differences with gender differences.

Comparing the risk profile of smokers and nonsmokers indicates the sharp differences in their risk-taking behavior more generally. Consider first the risk behavior that stems strictly from personal choices. Nonsmokers are considerably more likely to wear seatbelts than are smokers, with 61% of the female nonsmokers and 55% of the male nonsmokers wearing seatbelts always or almost always. The corresponding rates for female and male smokers are 48% and 39%. Similarly, nonsmokers are significantly more likely than smokers to check their blood pressure regularly, and are significantly more likely to floss their teeth. Both male and female smokers are significantly more likely to self-report that they are more than an average risk taker.

This evidence on preventive behavior is instructive in indicating the consistency of smoker and nonsmoker risk behavior. Although the various precautionary activities take very little time, and there is no necessary relationship between these activities, we find that smokers are systematically less likely than nonsmokers to undertake these precautionary behaviors.

The industry risk levels likewise vary considerably by smoking status, with smokers uniformly working in higher risk industries. Among the men in the sample, the work loss rate is 4.87 for smokers and 4.20 for nonsmokers. The corresponding work loss rates for women are 3.44 for smokers and 3.10 for nonsmokers. These differences by smoking status are statistically significant at the 1% level. The other measures of job risk likewise indicate that smokers are in significantly riskier jobs. There are more cases of restricted work activity for smokers (5.5 per hundred for men and 4.03 for women) than for nonsmokers (4.84 and 3.63 for men and women, respectively). Per hundred workers, male smokers average 92.0 lost workdays and male nonsmokers average 77.9 lost workdays. The corresponding values for women are 60.2 and 54.2. All of these differences are statistically significant at the 1% level. As we show later, these differences in job risks persist even after taking into account the role of personal characteristics such as education, age, and race.

Although smokers on average select jobs in industries with high risks of injury and illness, this result alone does not imply that smokers are more likely

than nonsmokers to be injured within a job of given riskiness. In the next section we will control for the objective measures of industry risk and for individual characteristics, but first we'll look at the patterns of injuries both on and off the job. Smokers of both genders are significantly more likely than nonsmokers to be injured on the job, as well as to be injured on the job severely enough to lead to a work loss injury. Smokers are about 50% more likely than nonsmokers to experience these types of work injuries. This greater discrepancy highlights an additional difference that is also apparent in multivariate regression analyses, which is that smokers are riskier workers even after taking into account the kinds of jobs they have.

Table 1
Risk Behavior by Smoking Status

	Female (n=5,166)			Male (n=4,821)		
	Non-smokers	Smokers	t	Non-smokers	Smokers	t
<i>Preventive behavior and attitudes</i>						
Seatbelt (%)	60.93	47.84	8.48	54.71	39.07	1006
Check blood pressure (%)	82.25	78.94	2.71	70.11	65.31	3.29
Floss teeth (%)	32.04	26.09	4.11	22.70	13.67	7.24
More than average risk taker (1-5)	2.08	2.20	3.36	2.57	2.68	2.76
<i>Industry job risks</i>						
Work loss rate (%)	3.10	3.44	4.92	4.20	4.87	8.55
Restricted rate (%)	3.63	4.03	5.50	4.84	5.50	7.25
Lost workdays per 100 workers	54.21	60.24	4.41	77.90	91.98	8.22
<i>Own accidents</i>						
Accident at work (%)	2.43	3.57	2.34	4.49	6.52	2.99
Accident at work leading to work loss (%)	1.93	3.08	2.51	3.33	5.81	4.05
Any accident leading to work loss (%)	5.00	7.00	2.81	7.03	10.01	3.57
Accident at home (%)	2.73	3.43	1.34	1.50	2.71	2.90

Home accidents likewise indicate a systematically greater risk level for smokers. Of the sample of male smokers, 2.7% were injured at home severely enough to require medical treatment in the preceding year. This is almost double the corresponding rate of 1.50% for nonsmokers. Female smokers are also more

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likely to be injured at home than nonsmokers, but the difference (3.4% compared to 2.7%) is not significant.

The total work loss injury rate refers to accidents from any source that lead to lost workdays, and incorporates accidents at home, at work, motor-vehicle accidents, and all other hazards. This annual injury probability for smokers is quite high in absolute terms, with 10% of the men and 7% of the women experiencing work loss due to an accident of any kind. Moreover, it is significantly greater than the comparable value for nonsmokers. As in the case of the job risk differences, these discrepancies are reduced but not eliminated by controlling for demographic characteristics other than smoking status.

The pattern of taking greater risks of all kinds, not just smoking, suggests that this risky behavior is not an isolated aspect of personal decisions. Rather, it reflects a consistent attitude toward bearing risks to one's own health across many domains, not just smoking. Observing this consistent pattern does not, however, resolve the source of the difference in its rationality. Moreover, it does not even enable one to conclude that individual choices alone account for the discrepancy. Another possibility is that the choices available to smokers may differ as well. Smokers, for example, may be choosing from a riskier set of job opportunities. To make any inferences regarding the character of smoker decisions and smokers as risk takers requires a fuller examination of those choices than simply observing the greater risk level.

Risk Choices and Smoking

The descriptive statistics discussed in the last section reveal substantial differences in average risks chosen or faced by smokers and nonsmokers. However, these differences may be largely attributable to demographic characteristics, and not to smoking or even to risk attitudes more broadly defined. In particular, smoking is highly correlated with education. Less educated people may be more likely to smoke as well as less likely to floss their teeth, but there is no necessary link between smoking behavior and teeth flossing, or even between risk attitudes and teeth flossing. Instead, teeth flossing may simply be something more educated and wealthier people do routinely.

In this section we estimate equations of the probability of each of the risk factors discussed in Section III, controlling for smoking status and exogenous personal characteristics. For the equations estimating preventive risk choices, industry risk, and accidents at home, we control for age, age squared, race, education, marital status, whether the individual has physical limitations that restrict the type of work they can perform, Standard Metropolitan Statistical Area (SMSA), and eight census division indicators. For the own injury at work equations, we control for the industry work loss rate in addition to the variables listed above. We also include additional controls for tenure, tenure squared, and indicators for eight occupational categories. Including the BLS measure controls for the inherently greater risk in jobs held by smokers on average, rather than to risky behavior of smokers.

Table 2 presents the coefficients on the smoking indicator in each of the 11 equations estimated. The preventive health and own accident equations are estimated by probit, since the dependent variable for these equations are 0 or 1.

Table 2
Effects of Smoking on Risk Behaviors

Dependent variable	Coefficient on smoking (standard error)	
	Female	Male
Seatbelt ^{a,c}	-0.104** (0.016)	-0.111** (0.017)
Check blood pressure ^{a,c}	-0.021* (0.013)	-0.041** (0.015)
Floss teeth ^{a,c}	-0.048** (0.015)	-0.075** (0.012)
More than average risk taker ^{a,d}	0.113** (0.038)	0.147** (0.043)
Work loss rate ^{a,d}	0.216** (0.071)	0.304** (0.080)
Restricted rate ^{a,d}	0.256** (0.074)	0.273** (0.094)
Lost workdays per 100 workers ^{a,d}	3.595** (1.403)	6.422** (1.760)
Accident at work (x 100) ^{b,c}	0.747* (0.466)	0.540 (0.601)
Accident at work leading to work loss (x 100) ^{b,c}	0.721* (0.413)	1.054* (0.525)
Any accident leading to work loss (x 100) ^{b,c}	1.488* (0.738)	1.536* (0.809)
Accident at home (x 100) ^{a,c}	0.594 (0.524)	0.793* (0.413)

a. Independent variables in equation are smoking, age, age squared, race, education, marital status, physical limitations on type of work, Standard Metropolitan Statistical Area (SMSA), and eight census division indicators.

b. Independent variables in equation are smoking, age, age squared, race, education, marital status, physical limitations on type of work, SMSA, eight census division indicators, tenure, tenure squared, and indicators for eight occupational categories.

c. Estimated by probit.

d. Estimated by heteroskedasticity corrected ordinary least squares.

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The coefficient on smoking is interpreted as the difference in probability between smokers and nonsmokers, controlling for the other factors. The own risk taking behavior equation and the industry risk equations are estimated by heteroskedasticity corrected ordinary least squares (OLS).

As the table indicates, smokers of both genders uniformly are more likely to take risks or get injured than nonsmokers, controlling for individual characteristics. For instance, smokers of both genders are 10% to 11% percent less likely than nonsmokers to wear a seatbelt, controlling for differences in education, age, marital status, and so forth. As noted in table 1, the gap between the probability of wearing a seatbelt is 13 percentage points for women and 15.6 percentage points for men. Thus, smoking status accounts for about two-thirds of the seatbelt use probability difference between smokers and nonsmokers, while the remainder is due to differences in demographic characteristics. Similarly, smoking explains about half of the gaps in probabilities for each of the preventive behaviors and own accident rates.

In addition to smoking, education had a consistently significant effect on risk behavior, uniformly indicating an inverse relation between education and risk-taking behavior. Not surprisingly, workers in jobs with higher BLS industry risk are more likely to be injured on the job. However, what is noteworthy is that smoking had an effect on injuries in addition to the effect captured by smokers sorting into riskier industries. Other factors, such as marital status, also affect risk-taking behavior, but the effects vary with the risk considered. In general, only smoking and education systematically affected risk behavior.

Value of Injuries by Smoking Status

In this section we summarize the findings of two earlier studies that show how wage-risk tradeoffs are affected by smoking and seatbelt wearing status, and provide an additional set of results. Table 3 summarizes the implicit value of injuries for these studies. All estimates are normalized to 1997 dollars using the CPI-U.

The results in Panel A from Hersch and Viscusi (1990), which is the first paper to examine the influence of individual risk-taking behaviors on compensating differentials for job risks. In this paper, we used data we collected by survey in Oregon in 1987. This data set includes information for 193 workers on a wide range of labor market factors and on smoking status and seatbelt use. The unique feature of this study is that it did not use the BLS risk measure but instead used the worker's own risk assessment for the particular job at which the worker was employed. In doing this we employed a linear risk scale in which subjects rated the riskiness of the job. The scale included two BLS reference points other than zero risk—the average risk for U.S. manufacturing workers and the average risk for workers in logging camps.

For the sample overall the implicit value of a statistical injury is \$70,235, or workers must receive \$70,235 in compensation for an injury to their group. The source of this estimate is that the average worker risk level in the sample is 1 per 29.5, for which the worker receives annual compensation of \$2,381. The implicit value of an injury is the value per unit risk, or \$2,381 divided by 1 per 29.5, which is \$70,235.

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The effects of risk attitudes proxied by seatbelt use and smoking behavior have a substantial impact on the value of injuries. The most safety conscious group—nonsmokers who wear a seatbelt—have the highest implicit value of an injury of \$121,987. People who smoke and do not use seatbelts have the lowest valuation of injuries—\$39,419. The implicit value of an injury for those engaging in only one of the two risk behaviors is between the values for those who engage in both or in neither activity.

Table 3
Implicit Values of a Lost Work Day Injury^a

	Values
<i>Panel A: Hersch and Viscusi (1990)</i>	
Full sample	\$70,235
Non-smoker - seatbelt user	\$121,987
Non-smoker - non-seatbelt user	\$55,420
Smoker - seatbelt user	\$97,384
Smoker - non-seatbelt user	\$39,419
<i>Panel B: Hersch and Pickton (1995)</i>	
Full sample	\$34,470
Non-smoker - seatbelt user	\$45,355
Non-smoker - non-seatbelt user	\$33,109
Smoker - seatbelt user	\$34,924
Smoker - non-seatbelt user	\$22,678
<i>Panel C: Hersch and Viscusi (1998)</i>	
Full sample	\$21,464
Non-smoker - seatbelt user	\$29,970
Non-smoker - non-seatbelt user	\$20,666
Smoker - seatbelt user	\$22,625
Smoker - non-seatbelt user	\$13,320

a. Values are reported in 1997 dollars.

The advantage of using the worker's own risk assessment is that it should be a more accurate index of the risk of the worker's own job, and it controls for the role of worker perceptions. Suppose that one hypothesized that smokers underestimated risks. Then because their compensation levels will be driven by the market they should receive more compensation than nonsmokers for the risks as they perceive them, which is not in fact the case.

The results in Panel B of table 3 are from Hersch and Pickton (1995). This study used the 1987 NMES and focused on smoking status and seatbelt use as well.⁹ The measure of risk used was the BLS rate of lost workdays per 100 workers, which indicates severity as well as frequency of injuries within the industry.

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The findings in Hersch and Pickton (1995) verified the generality of the results in Hersch and Viscusi (1990) using a large national data set. Although the magnitudes of the implicit value of injuries are lower than those estimated in Hersch and Viscusi (1990), the patterns by smoking status and seatbelt use are consistent. In particular, non-smokers who wear a seatbelt have an implicit value of injury of \$45,355, while the value for smokers who do not wear a seatbelt is \$22,678.

Finally, Panel C reports new estimates using the NMES based on the BLS workloss incidence rate. The magnitude of the implicit values are lower than those using the lost workday rate as reported in Panel B, but once again the pattern of the effects are consistent with Hersch and Viscusi (1990). Non-smokers who wear a seatbelt have an annual implicit value of injury of \$29,970, while smokers who do not wear a seatbelt have a value less than half that, equal to \$13,320.

Conclusion

The evidence regarding risk-taking behavior of smokers and nonsmokers is strong and strikingly consistent. The greater risk taking of smokers reflects a broad pattern of behavior and is not restricted to smoking decisions. Nor is this risk taking solely attributable to demographic factors such as educational differences.

In terms of the level of risk, smokers are less likely to perform preventive health activities such as seatbelt use, flossing, and checking their blood pressure. They choose riskier jobs, are more likely to be injured on their jobs controlling for objective measures of risk, are more likely to have an accident at home, and are more likely to have an accident overall. These choices do not stem from any greater economic payoff to smokers taking risks. Indeed, smokers place a monetary value on the risk of injury that is roughly half that of nonsmokers.

What do these results imply about smoking behavior and its rationality? Economists often rely on consistency checks as an index of rationality. Do preferences exhibit certain well behaved properties? Smokers, through their greater proclivity to bear risks of all kinds, clearly meet that aspect of a rationality test. Moreover, a lower valuation of health risks will lead one to be more willing to incur smoking risks, wholly apart from factors such as enjoyment of cigarettes.

Could, however, we observe these results if smokers were not fully rational? Are these consistency tests conclusive? They clearly do not rule out systematic mistakes across a variety of risk-taking domains. The one source of systematic error that cannot account for the results is persistent underestimation of risks. The wage equation estimates in Hersch and Viscusi (1990) accounted for such factors using workers' own risk beliefs, thus ruling out one source of error. Similarly, evidence in Viscusi (1992) suggests that smokers are aware of the lung cancer and mortality risks of smoking.

One could hypothesize a variety of other sources of error as well—failure to value one's health knowledgeably, myopic behavior, and the neglect of costs of quitting smoking to name three prominent possibilities. Although further exploration of these sources of error is clearly of interest, such analyses should

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be broader than just focusing on smoking alone. Cigarette smoking poses a truly substantial risk, but it is only one of many hazards that smokers incur to a greater degree than the rest of the population. Smokers endanger their lives in a variety of ways. Differences in risk taking could, of course, be fully rational, but they could also stem from erroneous decisions.

Analyses of cigarette smoking have focused almost exclusively on smoking-related behavior in an effort to ascertain its causes. The evidence in this paper shows that it is also instructive to explore other domains of risk-taking behavior in our efforts to determine why people smoke, whether these choices are rational, and how such decisions could be flawed. Job risk taking in the labor market was our primary source of comparative risk data. Other health-related behaviors provided additional support for smokers' systematic neglect of their health.

Notes

¹ U.S. Bureau of the Census 1997, table 221: 145.

² These estimates are derived in Viscusi (1992) using death statistics from the U.S. Surgeon General and other sources.

³ U.S. Bureau of the Census 1997, table 686:439.

⁴ U.S. Bureau of the Census 1997, table 137:102.

⁵ See Fischhoff, et al. 1981.

⁶ See Viscusi and Evans (1990).

⁷ See U. S. Department of Health and Human Services 1994:30 – 34 for a discussion of the correlation for youth between smoking and other drug use, and Pacula (1998) for evidence on the gateway effect.

⁸ This consideration of tradeoffs does not necessarily imply that the choices are sound and that the risks are well understood.

⁹ For comparison purposes, we converted the implicit value of injuries reported in Hersch and Pickton (1995) to the annual compensation per one expected job injury. Hersch and Pickton report the annual value of injury compensation (i.e., the implicit value of a single injury multiplied by the injury rate).

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