Hazard Pay in Unsafe Jobs: Theory, Evidence, and Policy Implications

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PUBLIC POLICY ON OCCUPATIONAL SAFETY AND health is currently in a state of turmoil. The regulatory strategy embodied in the 1970 Occupational Safety and Health Act has been subjected to a sustained and articulate barrage of criticism from analysts arguing that the unregulated labor market gives firms appropriate incentives to improve working conditions, in the sense of minimizing the sum of hazard costs and hazard-reduction costs. These critics argue that firms using hazardous technologies will be forced to pay higher wages than firms using safer technologies in order to obtain an equivalent supply of labor, since workers prefer safe conditions and will shun dangerous jobs unless adequately compensated. The hazard-related wage premiums allegedly both compensate workers for the risks they take and promote prevention policies on the part of management, since wages can be reduced if working conditions improve. The model of labor-market competition and hazard pay has provided the theoretical underpinnings for the deregulatory policies pursued by the Occupational Safety and Health Administration (OSHA) since 1981: deceleration of standards promulgation, weakening of standards enforcement, budgetary and staff cutbacks (U.S. President 1982, Chap. 6).

With federal occupational health programs in a period of retrenchment, policy initiatives have occurred most frequently at the state and local

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levels. Rather than pursuing the traditional strategy of standards promulgation and enforcement, these state and local efforts have focused on ways to increase participation by exposed workers in decisions concerning working conditions. Most prominent among these efforts have been "right-to-know" statutes that require firms to prepare and make available information on toxic properties of the products and processes they employ, in the hope that such information will stimulate worker self-help initiatives.

While often framed in proregulatory language, these statutes implicitly accept the main claim raised by foes of regulation, namely that appropriately informed workers can and will act to improve working conditions, thereby accomplishing at least part of the function assigned to OSHA under the traditional standards-oriented strategy. In contrast to the position of OSHA's market-oriented critics, however, these right-to-know initiatives have created demands for a new generation of regulations that dictate ways in which management must collect, disseminate, and utilize exposure and illness data.

This article presents a theoretical and empirical analysis of the hazard-pay model and an evaluation of its significance for public policy, in particular for the new generation of worker-oriented regulations. Two alternative theories of labor-market functioning are examined, one of which predicts that wages should be higher in hazardous than in safe jobs, while the other suggests the opposite. The two theories are found to be conditional on different sets of assumptions and to be complementary rather than contradictory under certain conditions. The empirical analyses use five independent sets of data on workers, jobs, and wages, and three different measures of workplace hazard to evaluate the predictive power of the alternative theories. In the concluding section, it is argued that both the conservative and liberal positions on occupational safety and health suffer from logical contradictions that limit their reach. The conservative critics have embraced the theory of hazard pay as the justification for dismantling OSHA's standards-oriented programs, but fail to recognize the potentially radical implications of the theory for worker participation and industrial democracy. The liberal proponents of the right-to-know and related strategies have embraced the participatory policy orientation that is implied by the hazard-pay model while rejecting that model itself in favor of the model of worker-as-victim that underlay traditional standards-oriented policies.

Alternative Theories of Wages and Working Conditions

Mainstream economic theory argues that competitive pressures in the labor market force firms with unsafe jobs to pay extra-high wages. When comparing alternative employment possibilities, workers take into consideration all dimensions of job quality, including health and safety hazards, promotion possibilities, fringe benefits, and other characteristics in addition to wages. If a negative job characteristic of one kind (dangerous conditions) is not balanced by a positive characteristic of another kind (high wages, good fringe benefits, etc.) the job will not be filled. This theory of "compensating differentials" traces its origin to Adam Smith, who wrote in *The Wealth of Nations* ([1776] 1974):

> The whole of the advantages and disadvantages of the different employments of labour and stock must, in the same neighborhood, be either perfectly equal or continually tending to equality. If in the same neighborhood, there was any employment evidently either more or less advantageous than the rest, so many people would crowd into it in the one case, and so many would desert it in the other, that its advantage would soon return to the level of other employments.

The assumptions underlying this theory are threefold. Workers must be aware of the hazards present, they must dislike hazard, and they must have more than one job option. Hazard pay will hence be low or nonexistent for workers who are not informed about health hazards, for workers who adopt an attitude of machismo with respect to hazards, and for workers who, due to discrimination or lack of relevant skills, have limited employment options.

Of these three necessary conditions, the most controversial is that requiring full awareness of occupational hazards. Much of the policy debate surrounding occupational and environmental health stems precisely from the wide areas of public ignorance concerning toxicology, extent of exposures, and the etiology of occupation-related disease. Viscusi (1979) develops a learning model to deal with this issue. According to this theory, workers are often only dimly aware of potential hazards at the time they accept a job, but their perceptions become more precise as a result of experiences on the job. Workers who come to realize that their jobs are more hazardous than they initially thought

are more likely to quit than workers who find their initial evaluations confirmed or for whom the true level of hazard is less than they initially conjectured. Hazard-related turnover imposes significant hiring and training costs on management, which will respond by improving working conditions or paying wage premiums. To the extent workers are able to learn about the hazards they face, direct governmental regulation of those hazards is unnecessary and undesirable (Viscusi 1978, 1983).

Viscusi's model clearly depends on an ability by workers in hazardous jobs to find alternative, safer jobs in order to achieve its conclusion that the labor market provides a self-correcting response to ignorance about hazards. Many workers have accrued important seniority benefits over the course of employment that they are loath to abandon even in the face of convincing new evidence on workplace health hazards. Even in these situations, however, improved worker awareness of hazard may lead to better working conditions or higher hazard pay, though by different mechanisms than those envisaged by Viscusi. Leigh (1982), Worrall and Butler (1983), and Hirsch and Berger (1984) find that workers in hazardous jobs are more likely than comparable workers in similar jobs to be represented by a labor union. Robinson, Dickens, and Wholey (1984) find that this correlation is due, at least in part, to the influence of hazardous conditions on worker desires for union representation, since nonunion workers in hazardous jobs are observed to be more likely to vote for a union than nonunion workers in safe jobs. Robinson (1986) documents a number of worker responses to workplace hazard in addition to quitting and unionization, including strikes and individual acts of militancy that result in discharge for cause.

The theory of compensating differentials propounded by Adam Smith received its earliest and most vigorous criticism from John Stuart Mill, in *The Principles of Political Economy* ([1848] 1965). As part of his theory of noncompeting groups, Mill argues that the labor market is stratified by skill and status as well as working conditions and that hazardous jobs tend to be assigned to less skilled and disadvantaged workers who claim only low wages. In commenting on Adam Smith's theory, Mill writes:

> These inequalities of remuneration, which are supposed to compensate for the disagreeable circumstances of particular employments, would,

> under certain conditions, be natural consequences of perfectly free competition; and as between employments of about the same grade, and filled by nearly the same description of people, they are, no doubt, for the most part, realized in practice. But it is altogether a false view of the state of facts, to present this as the relation which generally exists between agreeable and disagreeable employments. The really exhausting and the really repulsive labours, instead of being better paid than others, are almost invariably paid the worst of all, because performed by those who have no choice. . . . The more revolting the occupation, the more certain it is to receive the minimum of remuneration, because it devolves on the most helpless and degraded, on those who from squalid poverty, or from want of skill and education, are rejected from all other employments.

This view of the labor market as stratified into relatively noncompetitive layers finds a contemporary echo in theories of dual or segmented labor markets (Doeringer and Piore 1971; Edwards 1979; Berger and Piore 1980). According to this perspective, jobs in large, profitable, and unionized firms tend to be both safer and better paying than those in small, competitive, and nonunion firms in the same industry. Within large firms another form of stratification develops, as jobs are ordered into distinct promotion sequences with restricted mobility among, as distinct from within, progressions. Some job ladders require considerable on-the-job training and, in order to reduce quitting, provide high wages and safe conditions. In job progressions not requiring substantial training investments, turnover is less costly, and, hence, both wage rates and working conditions are poor. This view of hazardous jobs as involving low skills, low wages, and being staffed with minority and other socially disadvantaged workers underlies those regulatory strategies that base themselves on equity and social justice arguments (Ashford 1976).

While appearing on the surface to make opposite predictions concerning the relation between wages and working conditions, the compensating-differentials and noncompeting-groups theories are in fact compatible when their respective assumptions are made clear. As evident in the quote from Mill, the noncompeting-groups theory does not contest the claim that hazard pay will be observed when comparing relatively similar jobs staffed with relatively similar workers, since competitive pressures will equalize the total value of these positions. Holding constant levels of skill and status, more hazardous jobs are thus predicted by both theories to pay higher wages than safer jobs.

The compensating-differentials model, at least in its contemporary formulation (Thaler and Rosen 1976; Viscusi 1978), does not contest the claim that the labor market will sort into hazardous jobs those workers for whom the level of wage premium demanded per unit of hazard faced is the lowest. Hazardous jobs are predicted to be staffed with less educated, less advantaged social groups and to offer less on-the-job training than safe jobs, since these factors influence the level of hazard pay workers can successfully demand. Neither the compensating-differentials theory nor the noncompeting-groups theory yields a prediction as to whether the tendency for hazardous jobs to pay high wages dominates the tendency for hazardous jobs to require few skills and, hence, pay low wages. Whether hazardous jobs pay more or less than safe jobs in an absolute sense, not controlling for levels of skill and status, is an empirical question.

Data and Methods

In order to test adequately the two models of labor-market performance, this article employs three measures of workplace hazard and five sets of data on jobs and workers. The hazard variables include one measure based on average injury and illness rates by occupation, one based on average rates by industry, and a third based on workers' own assessments of the hazards they face.

Risk Measures

The occupational-risk measure employed in this article is that developed by the Bureau of Labor Statistics (BLS) using information on successful Workers' Compensation claims from the 25 states participating in the Supplementary Data System of the BLS (Root and Sebastian 1981). The measure is the percentage of total injury and illness cases accounted for by the occupation, divided by the percentage of total employment accounted for. It should be emphasized that this measure is not an injury rate, but rather a ratio. An occupation with an average proportion of injuries to employment is ascribed a value of 100, while safe occupations obtain values less than 100 and dangerous occupations obtain values greater than 100. As an illustration using major census occupational groupings, professional and technical workers are assigned

an index of 21, managers and administrators an index of 28, sales workers an index of 28, clerical workers an index of 24, nonhousehold service workers an index of 92, craft workers an index of 140, nontransport operatives an index of 179, transport equipment operatives an index of 209, and laborers an index of 370. The Workers' Compensation-based measure undercounts diseases not usually identified as occupational or not compensable as such under state laws.

The industry-level measure of hazard is based on mandatory injury-reporting forms collected by OSHA for the Bureau of Labor Statistics and published annually by industry at the one- through four-digit Standard Industrial Classification level. In order to focus on serious events, this study utilizes the rate of injuries resulting in at least one day lost from work, rather than the rate of total reported injuries. It is likely that differences in reporting styles among employers will be less important for these more substantial injuries. In 1977, for example, the rate of injuries resulting in at least one day lost from work was 51 per 1,000 employees in agriculture, forestry, and fisheries; 60 per 1,000 in mining; 59 per 1,000 in construction; 54 per 1,000 in durable goods manufacturing; 47 per 1,000 in nondurable goods manufacturing; 53 per 1,000 in transportation, communication, and public utilities; 29 per 1,000 in wholesale and retail trade; 8 per 1,000 in finance, insurance, and real estate; 22 per 1,000 in service industries; and 31 per 1,000 in the public sector.

The third measure of hazard is available in those data sets that include questions concerning conditions faced on the job. Responses to hazard-exposure questions are coded for this article in the form of a single dichotomous variable that takes the value 1 if the worker reports serious levels of exposure to any health or safety risk, and zero otherwise. Low and moderate levels of reported exposure are thus treated as nonexposures, so as to reduce the influence of idiosyncratic differences in worker evaluations of exposure levels.

Data Sources

The five sets of survey data provide different but complementary sources of information on working conditions, wages, and other job and worker characteristics. In general, data sets that include large numbers of workers surveyed present fewer available variables, since the cost per questionnaire increases rapidly with the number of questions

asked. Two of the data sets used here were adopted due to their large sample sizes, while the other three were employed in order to exploit the richer information on working conditions they contain.

The May 1977 Current Population Survey (CPS) contains information on 35,011 individuals employed during that month, including the hourly wage they were paid, the industry and occupation in which they were employed, and other variables on race, sex, age, education, and area of residence (Inter-University Consortium for Political and Social Research 1982). The industry and occupation information is coded by three-digit census codes, by which the Workers' Compensation measure of occupational risk and the OSHA measure of industrial injury rates can be merged. The demographic information is used to control for skill, status, and area cost of living differences that influence wages independently of the level of hazard.

The Panel Study of Income Dynamics (PSID) is an ongoing study of approximately 6,000 individuals who are reinterviewed annually by the University of Michigan's Survey Research Center (Institute for Social Research 1974). The PSID contains information on hourly earnings, plus demographic and area of residence variables similar to those in the CPS. In addition, it contains information on each respondent's total years of labor-force experience, years of tenure with current employer, and presence of any health limitations on the kind of work that can be performed. The 1974 year of the survey was used since it was the only year in which the respondent's three-digit census occupation code is included. Industry is also coded, but unfortunately only at the broad two-digit level. After excluding those not working due to retirement, student status, or other reasons, the 1974 PSID includes 4,533 observations.

The 1977 Quality of Employment Survey (QES) is a random sample of workers employed 20 hours a week or more in 1977, and provides the richest source of information on working conditions available in any broadly representative data set (Inter-University Consortium for Political and Social Research 1979). The primary advantage of the QES for present purposes lies in the large number of questions asked concerning hazards faced on the job, which form the basis of the worker-assessed hazard variable discussed earlier. Data on all relevant variables are available for 1,138 QES respondents.

The QES also contains three-digit census industry and occupation codes, plus information on worker race, sex, experience, education,

tenure, and area of residence. Five worker-assessed job characteristics in addition to the hazard measure are included to control for other workplace-related determinants of wages. These are used in the form of five dichotomous variables that take the value 1 if the worker reports his or her job provides no meaningful skills, is insecure, has no meaningful promotion possibilities, has unpleasant physical surroundings, or has poor supervisorial relations, and zero otherwise. Unfortunately, the QES does not allow the researcher to calculate hourly earnings for these workers paid by the week or the month. Annual earnings are thus used as the dependent variable in this article.

The last two data sets are the Young Women's and Young Men's National Longitudinal Survey (NLS) from 1982 and 1980, respectively (Inter-University Consortium for Political and Social Research 1984). These two data sets offer the advantages of worker-assessed hazard measures combined with sample sizes more than twice as large as that available in the QES. Both surveys ask respondents to rate the extent to which their jobs are dangerous and the extent to which they are exposed to unhealthy conditions. The hazard measure used in this article is a dichotomous variable taking the value 1 if the respondent says that it is "very true" that his or her job is dangerous or unhealthy, and zero otherwise. As in the case of the QES, mild exposure levels are treated as nonexposures. Experimentation with the danger and unhealthy conditions measures separately did not produce significant differences, since most jobs considered dangerous were also considered unhealthy.

The NLS data sets include hourly earnings, union representation, race, experience, tenure, health status, and area of residence variables similar to those in the other data sets. The NLS includes the same five worker-assessed job characteristics in addition to hazard as are used with the QES. The average industry and occupation injury and illness rates are not employed with the two NLS data sets since those rates are based on the experiences of all workers in each industry and occupation. The NLS data are not representative of the entire workforce but only of particular groups stratified by sex and age. For example, the average industry injury rate provides a very poor measure of working conditions faced by NLS women, who are disproportionately represented in white-collar occupations within industries, while the variation in the injury rate is largely caused by differences in working conditions faced by blue-collar workers. The concentration of women

in a relatively small number of occupations substantially reduces the predictive power of the average occupation risk measure, which is useful only in comparing experiences across a broad spectrum of occupations. These problems are less serious for the young men's sample, but even here it was clear that the occupational and industrial employment mix of young people who are often still uncertain as to their ultimate career choice was not at all consistent with the employment mix of the entire workforce, as observable in the CPS, PSID, and QES.

Statistical Methods

In order to observe the overall association between wages and working conditions, and to evaluate the respective strengths of the compensating-differentials and noncompeting-groups effects, the five data sets were first sorted into hazardous and safe subsamples using each of the hazard measures. Average levels of wages and earnings were then computed for each subsample. Hazardous occupations and industries were defined as those with occupation-risk indices and industry-injury rates equal to or greater than the sample mean, while safe occupations and industries were defined as those with risk indices and injury rates below the mean. Hazardous jobs in the QES and NLS samples were defined as those in which significant exposure levels were reported, while safe jobs were defined as those in which no exposures or only mild exposures were reported.

In order to control for skill, status, and area cost of living influences on wages, the earnings levels in each of the five data sets were then regressed against the hazard measures and the control variables discussed earlier. Based on these multivariate regressions, adjusted average wage and earnings levels are presented in the tables in the body of the text along with the unadjusted averages discussed above. Full regression results plus the formula used for calculating adjusted means are presented in the appendix.

Findings

Wages and Hazards across Occupations

Table 1 records unadjusted and adjusted mean earnings for CPS, PSID, and QES workers in hazardous and safe occupations, respectively,

TABLE 1
Wages and Hazards across Occupations

	Hazardous occupations	Safe occupations	P
	UNADJUSTED MEANS		
CPS (hourly earnings)	$ 5.27	$ 5.73	0.0001
PSID (hourly earnings)	$ 4.86	$ 5.70	0.0001
QES (annual earnings)	$12,437	$13,227	0.0367
	ADJUSTED MEANS		
CPS (hourly earnings)	$ 5.33	$ 5.69	0.0001
PSID (hourly earnings)	$ 4.99	$ 5.48	0.0004
QES (annual earnings)	$12,674	$13,061	0.2423

Note: P values are based on the T test for significance of the coefficients on the hazard variables in the univariate and multivariate regressions. The formula for calculating the adjusted means is presented in the appendix.

where hazardous and safe are defined with respect to the average Workers' Compensation risk index for the entire sample. Workers in occupations generating few Workers' Compensation injury and illness claims clearly earn more than workers in occupations generating many claims, with the difference ranging from 6 percent more in the QES to 17 percent more in the PSID. Noncompeting-groups effects dominate compensating-differentials effects overall; hazardous occupations pay lower, not higher, wages than do safe occupations.

The fourth through sixth rows of table 1 record adjusted mean earnings by extent of hazard, after controlling for differences in race, sex, years of education and experience, and the other variables discussed in the previous section. The earnings disadvantage faced by workers in hazardous occupations is attenuated compared to that observed in the unadjusted means, but is not eliminated. Even controlling for other measurable determinants of wage levels, workers in occupations with Workers' Compensation risk indices above the mean earn 3 to 10 percent less than similar workers in occupations with risk indices below the mean. The continued significantly negative association between wage rates and hazard levels across occupations testifies to the strength of the noncompeting-groups effect.

TABLE 2
Wages and Hazards across Industries

	Hazardous industries	Safe industries	P
	UNADJUSTED MEANS		
CPS (hourly earnings)	$ 5.82	$ 5.29	0.0001
PSID (hourly earnings)	$ 5.28	$ 5.08	0.0502
QES (annual earnings)	$14,318	$11,878	0.0001
	ADJUSTED MEANS		
CPS (hourly earnings)	$ 5.63	$ 5.34	0.0001
PSID (hourly earnings)	$ 5.31	$ 5.06	0.0153
QES (annual earnings)	$13,618	$12,298	0.0003
	ADJUSTED MEANS, INCLUDING PERCENTAGE UNIONIZED		
CPS (hourly earnings)	$ 5.35	$ 5.51	0.0001
PSID (hourly earnings)	$ 5.15	$ 5.20	0.6388
QES (annual earnings)	$13,118	$12,598	0.2193

Note: P values are based on the T test for significance of the coefficients on the hazard variables in the univariate and multivariate regressions. The formula for calculating the adjusted means is presented in the appendix.

Wages and Hazards across Industries

Unadjusted and adjusted mean earnings for workers in hazardous and safe industries, with hazard defined with respect to the sample average of the OSHA industry injury rate, are presented in table 2. In direct contrast to the results for occupations in table 1, the industry figures show that workers in hazardous industries earn 10 to 20 percent higher wages than workers in safe industries. While this correlation is consistent with the compensating-differentials effect, it is not a test of the theory, since that theory only predicts a positive association between wages and hazards when skill and status levels are taken into account.

Adjusted mean earnings that control for measurable dimensions of skill and status and, hence, that do provide a test for the compensating-differentials effect are presented in the fourth through sixth rows of table 2. The correlation between wages and hazardous working conditions continues to be significantly positive, but is no longer as strong as in the unadjusted means, with workers in hazardous industries earning

5 to 11 percent higher wages than comparable workers in safe industries. This continuing positive correlation does appear to support the compensating-differentials effect. Several aspects of the relationship are disturbing, however.

First, the positive association between hazard and wages is weakened, not strengthened, when one controls for skill and status. Second, the positive association between hazard and wages was found in other work (not presented here but available from the author) to be as strong for white-collar workers as for blue-collar workers. Indeed, for the CPS, PSID, and QES samples, white-collar workers earn a higher premium for working in a hazardous industry than do blue-collar workers. The compensating-differentials theory does not predict that wage rates for secretaries and accountants, for example, should be higher in the mining industry than in the banking industry merely due to the differences in working conditions faced by laborers and craft workers in those industries. Third, and most important, these findings conflict with those obtained using the occupation-level measure of hazard. This conflict between findings based on industry and occupation-based hazard measures has been reported repeatedly in the literature, and commented upon most forcefully by Smith (1979).

These issues suggest that the theory of compensating differentials may not be the appropriate explanation for the positive association between wages and injury rates across industries. It is possible that the injury rate, when used as the sole industry-level variable in regressions where the unit of analysis is the individual worker, is picking up more general cross-industry differences in the employment relationship. One important factor that has traditionally linked wage rates together within particular industries and unlinked them from wage rates in other industries has been collective-bargaining patterns. Unions in the United States tend to organize along industrial lines and seek to standardize wage rates within industries rather than allow them to vary freely with respect to area and occupation differences in labor supply. Wage rates for unskilled laborers in a steel mill in Chicago, Illinois, for example, are more closely related to laborer rates in a steel mill in Birmingham, Alabama, than to laborer rates in construction in Chicago. They are more closely related to skilled craft rates in the steel mill itself than they are to unskilled laborer rates outside the mill. If industry injury rates are strongly and positively associated with unionization levels across industries, then the injury rate variable

could be picking up the influence of unionization, rather than hazard, on wage rates. The wage regressions discussed above do include a dichotomous variable indicating whether the individual respondent is covered by collective bargaining. They do not include a variable indicating the percentage of the industry workforce that is unionized, though this union-power variable is likely to influence the wage rate earned by nonunion as well as union workers.

In order to test the hypothesis that the positive association between wages and industry injury rates is due to the correlation between injury rates and level of union organization, the wage regressions were reestimated, including as an additional variable the percentage of the industry workforce that is unionized. These regressions continue to include the dichotomous variable for whether the individual worker is covered by collective bargaining. Results from these regressions for the CPS, PSID, and QES are presented in the seventh through ninth rows of table 2.

Consistent with the hypothesis raised, inclusion of the percentage-unionized variable eliminates the observed correlation between wages and industry-injury rates. The coefficient on the injury-rate variable continues to be positive for QES workers, but is no longer statistically different from zero. It is negative in the PSID and CPS regressions, significantly so in the CPS.

The pattern of wages and hazards across major occupation and industry groupings thus appears to be as follows. Hazardous occupations tend to be low-skill, low-status occupations that pay wages less than those obtained in safe occupations. Wage rates in industries with high injury rates tend to be higher than wage rates in industries with lower injury rates. This latter association is due to the presence in industries with high injury rates of large numbers of high-wage white-collar workers and of labor unions that extract high levels of compensation for those blue-collar workers who do face hazards. Workers in very hazardous occupations that are not simultaneously in highly unionized industries do not receive meaningful levels of hazard pay.

Wages and Hazards across Jobs

The findings of wage patterns related to average occupation and industry hazard levels testify to the importance of skill, status, and unionization in explaining wage rates in the United States economy. They cannot,

TABLE 3
Wages and Hazards across Jobs

	Hazardous jobs	Safe jobs	P
UNADJUSTED MEANS: FULL SAMPLE			
QES (annual earnings)	$12,740	$12,756	0.9728
NLS women (hourly earnings)	$ 5.43	$ 5.50	0.6234
NLS men (hourly earnings)	$ 6.93	$ 7.62	0.0001
ADJUSTED MEANS: FULL SAMPLE			
QES (annual earnings)	$12,657	$12,807	0.7174
NLS women (hourly earnings)	$ 5.46	$ 5.48	0.9008
NLS men (hourly earnings)	$ 7.33	$ 7.32	0.9535
ADJUSTED MEANS: BLUE-COLLAR SAMPLE			
QES (annual earnings)	$11,708	$11,584	0.7696
NLS women (hourly earnings)	$ 4.87	$ 4.71	0.3609
NLS men (hourly earnings)	$ 6.79	$ 6.38	0.0049

Note: P values are based on the T test for significance of the coefficients on the hazard variables in the univariate and multivariate regressions. The formula for calculating the adjusted means is presented in the appendix.

however, provide a satisfactory test of the theory of hazard pay and compensating differentials, since they do not discern differences in exposure levels faced by workers within the same occupation and industry. Yet, as John Stuart Mill points out, the compensating-differentials theory is primarily about wage-hazard relations among jobs with relatively similar characteristics and staffed by relatively similar workers. In order to observe the effects of competition among workers for safe jobs within occupation and industry strata, it is essential to use worker-specific measures of exposure.

Table 3 records unadjusted and adjusted mean earnings for QES, Young Women's NLS, and Young Men's NLS workers according to whether or not they report serious levels of exposure to at least one health or safety hazard on the job. The unadjusted means in the first three rows of the table do not control for differences in skill and status, and, hence, pick up both compensating-differentials and non-competing-groups effects. No consistent pattern is evident, with QES workers and NLS women in hazardous jobs earning almost exactly

the same as workers in safe jobs, while NLS men in hazardous jobs earn 10 percent less per hour than their counterparts in safe jobs.

The fourth through sixth rows of the table present adjusted mean earnings where measurable dimensions of skill and status are controlled for. In principle, these figures should reflect compensating-differentials effects. Once again, however, a consistent pattern fails to emerge. QES workers and NLS women in hazardous jobs report lower, not higher, hourly wages than comparable workers—i.e., those with similar skill and status—in safe jobs. NLS men in hazardous jobs report levels of annual earnings very similar to those reported by comparable workers in safe jobs. These figures thus appear to be picking up noncompeting-groups effects as well as compensating-differentials effects, even after controlling for race, age, job tenure, and a host of other explanatory variables.

The seventh through ninth rows of table 3 record adjusted mean earnings for blue-collar QES and NLS workers alone. The blue-collar figures do reveal the role of worker competition and hazard pay within, as distinct from across, broad occupational strata. Once white-collar workers are deleted from the sample, a positive association between wage rates and hazard exposures is observed, though it is small. Blue-collar QES workers in hazardous jobs earn 1 percent more per year than blue-collar QES workers in safe jobs. Blue-collar NLS workers earn 4 to 7 percent more per hour if they are exposed to serious hazards than if they are not. Only the difference for NLS men is statistically significant at the 95-percent confidence level, however.

Policy Implications: Participatory Regulation

The findings presented in this article indicate that each of the two warring paradigms in occupational safety and health policy has at least some degree of validity. Controlling for skill, status, and occupational stratification, workers in hazardous jobs earn somewhat higher wages than comparable workers in safe jobs, as argued by conservative critics of OSHA. On the other hand, the strong tendency for employers using hazardous materials and processes to reduce the level of skill and status in their jobs creates the situation often described by liberal advocates of regulation: hazardous jobs are usually bad jobs in terms of wages, employment security, skill, and status, as well as working conditions. Governmental interventions targeted at workers

in hazardous jobs will, therefore, on average, be reaching the least advantaged members of the working population. The most important implications of these findings, however, concern the rationale for and desirable scope of informational and other worker-oriented OSHA strategies. Each of these points deserves a brief elaboration.

Early advocates of OSHA regulation tended to dismiss hazard-pay theories as completely counterintuitive, or, at best, as relevant only to explicitly negotiated, union hazard-pay clauses. (In the early 1970s, 15 percent of large union contracts had hazard-pay clauses covering at least some workers [U.S. Department of Labor, Bureau of Labor Statistics 1976].) Workers were typically portrayed as noble but hapless victims of the working conditions they faced, combining ignorance about exposure with macho attitudes and a lack of viable job alternatives.

This paternalistic justification for governmental intervention is less tenable now than it ever was. While they are certainly not fully informed about the hazards they face, workers overall are neither ignorant nor indifferent. Thirty-three percent of QES respondents, 27 percent of NLS women respondents, and 44 percent of NLS men respondents report serious hazards on the job. When attention is confined to blue-collar workers who are most at risk, those figures rise to 51 percent, 45 percent, and 62 percent, respectively. The wage data analyzed in this article indicate that workers are successful in gaining a certain degree of monetary compensation for facing those hazards. While the mechanisms underlying the wage premiums cannot be observed here, the studies summarized in the first sections of the article suggest that workers use a combination of "exit" and "voice" strategies (Hirschman 1970). Quitting, unionization, discharges for cause, and strikes are all more frequent in hazardous than in safe jobs.

These self-help efforts by workers exposed to hazardous conditions do not produce, however, the scenario sometimes evoked in conservative writings, according to which workers in hazardous jobs are high-income members of society, trading slightly increased chances of injury and illness for a comfortable middle-class lifestyle. While some hazardous jobs are, indeed, high paying in an absolute sense, most are not. The level of wage premiums employers must pay per unit of hazard to obtain employees increases rapidly with the number of alternative job options each worker has. This gives employers very strong incentives to organize production in such a manner as to be able to use those workers with the fewest job alternatives. Wherever possible, therefore, hazardous jobs are placed in low-skill, low-status job progressions,

and filled with socially disadvantaged workers. Shop-floor struggles for improved working conditions are, therefore, generally efforts by the least favored members of society to better their relative positions.

The available evidence on hazard pay suggests that a potentially effective self-help worker strategy exists, and that there is an important role within that strategy for regulatory initiatives of a new kind. The figures presented here certainly do not indicate that workers are fully and adequately compensated for the risks they take, nor that firms face the appropriate level and mix of incentives to invest in protective measures. Ignorance, indifference, and lack of better job alternatives continue to plague worker-oriented strategies and result in clearly excessive rates of occupational injury and illness. Intelligently designed and implemented public policies can, in principle, contribute substantially to workers' own efforts.

It is interesting, in light of this discussion, to note the evolution of OSHA standards since the early years of the agency. The first wave of standards focused on easily recognizable safety problems, and came to be criticized by many in labor as well as management as unnecessary, ineffective, and damaging to the reputation of the agency. Many of these standards were repealed by the prolabor OSHA of the Carter presidency. As the 1970s progressed, OSHA gradually shifted its focus from safety to health hazards. The end of the decade was the period when the agency promulgated or sought to promulgate strict health standards governing asbestos, polyvinyl chloride, chemical carcinogens, cotton dust, benzene, coke-oven emissions, and other major health hazards. By the last year of the Carter administration in 1980, however, interest was rising in the so-called "industrial relations" standards. Rather than set exposure limits to any particular substance, these standards attempted to change the ways in which workers, unions, and management interact on health and safety issues.

The best known of the various industrial-relations standards guaranteed to workers the "right to know" about the presence and degree of hazardous substances on the job (Ashford and Caldart 1985; Baram 1984; Bureau of National Affairs 1984). The original right-to-know standard was promulgated by the Carter administration in its final months and rescinded by the new Reagan administration. This encouraged states and localities to promulgate their own right-to-know standards, often covering substances encountered in the general environment as well as in the workplace. This, in turn, prompted the Reagan administration to promulgate its own, substantially more

narrow, standard. While differing with respect to the classes of substances and industries covered, the various right-to-know standards all embody the same principle—that worker participation in the decisions concerning working conditions is desirable and that information concerning hazards is a necessary first step. Analogous principles underlie the federal standard designed to guarantee to workers access to the medical records kept on those workers by their employers' medical departments (Ashford, Spadafor, and Caldart 1984).

Other industrial-relations standards more directly concern workers' rights with respect to performing hazardous tasks and with respect to transferal if they suffer a partially handicapping accident or are at special risk of disease if exposed to a toxin. Various pieces of legislation and case law are designed to protect workers' rights to refuse tasks that they perceive as posing imminent threats to health and safety (Ashford and Katz 1977; Drapkin 1980). These rules, which have been the subject of considerable debate in the courts, depart from the general practice of labor relations policy, which declares that management moves and union grieves, i.e., that instructions are to be carried out when given but can be contested later through the grievance mechanism with the possibility of retroactive compensation. Another set of rules has attempted to force employers who transfer workers because of job-related injuries, work-related hypersensitivity to particular chemical agents, or teratogenic threat to pregnancy to continue paying the workers at their original wage scales. These rules have had mixed success in the courts (Ashford, Spadafor, and Caldart 1984).

Finally, some industrial-relations standards seek to facilitate the involvement of the worker and the labor union in the regulatory process itself. The original 1970 act guaranteed to workers the right to call an OSHA inspection, participate in the inspection process, and be protected from management retaliation for so doing. The Carter administration promulgated a "walkaround pay" regulation requiring that workers participating in OSHA inspections be paid by the company at their regular rate for the time spent on the inspection. This regulation was subsequently rescinded by the Reagan administration. The "New Directions" grants program developed during the Carter administration provided funds for unions, universities, and firms to set up health and safety programs designed to educate workers about hazards. These grants were continued under the Reagan administration, albeit at a lower total level of funding and with greater emphasis on management than union and university programs (Lawrence and Mager 1982).

These standards, administrative rules, and funding programs are not usually considered under one rubric but do share the common principle of encouraging greater participation by workers. The list is not exhaustive of the possibilities, nor is every item on the list necessarily a desirable addition to occupational safety and health policy. It would be hard to argue from either a regulatory or a market-oriented perspective, however, that the industrial-relations standards as a group do not offer an interesting and imaginative set of possibilities for governmental policy.

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Appendix: Calculation of Unadjusted and Adjusted Mean Earnings

Unadjusted mean earnings for workers in hazardous and safe employments can be calculated by dividing the full sample into hazardous and safe subsamples and calculating mean earnings levels separately. Alternatively, unadjusted means may be derived from the univariate regression

$$(1)\quad w_i = b_0 + b_1 h_i + u_i$$

where w_i is the wage of the ith worker, h_i is the level of hazard he or she faces, u_i is a stochastic error term with zero mean, and b_0 and b_1 are coefficients. The average wage for the entire sample (W) is then

$$(2)\quad W = B_0 + B_1 H$$

where H is the average level of hazard and B_0 and B_1 are ordinary least squares estimates of b_0 and b_1. When hazard is measured as a dichotomous variable (high/low, exposed/nonexposed), then the average wage level for workers in safe jobs (H = 0) is B_0, while the average wage level for workers in hazardous jobs (H = 1) is

$$(3)\quad W_h = B_0 + B_1$$

With this framework in place, interpretation of the adjusted means is straightforward. Instead of (1), the estimated equation is now

$$(4)\quad w_i = b_0 + b_1 h_i + b_2 x_i + u_i$$

where x_i is a vector of nonhazard determinants of wages (education, experience, etc.) and b_2 is a corresponding coefficient vector. The mean wage level for the full sample is now

$$(5)\quad W = B_0 + B_1 H + B_2 X$$

where X is a vector of average values for the variables in x_i and B_2 is the vector of OLS estimates of b_2. The adjusted mean wage W_H for workers in hazardous positions H_H is

$$\begin{aligned}(6)\quad W_H &= B_0 + B_1 H_H + B_2 X \\ &= B_0 + B_1 H + B_2 X + B_1(H_H - H) \\ &= W + B_1(H_H - H)\end{aligned}$$

while that for workers in safe employments H_s is $W + B_1(H_s - H)$. If hazard is measured in a dichotomous fashion, H is the fraction of workers exposed, and (6) reduces to

$$\begin{aligned}(7)\quad W_H &= B_0 + B_1 H + B_2 X + B_1(1 - H) \\ &= B_0 + B_1 + B_2 X\end{aligned}$$

which can be easily compared to (3).

Appendix tables 1 to 5 record ordinary least squares coefficients and standard errors from the regressions of equation (4) using the five data sets and three hazard measures. From these values of B_0, B_1, and B_2 plus sample means W, H, H_H, H_s, and X the figures in text tables 1 to 3 were calculated.

APPENDIX TABLE 1

Wages and Hazards across Occupations: Regression Results

	Hourly wages (cents)	Hourly wages (cents)	Annual earnings (dollars)
	1977 CPS	1974 PSID	1977 QES
Occupational hazard index	−0.24	−0.18	−2.35
	(0.02)	(0.05)	(2.01)
Worker is unionized	103.76	34.53	886.90
	(3.97)	(12.48)	(448.99)
Worker is black	−54.19	−67.88	−302.43
	(6.11)	(13.62)	(722.04)
Worker is female	−213.67	−175.49	−5608.48
	(3.68)	(14.90)	(444.11)
Years of education	37.40	31.24	809.70
	(0.72)	(2.12)	(87.59)
Years of experience	17.28	8.79	519.15
	(0.43)	(1.56)	(61.12)
Years of tenure	—	15.49	220.48
		(2.57)	(95.49)
Worker is healthy	—	57.83	716.72
		(18.35)	(643.24)
Experience squared	−0.26	−0.14	−9.26
	(0.01)	(0.03)	(1.24)
Tenure squared	—	−0.35	−3.97
		(0.10)	(3.77)
SMSA	47.14	75.18	2192.45
	(3.80)	(12.50)	(441.48)
Northeast	−4.13	50.63	−203.71
	(4.96)	(16.47)	(561.24)
North central	17.63	59.64	784.43
	(4.59)	(14.29)	(510.66)
West	56.12	20.27	1108.92
	(5.17)	(17.17)	(602.86)
No training	—	—	−785.48
			(551.63)
Insecure job	—	—	−997.15
			(483.40)
No promotions	—	—	−1359.43
			(415.21)
Unpleasant surroundings	—	—	314.30
			(446.16)
Bad supervision	—	—	363.65
			(513.08)
R^2	0.25	0.21	0.40
N	33,555	4,216	1,074

Note: These regression results were used for computing the adjusted mean earnings levels in rows 4 to 6 of text table 1.

APPENDIX TABLE 2
Wages and Hazards across Industries: Regression Results Excluding Percentage Unionized

	Hourly wages (cents)	Hourly wages (cents)	Annual earnings (dollars)
	1977 CPS	1974 PSID	1977 QES
Industry injury rate	0.71	0.70	33.54
	(0.08)	(0.29)	(9.30)
Worker is unionized	94.07	22.44	555.85
	(3.95)	(12.01)	(454.10)
Worker is black	−60.69	−68.80	−458.01
	(5.90)	(13.02)	(716.43)
Worker is female	−191.99	−161.67	−5146.88
	(3.68)	(14.24)	(455.83)
Years of education	42.29	35.27	952.36
	(0.68)	(1.94)	(85.99)
Years of experience	17.11	8.98	490.78
	(0.41)	(1.48)	(60.64)
Years of tenure	—	15.38	227.45
		(2.42)	(95.13)
Worker is healthy	—	61.40	716.06
		(17.22)	(664.70)
Experience squared	−0.25	−0.14	−8.70
	(0.01)	(0.03)	(1.23)
Tenure squared	—	−0.39	−4.71
		(0.09)	(3.77)
SMSA	52.58	95.92	2275.63
	(3.72)	(11.70)	(441.99)
Northeast	−1.79	61.70	−243.64
	(4.90)	(15.90)	(566.00)
North central	13.64	51.93	765.18
	(4.54)	(13.53)	(514.80)
West	54.58	15.02	1079.38
	(5.09)	(16.20)	(596.47)
No training			−633.62
	—	—	(542.43)
Insecure job			−1085.56
	—	—	(481.84)
No promotions	—	—	−1655.87
			(414.22)
Unpleasant surroundings	—	—	300.48
			(449.82)
Bad supervision	—	—	522.42
			(516.48)
R^2	0.26	0.23	0.40
N	35,011	4,533	1,106

Note: These regression results were used for computing the adjusted mean earnings levels in rows 4 to 6 of text table 2.

APPENDIX TABLE 5

Wages and Hazards across Industries: Regression Results Including Percentage Unionized

	Hourly wages (cents)	Hourly wages (cents)	Annual earnings (dollars)
	1977 CPS	1974 PSID	1977 QES
Industry injury rate	−0.38	−0.15	12.84
	(0.09)	(0.33)	(10.45)
Industry percentage unionized	2.27	2.02	46.80
	(0.10)	(0.35)	(11.07)
Worker is unionized	68.08	3.70	33.39
	(4.07)	(12.41)	(467.24)
Worker is black	−55.66	−74.35	−340.56
	(5.86)	(13.01)	(711.47)
Worker is female	−179.22	−161.74	−4891.60
	(3.69)	(14.19)	(456.34)
Years of education	42.60	33.06	988.09
	(0.67)	(1.98)	(85.75)
Years of experience	16.09	8.73	488.60
	(0.41)	(1.47)	(60.18)
Years of tenure	—	15.01	219.34
		(2.42)	(94.42)
Worker is healthy	—	59.48	704.84
		(17.16)	(639.75)
Experience squared	−0.23	−0.13	−8.57
	(0.01)	(0.03)	(1.22)
Tenure squared	—	−0.38	−5.29
		(0.09)	(3.75)
SMSA	48.60	96.33	2151.17
	(3.70)	(11.66)	(439.58)
Northeast	−1.09	61.93	−174.19
	(4.86)	(15.84)	(561.89)
North central	9.89	48.50	733.72
	(4.50)	(13.50)	(510.90)
West	57.55	16.10	1193.13
	(5.05)	(16.14)	(592.50)
No training	—	—	−743.69
			(476.89)
Insecure job	—	—	−1070.33
			(478.15)
No promotions	—	—	−1539.36
			(411.96)
Unpleasant surroundings	—	—	99.55
			(448.88)
Bad supervision	—	—	371.24
			(513.76)
R^2	0.27	0.23	0.41
N	35,011	4,533	1,106

Note: These regression results were used for computing the adjusted mean earnings levels in rows 7 to 9 of text table 2.

APPENDIX TABLE 4
Wages and Hazards across Jobs: White Collar and Blue Collar Workers

	Annual earnings (dollars)	Hourly earnings (cents)	Hourly earnings (cents)
	1977 QES	1980 NLS women	1978 NLS men
Hazard	−147.77	−14.88	10.74
	(408.24)	(14.74)	(15.81)
Worker is unionized	965.11	42.39	28.59
	(421.19)	(13.87)	(16.11)
Worker is black	−452.19	−40.81	−128.97
	(667.98)	(14.99)	(19.20)
Worker is female	−5516.32	—	—
	(402.56)		
Years of education	867.16	36.55	48.36
	(78.17)	(3.46)	(3.85)
Years of experience	482.62	1.34	
	(56.72)	(9.22)	(9.32)
Years of tenure	233.78	26.04	13.07
	(88.42)	(4.42)	(5.04)
Worker is healthy	540.72	2.86	
	(602.28)	(21.12)	(28.66)
Experience squared	−8.53	0.05	−1.65
	(1.15)	(0.32)	(0.34)
Tenure squared	−4.66	−0.81	−0.30
	(3.51)	(0.31)	(0.35)
SMSA	2401.33	66.44	113.97
	(412.20)	(14.23)	(16.17)
Northeast	−104.58	—	—
	(525.50)		
North central	906.23	—	—
	(478.91)		
West	1233.58	—	—
	(556.15)		
South	—	−49.13	−58.31
		(13.42)	(16.26)
No training	−974.88	4.13	−35.56
	(506.02)	(14.51)	(17.45)
Insecure job	−1230.27	−28.61	17.35
	(450.25)	(15.91)	(18.58)
No promotions	−1674.15	−60.60	−61.73
	(386.54)	(13.40)	(15.90)
Unpleasant surroundings	298.51	24.40	31.28
	(433.92)	(14.82)	(16.45)
Bad supervision	656.64	26.88	18.27
	(480.92)	(16.14)	(18.71)
R^2	0.43	0.20	0.19
N	1,138	1,730	2,335

Note: These regression results were used for computing the adjusted mean earnings levels in rows 4 to 6 of text table 3.

APPENDIX TABLE 5
Wages and Hazards across Jobs: Blue Collar Workers

	Annual earnings (dollars)	Hourly earnings (cents)	Hourly earnings (cents)
	1977 QES	1980 NLS women	1978 NLS men
Hazard	125.02	16.06	41.39
	(426.62)	(18.33)	(14.22)
Worker is unionized	2202.61	84.60	122.83
	(437.91)	(19.10)	(14.60)
Worker is black	−1939.65	−15.78	−105.68
	(668.44)	(20.47)	(16.72)
Worker is female	−5652.18	—	—
	(465.48)		
Years of education	551.13	17.43	25.67
	(114.12)	(5.75)	(4.54)
Years of experience	335.79	−15.22	35.78
	(59.90)	(17.34)	(10.53)
Years of tenure	277.65	22.59	3.92
	(93.87)	(7.04)	(4.75)
Worker is healthy	512.46	−4.74	22.34
	(656.88)	(25.75)	(25.59)
Experience squared	−6.46	0.48	−1.00
	(1.21)	(0.52)	(0.35)
Tenure squared	−4.94	−0.95	−0.12
	(3.67)	(0.51)	(0.33)
SMSA	1982.91	37.16	85.71
	(425.88)	(19.47)	(14.59)
Northeast	−794.53	—	—
	(579.55)		
North central	962.04	—	—
	(515.50)		
West	989.34	—	—
	(612.05)		
South	—	−119.66	−82.31
		(20.63)	(15.64)
No training	−868.54	−10.71	−25.45
	(468.98)	(19.19)	(15.33)
Insecure job	−939.05	−55.46	23.11
	(459.29)	(20.52)	(17.35)
No promotions	−1354.32	−54.67	−19.61
	(418.94)	(19.78)	(14.72)
Unpleasant surroundings	934.43	37.93	53.76
	(439.23)	(20.09)	(15.06)
Bad supervision	−393.33	31.94	−17.18
	(498.52)	(21.81)	(17.39)
R^2	0.51	0.39	0.28
N	580	326	1,230

Note: These regression results were used for computing the adjusted mean earnings levels in rows 7 to 9 of text table 3.