CIGARETTE SMOKERS AS JOB RISK TAKERS

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Abstract—Using a large data set, the authors find that smokers select riskier jobs, but receive lower total wage compensation for risk than do nonsmokers. This finding is inconsistent with conventional models of compensating differentials. The authors develop a model in which worker risk preferences and job safety performance lead to smokers facing a flatter market offer curve than nonsmokers. The empirical results support the theoretical model. Smokers are injured more often controlling for their job's objective risk and are paid less for these risks of injury. Smokers and nonsmokers, in effect, are segmented labor market groups with different preferences and different market offer curves.

I. Introduction

THIS paper is motivated by our empirical observation that smokers face greater job risks than do nonsmokers but receive less hazard pay. This result is not consistent with existing models of compensating differentials. Workers may, of course, differ in their attitudes toward risk. Labor economists have long noted that workers who are more willing to bear risk will gravitate towards more hazardous jobs and their commensurately greater hazard pay. The empirical anomaly that we seek to explain is that smokers choosing very risky jobs actually receive less hazard pay than do nonsmokers in comparatively safer jobs. This outcome is seemingly irrational, because smokers presumably should also find jobs that pose lower risk but offer greater hazard pay more attractive than riskier, less remunerative jobs. Our explanation of this phenomenon will utilize a variant of the compensating differentials model in which worker risk preferences affect both the supply and demand sides of the market.

Studies of compensating differentials for job risk usually do not explicitly recognize individual heterogeneity in risk preferences in estimating average wage-risk tradeoffs. In practice, however, there are likely to be substantial differences in worker attitudes toward risk. These differences in preferences may affect both the risks that workers select as well as their associated wage-risk tradeoff. Moreover, in situations in which workers' safety behavior is an important contributor to the riskiness of the job, the nature of the labor market opportunities may differ as well.

The standard hedonic wage model hypothesizes that worker preferences affect the worker's choice of the job from the offer curve, but they do not generally influence the offer curve itself. To the extent that there is an effect, it is indirect. If, for example, too few workers select jobs at high risk firms, firms will close such operations, leading to a reallocation of capital to lower risk enterprises. This paper examines heterogeneous worker attitudes toward health risks, which will affect their job safety performance as well as their job choice. Firms will alter their offer curves in response to differences in riskiness. Differences in worker attitudes toward risk consequently affect the shape of worker indifference curves as well as the market opportunities from which they choose.

Although it is not possible to observe worker health risk preferences directly, these preferences are likely to be revealed through other risk-taking behavior. The measure that we use as a proxy for these risk attitudes is cigarette smoking.[1] Because cigarette smoking poses a lifetime mortality risk of 0.18 to 0.36, this risk is usually several orders of magnitude greater than almost any other personal risk.[2] Further, controlling for observable characteristics, smokers earn less than nonsmokers do overall.[3]

Our model predicts unambiguously that, if all workers face the same offer curve, smokers will select a greater job-risk level than will nonsmokers. At a higher risk level, smokers should necessarily receive greater total risk premia than nonsmokers. However, this result is not borne out in our empirical analysis. Smokers choose jobs in higher risk industries but have a sufficiently lower wage-risk tradeoff that their total risk compensation is less. The implicit value that smokers attach to a statistical job injury is one-half that of nonsmokers. Such a finding is inconsistent with smokers and nonsmokers facing the same wage offer curve. The observed result could arise if smokers were more hazard-prone and, as a result, faced a wage offer curve that was flatter. Indeed, we find that smokers are more hazard-prone on the job, controlling for the industry risk level. They are also more hazardous in their personal actions.

It should be emphasized that concave offer curves alone, coupled with smokers picking higher risk jobs, cannot account for our results. Smokers face higher risk and have lower wage-risk tradeoffs. These results could be consistent with being on the same offer curve. However, they also receive less hazard pay for more total risk, which is not consistent with smokers being on the same offer curve as nonsmokers. Their offer curve must be flatter. Moreover, smokers are paid less than nonsmokers for a zero risk job, which also indicates that their offer curve is lower as well as flatter than that for nonsmokers.

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[1] Ippolito and Ippolito (1984) present related evidence on the implications of smoking behavior for smokers' value of life. See Fuchs (1986), Manning et al. (1991), and O'Conor, Blomquist, and Miller (1996) for a broader analysis of the effect of smoking status on health-related decisions. Also see Hersch and Viscusi (1990) and Hersch and Pickton (1995) for analyses of wage-risk tradeoff effects of smoking status.

[2] Supporting statistics appear in Viscusi (1992), especially p. 70.

[3] See Levine, Gustafson and Velenchik (1997) for an analysis of the wage effects of smoking status.

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After developing the model in section II, we describe the data used in the empirical analysis in section III. Section IV presents estimates of wage equations. Section V documents the higher industry risks of the jobs selected by smokers, and section VI explores smokers' injury performance. We conclude that the combined implications of these results are that smokers and nonsmokers differ both in terms of their preferences and their market offer curves.

II. Smoking Status and Compensating Differential Theory

A. *Optimal Job Risks*

The standard formulation of compensating differentials models the choices made by a representative worker.[4] Choices by a variety of such individuals give rise to the supply side of the market. Although past studies do not assume that all workers are homogeneous, they typically do not explore the explicit economic factors that lead to heterogeneous preferences. This paper extends these approaches by incorporating the role of smoking status into both sides of the market. We develop our model of the role of workers' risk preferences using smoker status as an indicator of risk attitudes, because this approach allows a direct empirical test. However, the theory applies generally to any stratification of workers by their risk preferences.

Both the supply and demand components of the hedonic wage model vary depending on smoking status. Firms' offer curves define the market opportunities facing workers, in which the envelope of these individual offer curves is the nondominated choice set. The variable s is a measure of smoking intensity, where higher values of s reflect greater intensity. The value of s is 0 for nonsmokers.

Let the job risk be denoted by p, where $0 \leq p \leq 1$, and let w denote the wage rate. The market opportunities locus is denoted by $w(p, s)$. Market wage premia for risk, w_p, are positive, reflecting the positive marginal cost of safety to the firm, which results in greater willingness to pay higher wages for increased risk levels. Because the marginal costs to the firm of safety improvements are increasing, the cost savings to the firm from higher levels of risk are diminishing, or $w_{pp} < 0$. If smoking intensity does not affect worker productivity, then $w_s = 0$. For situations in which this equality always holds, $w_{ps} = 0$ as well. However, if smokers are less productive—perhaps in part because they are riskier workers—w_s will be negative. To summarize, the overall shape of $w(p, s)$ has the properties that $w_p > 0$, $w_{pp} < 0$, and $w_s \leq 0$. If smokers are more productive, then $w_s > 0$, but this possibility is not consistent with subsequent empirical results.

Monitoring smoking-related differences must be feasible for firms to be able to link wages to smoking status. For firms' offer curves to vary with smoking status in this model, firms must either observe smoking status directly or observe other characteristics correlated with smoking status, and they must be able to ascertain how these attributes are correlated with productivity or greater riskiness. In the extreme case in which neither smoking status nor attributes correlated with smoking are observable, all influences discussed below will be through worker preferences on the supply side of the market rather than through differences in labor demand.

Workers have state-dependent utility functions for two states of nature: no injury and injury. If the injury is fatal, the utility function is a bequest function. The main role of smoking intensity in the model is to serve as an index of the unobservable utility function parameter $h(s)$ that indicates a greater willingness to bear health risks. People who smoke more have revealed that they are more willing to incur risks of ill health. Smoking intensity could potentially reflect differences in tastes that affect preferences in both health states. However, it is sufficient and more tractable to assume that only the injury (or ill-health) state is affected. The final assumption governing the utility function formulation is that, with no loss of generality, the role of nonwage income such as assets or workers' compensation will be subsumed in the functional form of the utility functions.

Although smokers endanger their health more than nonsmokers, whether these differences in risky behavior arise from preferences or perceptions has not been fully resolved. Three possibilities for how smoking status may affect job risk decisions are most salient.[5] First, smokers may not value their health as much as do nonsmokers. This case stems from an underlying difference in preference structures and will be the focus of the analysis here. Second, smokers may value ill health less if they undervalue the losses they will suffer.[6] A high discount rate with respect to future health losses likewise could account for this effect. These examples of undervalued health losses simply involve a different interpretation of the reason why smokers have a different utility function in the ill-health state. Our model also pertains to this case. Third, one could hypothesize that smokers underperceive health risks of all kinds. However, this possibility is not borne out by our evidence on workers' own subjective job-risk perceptions and the associated compensating differentials by smoking status reported in Hersch and Viscusi (1990). As a result, the model below focuses on preference-related differences, recognizing that one cannot

[4] The first wage-risk estimates in the modern literature appear in Smith (1974). See, among many others, Thaler and Rosen (1976), Rosen (1986), and the surveys by Viscusi (1983, 1993), Jones-Lee (1976, 1989), Kniesner and Leeth (1995), Smith (1979), and Brown (1980). For international evidence, see Kniesner and Leeth (1991). The model here extends the formulation in Viscusi (1979). See Viscusi and Evans (1990) for empirical estimation of utility functions for workers that yield results consistent with this formulation.

[5] Fuchs (1986) provides an early discussion of many of these issues.

[6] The rationality of smoking decisions is of particular concern with respect to youth smoking. Chaloupka (1991) examines whether younger and less educated individuals are more likely to be myopic in their smoking behavior.

TABLE 1.—SUMMARY OF DIFFERENCES IN RISK OUTCOMES

Effect of Smoking Status on Wages	Offer Curve	Effect on Smokers' Outcomes Relative to Nonsmokers: Risk p	Total Risk Premium	Wage Rate
1. $w_s = 0$, $w_{ps} = 0$	Same for both groups.	↑	↑	↑
2. $w_s < 0$, $w_{ps} = 0$	Smokers have offer curve that is a downward parallel shift of nonsmokers' curve.	↑	↑	?
3. $w_s < 0$, $w_{ps} > 0$	Smokers face steeper wage offer curve that starts below nonsmokers' curve.	↑	↑	?
4. $w_s < 0$, $w_{ps} < 0$	Smokers face flatter wage offer curve that lies below nonsmokers' curve.	?	?	?

The ↑ indicates higher effects, and the ? denotes effects of uncertain direction.

necessarily impute complete rationality to the observed choices, only consistency across risk-taking domains.

Our specification of the nature of preferences is consequently quite general. The utility of good health is $U^1(w(p, s))$ and the utility in the injured state is $U^2(w(p, s), h(s))$.[7] In the good-health state, utility is a function of the wage only. In the post-injury state, utility is also a function of $h(s)$, which relates smoking to unobservable taste characteristics. We assume that smokers suffer less of a drop in utility with injury than do nonsmokers and that people are either risk-averse or risk-neutral ($U_w^1, U_w^2 > 0$, and $U_{ww}^1, U_{ww}^2 \leq 0$). The key assumption driving compensating differentials is not risk aversion with respect to financial losses but an assumed preference for being healthy rather than not, or $U^1(w) > U^2(w, h)$ for any given wage value w. The marginal utility of income is higher in the good-health state for any given level of w, or $U_w^1 > U_w^2$. We also assume that smoking intensity has a nonnegative effect on the utility of ill health, or $U_h^2 h_s \geq 0$, and that smoking intensity has a nonnegative effect on the marginal utility of income in the injury state, or $U_{wh}^2 h_s \geq 0$.

The worker selects the optimal job risk p from the available wage offer schedule to maximize expected utility V, or

$$\max_p V = (1 - p)U^1(w(p, s)) + pU^2(w(p, s), h(s)), \tag{1}$$

leading to the first-order condition

$$w_p = \frac{U^1 - U^2}{(1 - p)U_w^1 + pU_w^2}. \tag{2}$$

At the optimal job risk, the worker equates the marginal compensating differential w_p to the difference in utility in the two health states normalized by the expected marginal utility of income. The second-order condition is also satisfied given the assumptions above. We label the second-order condition expression D, where $D < 0$.[8]

[7] If there is a lag before the injury occurs, the value of U^2 could subsume the role of discounting.

[8] In particular,

$$D = -2w_p(U_w^1 - U_w^2) + (1 - p)U_{ww}^1(w_p)^2 + pU_{ww}^2(w_p)^2 + (1 - p)U_w^1 w_{pp} + pU_w^2 w_{pp} < 0.$$

B. The Effect of Smoking Status

The choices implied by equation (2) vary with the structure of utility functions and wage offer curves, each of which may vary with smoking status. To assess the effect of smoking intensity on the optimal job risk selected, we totally differentiate equation (2) and solve for dp/ds, yielding

$$\frac{dp}{ds} = \{-(U_w^1 - U_w^2)w_s + (1 - p)U_{ww}^1 w_s w_p + (1 - p)U_w^1 w_{ps} + U_h^2 h_s + pU_{ww}^2 w_s w_p + pU_{wh}^2 w_p h_s + pU_w^2 w_{ps}\}/(-D). \tag{3}$$

Because $U_w^1 > U_w^2$, all terms in the bracketed expression in the numerator of equation (3) are nonnegative with the possible exception of the two terms involving w_{ps}, which represents the effect of smoking intensity on the marginal wage-risk tradeoff offered to workers. If w_{ps} is positive, smokers face a steeper wage-risk curve than do nonsmokers. The sign of w_{ps} also influences the relation between smoking status and optimal job risks. If w_{ps} is not negative, dp/ds will be positive: the optimal job risk increases with smoking intensity. However, if w_{ps} is negative, dp/ds could be negative as well if this influence is dominant.

Because of this indeterminacy, there are a variety of different possible effects of smoking status on the slope of the wage-risk tradeoffs.[9] Table 1 summarizes the four dif-

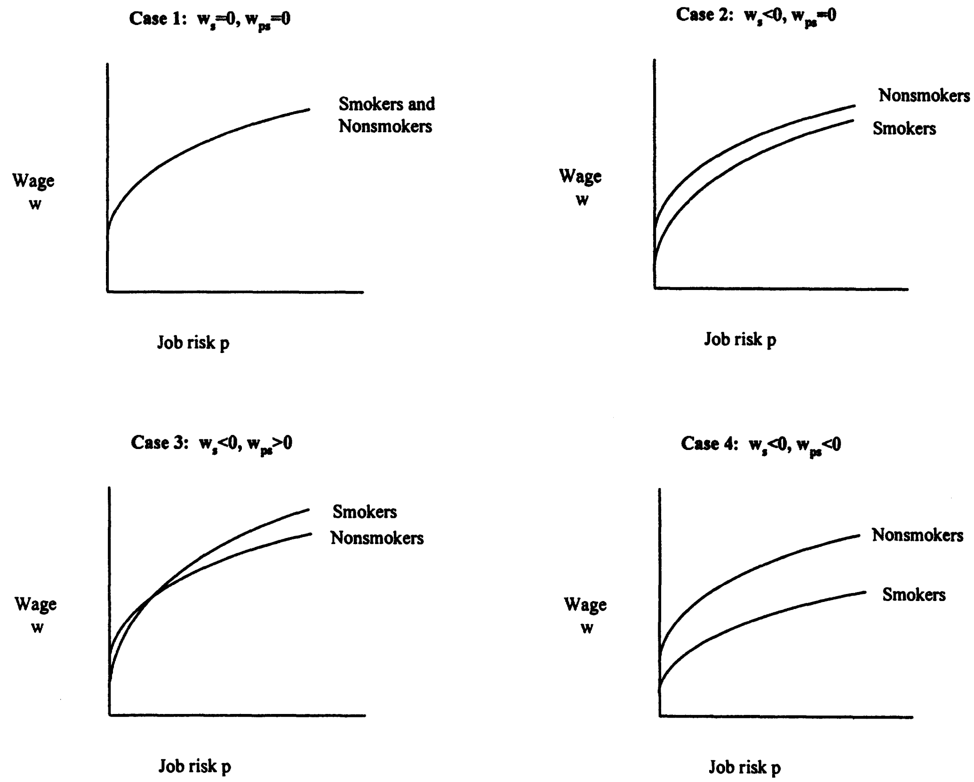
[9] The indeterminacy of the slope of the tradeoff rate selected is attributable to the absence of a clearcut relationship between

$$w_p(p_0, 0) = \frac{U^1(w(p_0, 0)) - U^2(0, w(p_0, 0))}{(1 - p)U_w^1(w(p_0, 0)) + pU_w^2(w(p_0, 0))} \quad \text{and}$$

$$w_p(p_s, s) = \frac{U^1(w(p_s, s)) - U^2(w(p_s, s), h(s))}{(1 - p)U_w^1(w(p_s, s)) + p_s U_w^2(w(p_s, s), h(s))},$$

where p_s is the risk selected by smokers and $h(0)$ is assumed to be zero, without loss of generality.

FIGURE 1.—SUMMARY OF SMOKER WAGE-RISK CASES



ferent situations based on possible signs of w_s and w_{ps}. Figure 1 illustrates these four cases.

Whether the total risk premium received by smokers is greater than that of nonsmokers depends on whether all workers face the same wage offer curve. For each of the four cases shown in table 1 and figure 1, smokers and nonsmokers will have constant expected utility loci that are upward sloping with a positive second derivative with respect to job risks. The character of the labor market outcome is similar for three of the cases and is ambiguous for one.

In case 1, in which smokers and nonsmokers face the same offer curve, smokers will select a greater job risk and consequently receive a greater risk premium, as well as a higher total wage rate. If smokers' market offer curve involves a downward parallel shift as in case 2, these results for the risk level and risk premium continue to hold except that the wage rate received by smokers may be less. In case 3, for which $w_{ps} > 0$, the greater steepness of the wage offer curve for smokers makes risky jobs more attractive to smokers than in the counterpart case 2. The general spirit of the results in terms of the effects on risk, compensating differentials, and wages follows the identical pattern as in case 2. Increasing the steepness of smokers' offer curves in case 3 does not alter the general character of the results found for case 2. The same is not true if the wage offer curve for smokers is flatter. Case 4 permits the wage offer curve to be flatter for smokers, leading smokers to possibly select higher or lower job risk levels, with ambiguous effects on compensating risk differentials and wage levels.

The strategy for the empirical work is to ascertain the various effects of smoking status on job risks and compensating differentials for risk. These influences will make it possible to distinguish which market offer curves could be consistent with the market outcome. If, as we will find below, smokers incur greater job risks but are paid less in total risk compensation, cases 1 through 3 can be ruled out.

The reasoning is the following. Let p_2 be the risk chosen by smokers and p_1 be the risk chosen by nonsmokers. Suppose that empirically we observe that $p_2 > p_1$ after controlling for other personal characteristics. Then suppose that we observe empirically that the wage premium for risk received by smokers is less than for nonsmokers, or

$$w(p_2, s) - w(0, s) < w(p_1, 0) - w(0, 0). \tag{4}$$

However, if smokers and nonsmokers faced the same offer curves, then

$$w(0, s) = w(0, 0), \tag{5}$$

so that equation (4) reduces to

$$w(p_2, s) < w(p_1, 0). \tag{6}$$

An assumption of identical offer curves for smokers and nonsmokers implies that

$$w(p_2, s) = w(p_2, 0). \quad (7)$$

But, because $p_2 > p_1$, $w(p_2, 0)$ should exceed $w(p_1, 0)$ if $w_p > 0$ for firms' offer curves, leading to a contradiction of the implications of equation (6) and (7). Moreover, workers will never locate on a segment of the wage-offer curve for which $w_p \leq 0$.[10]

III. The Risk and Employment Data

To explore the implications of smoking status for job-safety decisions, we need data on wages, individual smoking behavior, a measure of the objective riskiness of the worker's job, and a measure of the worker's own job-risk behavior. The data set we use is the 1987 National Medical Expenditure Survey (NMES), which is a national probability sample of the noninstitutionalized population of the United States. These data uniquely offer the advantage of including comprehensive labor market variables as well as information pertaining to the worker's on-the-job injury experience and smoking behavior. Thus, it is possible to investigate not only whether smoking affects compensating differentials for risk but also whether smokers are more accident-prone in their jobs. The NMES does not, however, include a state identifier so that an expected workers' compensation variable could not be included in this analysis. Similarly, the absence of state information does not permit us to use state tax rates to create an instrument for smoking status.

We restrict the sample to male employees, age 18 to 65, with hourly wages of \$2 to \$100 per hour, and with complete information on the variables used in the analyses. In order to match individuals to the U.S. Bureau of Labor Statistics (BLS) risk measures, we exclude agricultural workers, the self-employed, and private household workers. This results in a sample of 4,821 individuals, with 3,273 nonsmokers and 1,548 smokers.

Table 2 summarizes the sample characteristics by smoking status. The smoking rate for this sample is 32%, which is just above the U.S. average for adults. The corresponding national rate for males in 1987 is 31.2% (U.S. Department of Commerce, 1995).

Smokers and nonsmokers in this sample are largely similar in their demographic characteristics. Although there are statistically significant differences in residence in an SMSA and whether physical conditions limit work, the differences are minor. There are no statistically significant differences by smoking status in race and union status. However, there is a large difference in years of education, with nonsmokers averaging over one year of college and smokers averaging less than twelve years of education. Nonsmokers have more years of experience with their current employer (*Tenure*). Smokers are much less likely to be employed in a white-collar job (28% versus 46%). Given these differences in human-capital characteristics, it is not surprising that smokers earn less, with nonsmokers earning \$1.10 more per hour.

Following the conventional practice in the compensating differentials literature, we match each worker to BLS risk measures based on the worker's reported three-digit industry code. We use two such measures to capture both injury frequency and duration-weighted frequency. The first measure is the annual number of lost workdays due to injury and illness per 100 full-time employees (*BLS Lost Workdays Rate*), and the second variable is the annual lost workday injury and illness incidence rate per 100 full-time workers (*BLS Injury Rate*).

To measure individual-specific injury experience, we use additional data requested in the survey. The NMES survey asked all respondents to report the location of any accidents that caused an injury in 1987 leading to a period of disability or use of medical services or goods. If the reported

[10] This result is derived by Viscusi (1979) for an analogous model without heterogeneity.

TABLE 2.—SAMPLE CHARACTERISTICS

Variable	Mean (Standard Deviation) Nonsmoker	Smoker	Absolute Value of t-Statistic of Difference in Means or Proportions
Job and Personal Characteristics			
Hourly wage (1987\$)	10.44	9.34	5.84
	(6.32)	(5.49)	
Age	36.00	36.81	2.21
	(12.22)	(11.15)	
White	0.76	0.77	1.01
	(0.43)	(0.42)	
Education	13.12	11.89	14.44
	(2.83)	(2.61)	
Experience	16.58	18.60	5.35
	(12.49)	(11.70)	
Tenure	7.14	6.20	3.41
	(8.50)	(7.69)	
Married	0.63	0.64	0.03
	(0.48)	(0.48)	
Physical condition limits work	0.06	0.08	2.75
	(0.23)	(0.27)	
Union member	0.20	0.22	1.51
	(0.40)	(0.41)	
White-collar	0.46	0.28	12.53
	(0.50)	(0.45)	
SMSA	0.77	0.73	3.46
	(0.42)	(0.45)	
Risk Characteristics[a]			
BLS Lost Workdays Rate	77.90	91.98	8.22
	(54.67)	(57.38)	
BLS Injury Rate	4.20	4.87	8.55
	(2.56)	(2.59)	
Worker injury (percentage)	3.33	5.81	4.05
Accident at home (percentage)	1.50	2.71	2.90
Individual injury (percentage)	7.03	10.01	3.59
Sample size	3,273	1,548	

Data are drawn from the 1987 National Medical Expenditure Survey.
[a] BLS injury rates are taken from *Occupational Injuries and Illnesses in the United States by Industry, 1987*, Table 1, Bureau of Labor Statistics (Bulletin 2328, May 1989). All injury statistics are per 100 workers.

accident occurred at a work location and caused the worker to lose work, we coded the accident as a work-related injury (*Worker Injury*).[11] We emphasize that survey respondents were instructed to report only those injuries that resulted directly from an accident. Other lost workday injuries and illnesses that do not result from an accident will be underreported. For example, lost workdays that result from repetitive-motion disorders will not be included.[12]

The own injury variable captures two types of effects. First, this variable may be a more accurate index of the riskiness of the worker's particular job than the BLS risk variable, which reflects the average risk for the industry. Second, for any given level of objective riskiness of the job, workers may differ in their degree of care and propensity to injury. Past injury experiences consequently may indicate that the workers themselves are riskier, not that the job itself poses higher objective risks. We recognize that, although the own injury variable has the advantage of being job specific, it is not a better job risk measure than objective industry risk data based on large samples of injury experiences. Seriously injured workers also may switch jobs, starting a new injury history record for their job.

The risk characteristics of the sample differ considerably by smoking status. The BLS industry average risk measures indicate that smokers sort themselves into riskier industries on average. Smokers are also more likely to get injured. Although smokers' higher work injury rate is due in part to employment in higher-risk industries, it is noteworthy that smokers are significantly more likely than nonsmokers to have an accident at home (*Accident at Home*) or an accident of any kind (*Individual Injury*). The Individual Injury variable exceeds the sum of Worker Injury and Accident at Home because it also includes other classes of accidents, such as those due to motor vehicles and recreational activities.

IV. Wage-Risk Tradeoff Rates

A. *Compensating Differentials Estimates*

The empirical analysis begins with a conventional compensating differentials equation to capture the equilibrium labor market tradeoffs that reflect the joint influence of supply and demand factors.

To explore the effect of smoking, we estimate an equation of the following form:

$$\ln wage = \beta_0 + X\beta_1 + \beta_2 BLS\ Rate + \beta_3 Worker\ Injury + \varepsilon, \tag{8}$$

where X is a vector of personal and job characteristics, such as education, experience, union status, and handicapped status. The variable *BLS Rate* measures the industry's risk level and *Worker Injury* is a dummy variable indicating whether the worker had an on-the-job injury in the preceding year. The term ε is a random-error term that we assume is normally distributed. The semilogarithmic form in equation (8) is the norm in the compensating differential literature and the labor economics literature more generally. Although the offer curve is concave, worker indifference curves are convex. What is being estimated is the locus of tangencies for observed wage-risk combinations rather than the wage offer curve itself.[13] Because both the offer curves and the constant expected utility loci could differ by smoking status, we estimate separate equations for smokers and nonsmokers. Tests for whether smoking status enters simply by altering the intercept rather than the entire equation structure indicated that one could reject the hypothesis that the effect of smoking was restricted in such a manner.[14]

If nonsmokers and smokers face wage offer curves that are similarly shaped but with possibly different intercepts, as in the case 1 or 2 models, the value of β_2 is larger for nonsmokers than it is for smokers. Nonsmokers should select a lower risk job on the steeper section of the wage offer curve. For case 3 as well, smokers will select greater risks than will nonsmokers. As a consequence, they will also receive greater total risk premia due to their higher wage-risk tradeoff. For the case 4 model, there is ambiguity regarding relative risk levels, risk premia, and wage-risk tradeoffs.

The expected sign of the coefficient β_3 on the own worker injury variable is ambiguous. If the own worker injury risk variable better reflects the objective riskiness of the job that drives market risk premia, then β_3 should be positive. If, however, the role of the variable is to reflect differences in worker riskiness, then β_3 will be negative.

A longstanding issue in the literature has been the joint determination of wages and risk levels. Thus, the risk level is correlated with the error term in the wage equation. The standard compensating differential model

[11] We coded an accident as a workplace accident if the respondent reported the location was at an industrial place, at work, at business, or adjacent to business. The survey asked if the worker had lost at least one-half of day of work due to the accident.

[12] The injury rate calculated using the NMES will not correspond exactly to the BLS injury rate. The BLS injury rate is derived from a survey of employers and includes lost workdays resulting from any occupational *injury* or *illness*. The injury rate calculated in the NMES is based on workers' self-reported accidents, and excludes other occupational illnesses and injuries. Further, individuals whose injuries prevent them from returning to work are not represented in the sample.

[13] Explorations of alternative functional forms, such as the inclusion of quadratic risk variables, failed to yield significant effects for the quadratic form. Other specifications, such as log wage-log risk yielded significant job risk effects for nonsmokers only. Although there is no theoretical basis for selecting the semilogarithmic form as there is for models linking wages to education, this specification is in line with that used in the literature.

[14] We rejected the hypothesis that the coefficients on job risk, own injury, tenure, union, and professional occupation are the same for smokers and nonsmokers (p-values are 0.02 and 0.03) based on equations including *BLS Lost Workdays Rate* and *BLS Injury Rate*, respectively.

TABLE 3.—LOG WAGE EQUATION ESTIMATES

Independent Variables	Nonsmokers	Smokers	Nonsmokers	Smokers
BLS Lost Workdays Rate	0.101	0.058		
	(0.016)**	(0.020)**		
	[0.027]**	[0.021]**		
BLS Injury Rate/100			1.500	0.733
			(0.340)**	(0.434)*
			[0.606]**	[0.491]
Worker Injury	−0.008	−0.086	−0.009	−0.083
	(0.037)	(0.038)**	(0.037)	(0.038)*
	[0.032]	[0.037]**	[0.032]	[0.037]**
Experience	0.010	0.010	0.010	0.010
	(0.001)**	(0.001)**	(0.001)**	(0.001)**
	[0.001]**	[0.001]**	[0.001]**	[0.001]**
Tenure	0.034	0.026	0.034	0.025
	(0.003)**	(0.004)**	(0.003)**	(0.004)**
	[0.004]**	[0.005]**	[0.004]**	[0.005]**
Tenure squared × 100	−0.083	−0.064	−0.083	−0.064
	(0.010)**	(0.013)**	(0.010)**	(0.013)**
	[0.011]**	[0.014]**	[0.011]**	[0.014]**
Education	0.054	0.047	0.054	0.047
	(0.004)**	(0.005)**	(0.004)**	(0.005)**
	[0.005]**	[0.006]**	[0.005]**	[0.006]**
White	0.115	0.119	0.114	0.119
	(0.018)**	(0.026)**	(0.019)**	(0.026)**
	[0.021]**	[0.022]**	[0.021]**	[0.022]**
Handicapped	−0.132	−0.078	−0.132	−0.080
	(0.038)**	(0.043)*	(0.038)**	(0.043)*
	[0.037]**	[0.050]*	[0.037]**	[0.045]*
Union	0.146	0.216	0.152	0.220
	(0.021)**	(0.027)**	(0.021)**	(0.027)**
	[0.029]**	[0.036]**	[0.030]**	[0.036]**
R^2	0.39	0.39	0.39	0.38

Dependent variable: log of hourly wage. Additional variables in each equation are a constant, and indicator variables for eight census divisions, SMSA, and eight occupations.
Standard errors corrected for heteroskedasticity in parentheses; standard errors corrected for within-group correlation in brackets. ** (*) by the standard error indicates that the coefficient is significant at the 1% (5%) level based on that standard error (one-sided tests).

does not seek to estimate the underlying economic structure but focuses only on the observed market equilibrium tradeoffs.

However, the data set afforded a number of potential instruments, so we explored the endogeneity issue using IV estimation. The potential instruments included self-reported risk taking, height, weight, seatbelt use, checking blood pressure, exercising, flossing teeth, and limitations on walking, climbing stairs, and lifting heavy objects. Jointly, these variables were only marginally significant (10% level) in determining the individual's choice of industry level risk. In addition, subsets of these variables yielded even weaker explanatory power. Nonetheless, using these admittedly weak instruments in a wage equation, a Hausman test indicated that we could not reject the hypothesis that the job risk variable was exogenous. This result is not unexpected because of the weak nature of available instruments. As a result, our empirical model uses a standard OLS regression equation.

Table 3 summarizes the key coefficients for the estimated wage equations by smoking status. Selection-corrected estimates for the probability that an individual is a smoker yields essentially identical results, for example, *BLS Injury Rate* coefficients of 1.416 for nonsmokers and 0.742 for smokers.[15] The first set of equations uses *BLS Lost Workdays Rate* to indicate industry risk, and the second set uses the *BLS Injury Rate*. We present two sets of standard errors. The first set indicated in parentheses are the White (1980) heteroskedasticity-adjusted standard errors. However, because we assign the same BLS risk measure to all individuals within the same industry, the residuals in the regression for workers in the same industry may be correlated. Standard errors that do not account for this correlation may be too small. As a result, we also present, in brackets, robust standard errors that account for this within-group correlation.[16]

The demographic variables follow the usual patterns, with better educated and more experienced workers earning more. The difference in the rates of return to education is not significant, so that, even though smokers have less education, it does not offer a higher rate of return. Smokers' different risk choices consequently are not attributable to

[15] The instruments used in the IV equation are also used here in the selection equation.

[16] See Huber (1967) and Rogers (1993). This correction appears in Hersch (1998) but not elsewhere in the compensating differentials literature.

differences in rates of time preferences with respect to income.[17]

The results in table 3 indicate that all workers receive positive compensation for bearing job risks. The estimated job risk premia per unit risk for smokers are consistently below those of nonsmokers, with the difference significant at the 5% level based on the *BLS Lost Workdays Rate* and at the 9% level based on *BLS Injury Rate* (one-sided tests). The magnitude of the coefficients differs considerably by smoking status, with the job-risk coefficient for nonsmokers being twice that of smokers using either measure of industry risk. The estimated compensating differentials suggest that smokers have lower wage-risk tradeoff rates than do nonsmokers. However, these results alone do not identify which of the possible wage-offer curves pertain to smokers and nonsmokers.

The own worker injury variable adds information on the effect of personal job safety on wages. Wages of nonsmokers are not affected by whether the worker had been injured on the job in the preceding year. However, there is a negative effect of own injury on the wages of smokers. This result would occur if smokers are more careless for a given industry risk level and consequently less productive in promoting workplace safety.[18] Nonsmoking careless workers also should be paid less.[19] Because nonsmokers who suffer injuries do not incur any wage penalty, it may be that the character of their injuries is different. For example, nonsmokers' accidents may be more attributable to workplace characteristics than dysfunctional worker behavior. Although we do not have data to distinguish all such influences, we will examine the hypothesis that smokers are riskier workers and riskier people more generally.

B. Risk Compensation and the Implicit Value of Job Injuries

Table 4 summarizes the implicit injury values and total wage compensation for risk implied by the wage equation estimates in table 3.[20] A measure of the tradeoff rate is the implicit value of a statistical workplace injury. For any injury-frequency risk measure *Risk,* this value is simply $\partial w/\partial Risk$, with appropriate adjustment for the annual units of wages (assuming 2,000 hours per year) and risk. Panel A of table 4 summarizes these implicit value results. Based on the discrete injury frequency rate results, nonsmokers receive $31,320 per expected job injury and smokers receive just under half this amount ($13,692 per injury). The estimates taking into account injury duration yield a similar pattern. Nonsmokers receive $2,109 compensation per expected day lost due to injury as compared to $1,083 for smokers. The duration of smokers' injuries is somewhat greater than for nonsmokers so that there is a narrower relative spread between the implicit value of an expected injury spell than the value per injury day: $39,017 for nonsmokers and $20,469 for smokers.

TABLE 4.—WAGE-RISK TRADEOFFS IMPLIED BY REGRESSION RESULTS

Panel A: Implicit Values of Injury Days and Injuries

	Nonsmokers	Smokers
BLS Injury Rate		
Implicit value per injury	$31,320	$13,692
BLS Lost Workdays Rate		
Implicit value per injury day	$2,109	$1,083
Implicit value per injury	$39,017	$20,469

Panel B: Total Wage Compensation Compared to Zero Risk Level[a]

Initial Risk Level	Nonsmokers	Smokers
BLS Injury Rate (mean)		
Nonsmoker risk (4.20)	$1,122	$516
Sample average risk (4.41)	$1,214	$542
Smokers' risk (4.87)	$1,346	$594
BLS Lost Workdays Rate (mean)		
Nonsmoker risk (77.90)	$1,394	$756
Sample average risk (82.42)	$1,512	$798
Smokers' risk (91.98)	$1,696	$888

[a] These amounts pertain to $w(p, s) - w(0, s)$ for different risk-level p values specified in the table. Estimates were obtained using the wage equations for the different smoking groups, where all calculations are done on an individual worker basis. If the individual belongs to the particular risk level group, then the own risk level is used. Otherwise, the sample average risk is used.

Another measure of the difference in wage compensation for risk is the total value of compensation that workers receive relative to what the earnings equations would predict. For zero risk, this value is $w(p, s) - w(0, s)$, which we calculate on an individual worker basis using the particular group's log wage equation. At the individual's own risk level, nonsmokers average $1,122 in risk compensation compared to $594 for smokers based on the injury-rate regressions, and $1,394 for nonsmokers and $888 for smokers based on the lost-workday rate regressions. These differences are surprising because smokers face higher job risks yet receive less total job risk compensation. The estimates imply that the wage difference between smokers and nonsmokers stemming from hazard pay alone is $528 based on the injury rate estimates and $506 based on the lost-workday risk estimates. Note that the overall wage gap between smokers and nonsmokers is $2,200 annually, so that risk premiums account for about one-fourth of the difference. The differences in compensation due to job risks would be even greater if smokers and nonsmokers faced the same risk level.

Smokers and nonsmokers receive different wages for reasons other than risk. Three of the cases illustrated in figure 1 indicate that smokers and nonsmokers wages may

[17] One might hypothesize, of course, that rates of time preference for different health states over time could differ from rates of time preference for money, but if what is being discounted is utility in different time periods, both income and health would be treated symmetrically.

[18] This result could also occur if smokers picked safer jobs for any given industry risk level, although this interpretation appears less plausible because smokers tend to work in higher risk industries.

[19] It is difficult to develop a long list of occupations in which recklessness is valued. For high rise construction work and race-car driving, boldness is desirable, but carelessness that leads to work accidents is not generally desirable even in those risky pursuits.

[20] For a survey of the value of worker injuries, see Viscusi (1993). Our findings are consistent with the estimated range in past studies for combined samples of smokers and nonsmokers.

differ due to factors other than risk. Indeed, our estimates suggest that approximately three-fourths of the earnings difference would remain at a zero risk level.

Panel B of table 4 also indicates the total wage risk premiums for different base risk levels, as compared to the zero risk level. If both smokers and nonsmokers were at the smokers' risk level, the earnings difference would widen by \$224 to \$302 beyond their observed amount. Earnings differences if all workers were at the average sample risk or at the nonsmokers' risk level would be less. These results illustrate how the higher risk level faced by smokers narrows the nonsmoker-smoker relative risk-compensation gap, but not by enough to generate higher wage-risk premia for smokers.

V. Industry Risk Differences of Smokers and Nonsmokers

A principal theoretical prediction in section II is that, if smokers face a wage offer curve with the same or steeper slope than do nonsmokers, they will choose jobs with greater objective risk. Only a flatter market offer curve for smokers could potentially lead to the result that smokers are on jobs with lower objective riskiness. Results in section IV indicate that smokers have a lower wage-risk tradeoff and receive lower compensation for risk. If we also can assess the risk level selected by smokers after controlling for personal characteristics, we can potentially distinguish which offer curve smokers are on and where they are situated.

Based on both risk measures, smokers incur greater job risks but receive lower total risk premia.[21] If smokers faced the same market opportunities locus as nonsmokers, such behavior would be irrational. Such an outcome could occur under case 4. Moreover, case 4 assumes that smokers receive a lower wage when $p = 0$, which is also the case. This discussion of the possible cases presupposes, however, that the reason why smokers are located at higher job risk levels along the market offer curve is due to their smoking status, not variables correlated with smoking. If, for example, differences in educational background accounted for the job risk difference rather than smoking status, then the interpretation of the compensating differential results could differ. Thus, a fundamental empirical concern is whether smoking status per se leads smokers to select a higher job-risk level.

Consistent with the theory, the empirical analysis of job risk choice utilizes a reduced form model in which only exogenous personal characteristic variables are included. Variables such as job tenure and worker injury experience consequently do not appear in the model. Let

$$Risk = \gamma_0 + Y\gamma_1 + \gamma_2 Smoker + \varepsilon, \qquad (9)$$

[21] Recall the descriptive statistics in table 2 and see the regression results in table 5.

TABLE 5.—REGRESSION ESTIMATES OF BLS INDUSTRY RISK EQUATIONS

	Dependent Variable	
	BLS Lost Workdays	BLS Injury Rate
Smoker	6.422**	0.304**
	(1.760)	(0.080)
Age	1.729**	0.069**
	(0.450)	(0.021)
Age Squared × 100	−2.199**	−0.092**
	(0.558)	(0.026)
White	−2.694	−0.168*
	(1.891)	(0.087)
Education	−5.299**	−0.265**
	(0.307)	(0.014)
Married	4.245**	0.157
	(1.822)	(0.084)
Handicapped	−4.248	−0.152
	(3.439)	(0.157)
SMSA	−5.552**	−0.247**
	(1.906)	(0.088)
R^2	0.10	0.11

Equations also include a constant and indicators for eight census divisions.
Standard errors are in parentheses. ** (*) indicates significance at the 1% (5%) level (one-sided tests).

so that the risk level chosen by the worker is a function of a vector of demographic and regional variables Y with the coefficient vector γ_1, and smoking status with coefficient γ_2. The *Risk* variable pertains to each of the two BLS measures. *Smoker* is a 0-1 indicator variable. The expected sign of γ_2 predicted by the theory is positive in cases 1 through 3 and is ambiguous in case 4.

Table 5 reports the estimated risk equations for both BLS risk measures. The key finding is that, controlling for individual characteristics, workers who smoke select jobs in higher-risk industries. Education and age also affect the chosen risk level, with better educated workers choosing less risky industries. Job risk levels rise with age but at a diminishing rate.

Controlling for other personal characteristics, the magnitude of the coefficient on smoking status is substantial. Smokers select jobs in industries with a *Lost Workdays Rate* that is 6.4 per 100 workers higher—or more than 8% greater—than the average *Lost Workdays Rate* of 77.9 for nonsmokers. However, the total average gap between smokers' and nonsmokers' *Lost Workdays Rate* is 14.1, so that more than half of the smoker-nonsmoker difference is attributable to demographic characteristics of smokers other than smoking status alone.

The results for the *BLS Injury Rate* variable are similar in that smokers' industries have a significantly higher injury rate that is 7% greater than that of nonsmokers after taking into account other personal characteristics. However, the total unadjusted smoker-nonsmoker *BLS Injury Rate* difference is 16%, so that just under half of the unadjusted smoker-nonsmoker risk difference is attributable to smoking status per se.

The finding here using both risk measures is that smokers face greater industry risks controlling for other personal characteristics. As we found in section IV, smokers also have lower wage-risk tradeoffs and receive less total risk compensation. For the wage-offer curve facing smokers to be flatter, there must be some demand-side influence that would account for such an effect. One such possibility is that smokers are less effective in producing safety (that is, they are more injury-prone), so that their productivity in unsafe jobs is comparatively low. We examine this possibility below.

VI. Workers' Own Injury Experiences

If smokers are less averse to being injured, they should be less careful than nonsmokers within jobs of given riskiness. Smokers consequently should experience more work injuries controlling for the industry risk level and other measures of the objective job characteristics. Measurement error could also be a contributing influence. Smokers could be more injury-prone if the actual risks of their jobs are greater than the industry risk average. Although such a relationship is possible, it is not supported by the evidence on wage premia for higher personal injury risks, which were found to be negative for smokers and insignificant for nonsmokers.

To explore whether smokers are riskier workers, we estimate the relationship

$$Injury = \delta_0 + Z\delta_1 + \delta_2 BLS\ Rate + \delta_3 Smoker + \varepsilon, \tag{10}$$

where Z is a vector of personal and job characteristic variables. We expect the coefficient δ_2 for *BLS Rate* and δ_3 for *Smoker* to be positive.

We consider three measures of worker riskiness. The first measure is whether the worker has had a lost-workday accident in the past year on the worker's current job (*Worker Injury*). This variable is the own injury variable that entered the wage equations above. The second risk measure is whether the worker has experienced any accident in the past year—whether at work or elsewhere—that has caused the worker to miss at least one-half day of work (*Individual Injury*). The final personal risk variable is whether the worker has experienced a home accident in the past year (*Accident at Home*). This variable captures riskiness of behavior in contexts other than the job, which should be instructive in indicating the degree of risks and precautions the person selects. Because job risks are not a measure of home accident conditions, the *BLS Rate* variable does not enter this equation.

Because the injury experience variable is discrete, we use probit to estimate the marginal probability of an injury based on a one-unit change in each of the independent variables. The BLS risk measure used in the two equations with dependent variables encompassing job safety is the *BLS Injury Rate*. Results were similar using the *BLS Lost Workdays Rate*. Once again, we report robust standard errors corrected for heteroskedasticity (errors in parentheses) for all equations and standard errors corrected for within-group correlation (errors in brackets) for the two equations including the *BLS Injury Rate*.

TABLE 6.—PROBIT ESTIMATES OF THE PROBABILITY OF INJURY EXPERIENCE

	Dependent Variable		
	Worker Injury	Individual Injury	Accident at Home
Smoker	0.011	0.015	0.008
	(0.005)*	(0.008)*	(0.004)*
	[0.005]*	[0.008]*	—
BLS Injury Rate/100	0.269	0.537	—
	(0.099)**	(0.153)**	—
	[0.105]**	[0.132]**	—
Age × 100	−0.037	−0.203	0.115
	(0.128)	(0.235)	(0.116)
	[0.120]	[0.214]	—
Age Squared × 10,000	−0.066	−0.046	−0.002
	(0.163)	(0.302)	(0.001)
	[0.150]	[0.274]	—
White	0.007	0.015	0.008
	(0.005)	(0.008)	(0.004)*
	[0.006]	[0.008]	—
Education	−0.003	−0.006	−0.002
	(0.001)**	(0.002)**	(0.001)*
	[0.001]**	[0.002]**	—
Married	0.010	0.014	0.004
	(0.005)*	(0.008)	(0.004)
	[0.004]*	[0.008]	—
Handicapped	0.011	0.043	0.006
	(0.011)	(0.019)**	(0.008)
	[0.011]	[0.020]*	—
Tenure	−0.002	−0.002	—
	(0.001)**	(0.001)	—
	[0.001]*	[0.002]	—
Tenure Squared × 100	0.006	0.005	—
	(0.003)*	(0.005)	—
	[0.003]*	[0.005]	—
Log-Likelihood	−758.64	−1267.33	−437.79

Additional variables in Worker Injury and Individual Injury equations are a constant and indicators for SMSA, eight census divisions, and eight occupations. Additional variables in the Accident at Home equation are a constant and indicators for SMSA and eight census divisions.

Standard errors corrected for heteroskedasticity in parentheses; standard errors corrected for within-group correlation in brackets. ** (*) by the standard error indicates that the coefficient is significant at the 1% (5%) level based on that standard error.

As the results presented in table 6 indicate, workers in risky industries based on BLS measures are more likely to experience an on-the-job injury, as expected. Better educated workers are injured less often, which is consistent with a lifetime wealth effect. Also, injuries diminish at a decreasing rate with job tenure, reflecting the role of workers learning about job risks and the effect of experience on work accidents.[22]

The main variable of interest is smoking status, which is consistently positive and statistically significant for all three personal risk measures. Smokers have significantly higher accident rates on the job than do nonsmokers, controlling for the average industry risk level and personal characteristics. Smoking status increases the annual job injury probability by 0.011 above that for nonsmokers. As noted in table 2, nonsmokers have a work injury probability of 0.033,

[22] As is shown in Viscusi (1979), if workers experiment with risky jobs and quit if their experiences are sufficiently unfavorable, there will be a negative relationship between tenure and job riskiness apart from any safety productivity effect.

TABLE 7.—ALTERNATIVE PROBIT ESTIMATES OF THE EFFECT OF SMOKING STATUS ON INJURY EXPERIENCE

	Dependent Variable			
	Worker Injury		Individual Injury	
	(1)	(2)	(3)	(4)
Smoker	0.009	0.011	0.017	0.016
	(0.012)	(0.005)*	(0.017)	(0.008)*
	[0.011]	—	[0.016]	—
BLS Injury Rate/100	0.261		0.547	
	(0.125)*		(0.188)**	
	[0.133]*		(0.175)**	
BLS Injury Rate × Smoker	0.019		−0.025	
	(0.176)		(0.281)	
	[0.156]		[0.245]	
Log-Likelihood	−758.64	−762.70	−1267.32	−1273.45

Additional variables in each equation are a constant, age, age squared, education, tenure, tenure squared, and indicators for race, married, handicapped, SMSA, eight census divisions, and eight occupations.

Standard errors corrected for heteroskedasticity in parentheses; standard errors corrected for within-group correlation in brackets. ** (*) by the standard error indicates that the coefficient is significant at the 1% (5%) level based on that standard error.

and smokers have an average probability of 0.058. Smoking status per se accounts for 0.011 of the 0.025 overall average smoker-nonsmoker job injury probability difference between smokers and nonsmokers. Background variables correlated with smoking status also account for much of the propensity toward job risks. Smoking status consequently may be a signal of being risky in other ways.

Smokers' greater riskiness on the job is consistent with the other two risk-behavior equations. Smokers have an annual probability of any injury—on or off the job—that will lead to a loss of work that is 0.015 greater than for nonsmokers. The overall individual accident rate difference averages 0.03 (from table 2), so that smoking status alone accounts for half of the difference without controlling for other demographic factors. Smoking status increases the annual probability of an injury at home by 0.01, as compared to the nonsmokers' average home accident rate of 0.02 per year. Smokers are thus one-and-a-half times as likely to experience home accidents as are nonsmokers. Smokers are consequently riskier people in a variety of pursuits, an effect that will make it desirable for firms' offer curves to be flatter for smokers than nonsmokers.

Table 7 examines the robustness of these estimates using different specifications to examine the influence of the smoking and risk variables. Equation (1) and (3) in table 7 add an interaction term between the *BLS Injury Rate* and *Smoker,* but this effect is not statistically significant in either the work-injury or overall individual-injury equation. *Smoker* and the interaction term are highly correlated (r = 0.84), so it is difficult to distinguish these effects.[23] Because smoking status is reflected in part in the objective job risk selected by the worker, equation (2) and (4) omit this objective risk measure. The magnitudes of the smoking coefficients are almost identical to those in table 6.

[23] The two smoking variables remain jointly significant at the 10% level (p-value = 0.09).

VII. Conclusion

Smoking status influences the character of the compensating risk differential mechanism. Somewhat paradoxically, smokers incur greater job risks but receive lower total wage compensation for risk than do nonsmokers. A difference in wage-risk tradeoffs arising from different risk preferences of smokers cannot account for this result. The evidence suggests that smokers differ not only in their preferences but also in their market opportunities. Smokers face a lower and flatter wage offer curve.

The only situation in which these results could occur is case 4 in table 1. Because smokers also would receive a lower wage rate even for jobs with zero risk (at the 90% significance level), case 4 is also consistent with the specified level of the intercept. Smokers are more willing to incur risks, and they face market offer curves that are lower and flatter than those of nonsmokers. The underlying economic rationale for this difference is that smokers are less efficient in the production of safety. Smokers are more prone to accidents at work. They are also more likely to be injured at home and, given the substantial health risks posed by smoking, are more likely to incur risks of other kinds as well. An economically interesting aspect of this heterogeneity is that the pattern of influences suggests that both the supply and demand components of the hedonic market equilibrium vary with smoking status.

Smokers value an expected lost workday injury from \$14,000 (*Injury Rate*) to \$20,000 (*Lost Workdays Rate*), whereas nonsmokers value an expected injury as \$31,000 (*Injury Rate*) to \$35,000 (*Lost Workdays Rate*). The extent of the risk-money tradeoff discrepancy between smokers and nonsmokers is roughly 100% for results using comparable risk measures. Overall, differences in job risk premia account for about one-fourth of the smoker-nonsmoker wage gap. If smokers faced the same job risk levels as do nonsmokers, the wage gap would even be greater because smokers have much higher risk jobs.

These findings do not necessarily imply that smokers are making fully rational decisions. However, they do suggest that smokers are exhibiting a consistent pattern of risk-taking behavior. More importantly, they illuminate the role of heterogeneity in the compensating differential process, which responds in quite reasonable ways to the greater riskiness of smokers.

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