Union, Labor Market Structure, and the Welfare Implications of the Quality of Work

W. KIP VISCUSI
Northwestern University

I. Introduction

The institutional labor economics literature suggests that trade unions have diverse impacts on worker wage rates, promotion policies, grievance procedures, internal transfers, and other aspects of the employment relation.[1] Until recently, only the wage effect had been shown to be a net empirical impact of unions, taking into account the characteristics of the workers and their place of employment.

However, a series of recent studies suggests that unions also exert diverse influences on nonpecuniary job attributes. An extensive investigation along these lines is Freeman's (1976a,b) application of Hirschman's (1970) exit-voice analysis to union actions. Freeman demonstrates that unions increase workers' job satisfaction and stability, effects which he attributes to union "voice" activities such as grievance procedures and bargaining on behalf of workers' interests. Freeman's (1978) analysis of fringe benefits and Medoff's (1976) study of layoff policies also indicate significant union effects on nonpecuniary job characteristics and the mix of compensation. The principal issue to be considered here is whether one can make any definitive judgments regarding the welfare implications of union effects on work quality.

In a perfectly competitive market, there is no productive role for unions. Following Adam Smith's analysis of compensating wage differentials, one can show that firms with unattractive working conditions will pay higher wages, while enterprises with higher levels of work quality will pay lower wages. Individuals who are less averse to adverse conditions, perhaps because of differences in tastes or wealth, will be attracted to these enterprises since they will require less compensation for the undesirable characteristics. This process leads to socially optimal outcomes, where the social welfare criterion is the maximization of the surplus received by employers and workers.[2] This result simply extends Hicks' (1941) analysis for product markets, where in this instance the good being traded is work at some quality q.[3]

[1]See, for example, the studies by Dunlop (1958), Bok and Dunlop (1970), Rees (1962), and Slichter, Healy, and Livernash (1960) for discussion of these effects.

[2]For simplicity, income effects are ignored. As Willig (1976) has demonstrated for the product market context, this approximation is likely to involve very small errors.

[3]See Hicks (1963), Oi (1973), Thaler and Rosen (1976), and Viscusi (1976) for more detailed discussion of competitive outcomes in the labor market.

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In other market contexts, economic outcomes may not be optimal. Section II addresses the nature of market outcomes in monopsonistic situations, focusing primarily on the effect of such market power on work quality rather than on the more familiar impact on employment. The implications of union actions in monopsonistic contexts and in otherwise competitive markets is explored in Section III. This framework not only provides insight into the economic incentives leading unions to influence aspects of employment other than wage rates, but it also highlights the circumstances under which these actions will enhance social welfare. In Section IV, I consider the effect of unions on the earning premiums for job risks, indicating how these influences are related to the broader concern of unions with the quality of work and its impact on worker welfare. The general ramifications of this analysis are summarized in Section V.

II. Causes and Implications of Monopsony Power

A. *Sources of Monopsony Power*

The standard labor economics literature treats monopsonies largely as a curiosity pertinent only in discussing the somewhat strained textbook examples of a company town. However, the more recent search theory literature, such as the study by Mortensen (1970), has indicated that upward sloping labor supply curves are likely to be the norm rather than the exception. Search costs limit the size of the applicant pool at any particular time, while the hiring and screening procedures of the enterprise introduce additional delays. Qualified new workers are recruited at a finite probabilistic rate. The labor supply curve to the enterprise is upward sloping since the firm can increase the flow of new workers by raising its wage.

The analysis in Viscusi (1979) indicates that similar probabilistic elements are associated with worker turnover in response to changes in wages or perceived working conditions. Differences in the on-the-job experiences of workers in adaptive situations and differences in turnover costs of changing jobs are two important contributors to monopsonistic elements on the quit rate margin. In short, the finite level of hiring rates and turnover rates in response to changes in the wages and working conditions generate monopsonistic power. The analysis in the following section explores the implications of these monopsonistic elements for market outcomes.

B. *Monopsony and Work Quality*

To facilitate the exposition, I will focus on the simplest possible model in which there are no uncertainties, and where workers perceive conditions correctly and respond to them optimally.[4] Consider a representative firm, which has two inputs — capital K, which has a price per unit r, and labor L, which is paid a wage rate $w(q,L)$, where q is the level of work quality. The inverse supply curve $w(q,L)$ gives the wage rate required to attract L workers at work quality q. For a monopsonistic firm, $w_L > 0$ and $w_q < 0$ since workers require compensating wage differentials for lower levels of work quality.

[4]Many of the complications created by uncertainty regarding work quality and workers' preferences are explored in Freeman (1976a) and Viscusi (1976).

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The restriction of the analysis to a single work quality index simplifies the presentation but is not essential. What is important is that because of the fixed costs associated with work quality options, the enterprise does not vary work quality on an individual basis, but instead selects on overall level of work quality for the workplace. This assumption captures the nonexcludability aspects of many work quality components such as the speed of the assembly line, the existence of grievance procedures, the scheduling of work time, and levels of noise and noxious fumes.

The production process yields two joint products — work quality q and the output x. For given levels of K and L, the enterprise has choices among combinations of work quality and product output levels. The enterprise must choose not only the optimal level of inputs but also the appropriate tradeoff between these Marshallian joint products.[5] The output x is sold in the market at price p, while the work quality output reduces labor costs through its influence on the wage rate.

The implicit form of the production function to be utilized is $G(x,q,L,K)$, which is assumed to be convex, continuous, twice differentiable, and closed in nonnegative orthant for these four variables. Following standard conventions, I assume that

$$G_x>0,\ G_q>0,\ G_K<0, \text{ and } G_L<0.$$

The analysis is restricted to finite input values, which are assumed to yield finite values of the two outputs.

The monopsonistic enterprise's surplus value (or profit) E is given by

$$E=\pi=px-w(q,\ L)L-rK+\lambda G(x,\ q,\ K,\ L).^{6} \tag{1}$$

Unlike the situation in a competitive market, the surplus value V reaped by workers is not independent of the actions of the enterprise due to the presence of monopsonistic elements in the market. The economic rents V reaped by workers are given by

$$V=Lw(q,\ L)-\int_0^L w(q,\ v)dv.^{7}$$

Total surplus S is the sum of worker and enterprise surplus and consequently is

$$S=E+V=px+\lambda G(x,\ q,\ K,\ L)-\int_0^L w(q,\ v)dv. \tag{2}$$

The analysis below assumes that income effects are sufficiently small so that this total surplus measure can be taken as an index of social welfare.

[5]The Marshallian joint products analysis of work quality was introduced by Oi (1973).

[6]Alternatively, one could reverse the inequality signs, changing also the sign of the Lagrange multiplier.

[7]Alternatively, one could take the integral along the w axis, yielding a value of

$$V=\int_o^{w(q,L)} L(q,\ v)dv.$$

The expression in the text is somewhat simpler to manipulate since the $Lw(q,\ L)$ term cancels when the worker and enterprise surplus terms are added.

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The firm selects x, q, K, and L to maximize π not S. As is well known, the monopsonistic enterprise hires a suboptimal amount of workers since it will set

$$w(q, L) + Lw_L = -p \frac{G_L}{G_x},$$

where the Lw_L term is the only difference from the first-order condition for an optimizing competitive firm. The matter of concern here is whether, for given levels of the other choice variables, the level of work quality selected by the enterprise is also inappropriate.[8] The enterprise selects q so that

$$\pi_q = 0 = -Lw_q + \lambda G_q. \tag{3}$$

However, the optimization of the total surplus S with respect to q would yield the optimality condition

$$\frac{\partial S}{\partial q} = 0 = \lambda G_q - \int_0^L w_q dv. \tag{4}$$

To analyze whether work quality is too high or too low when the enterprise selects its optimal level of q, substitute the value of λG_q from equation 3 into equation 4 so that

$$\frac{\partial S}{\partial q} = Lw_q - \int_0^L w_q dv.$$

Work quality is optimal if the valuation of work quality by the marginal worker is the same as the average of the marginal valuations, that is, if

$$w_q = \frac{1}{L} \int_0^L w_q dv,$$

where w_q is the marginal valuation term and $1/L \int_0^L w_q dv$ is the average marginal valuation term. This result is similar in spirit and mathematical form to that obtained in Spence's (1975) analysis of the provision of product quality by a monopolistic firm.

Work quality is too low (i.e., $\partial S/\partial q > 0$) if the marginal valuation term exceeds the average marginal valuation term, and conversely. It is important to note that since w_q is negative, work quality is below the socially optimal amount when the marginal worker is willing to accept less of a decrease in wages for a marginal improvement in work quality than the average wage reduction acceptable to all workers. On an empirical basis one would expect the marginal worker to be younger and less experienced.[9] The inframarginal workers, who are older and wealthier, will tend to place a greater valuation on work quality since they have greater wealth and family obligations.[10] Consequently, monopsony power should result in suboptimal levels of work quality.

[8]Analysis of the combined effect of the monopsonist's choice of L and q will not be presented here since it closely parallels the analysis by Spence (1975) for the product monopoly case.

[9]This characterization of turnover propensities is borne out in the empirical analyses of quit behavior by Freeman (1976b) and Viscusi (1979).

[10]In Viscusi (1978b), it is demonstrated both conceptually and empirically that willingness to accept job risks is negatively related to worker wealth.

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In all types of labor market situations, workers will have heterogeneous preferences for work quality. However, unlike the competitive enterprise, the monopsonist will typically not face flat labor supply curves for different levels of q since the presence of search costs, enterprise-specific seniority rights, and similar influences have in effect created an internal labor market. Whereas all workers at a competitive enterprise can be viewed as marginal workers who would quit if w or q were lowered, at a monopsonistic enterprise there will typically be substantial heterogeneity of employees' work quality preferences so that there will be many inframarginal workers who will quit only if q or w drop dramatically.

The source of the difficulties with a monopsony's selection of q is that the preferences of the marginal worker motivate profit-maximizing decisions, whereas the preferences of the inframarginal workers are critical to the social welfare calculation. It is an oversimplification to suggest that this problem is due to inadequate information, since the enterprise does know the labor supply with complete certainty. Rather, the difficulty is that market incentives are linked to the preferences of the worker on the margin rather than the enterprise's entire workforce.

C. *Wage Discrimination*

One might ask why the inframarginal workers do not reveal their true preferences with respect to work quality and the wages they require to offer their labor for particular levels of q. Instead of simply knowing the labor supply curve, the firm could then match these workers to points on the labor supply curve, pay a wage to each worker dependent on his preferences, and set the work quality level taking workers' diverse preferences into account.

The optimal wage policy for the enterprise would be to offer each worker his reservation wage, so that the monopsony now selects x, q, K, and L to maximize

$$\pi = px - \int_0^L w(q, v)dv + \lambda G(x, q, K, L), \tag{5}$$

where the integral term represents the wage bill with wage discrimination. Enterprise profits are now identical to total surplus to society S given by equation 2 so that maximization by the monopsony will lead to a welfare maximizing outcome, as can be readily verified.[11]

The distributional aspects of this efficient outcome are quite unattractive for workers since the monopsonistic enterprise reaps the entire surplus. Consequently, workers do not even receive the surplus they would have obtained in the pure monopsony case. Consider the outcome prior to the workers' revelation of their preferences. The enterprise selected a work quality level q', employed L' workers, and paid a wage level $w(q', L')$. All workers except the marginal employee earned an economic rent, with the total surplus, V' equal to

$$V' = L'w(q', L') - \int_0^{L'} w(q', v)dv.$$

[11]This result can be viewed as a monopsonistic analog of the guaranteed annual wage contract theory of Leontief (1946). In that analysis, a labor union would specify the wage and amount of labor to be hired, subject to the constraint that the employer not be made worse off. The union extracted the entire surplus, resulting in an efficient market outcome.

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Suppose that workers were to permit wage discrimination provided that they would also be paid the economic rents they would have received for that level of L and q in a regular monopsony situation. Thus, the profit function for the wage discrimination case (equation 5) would be reduced by a transfer equal to the worker surplus V, yielding

$$\pi = px - \int_0^L w(q, v)dv + \lambda G(x, q, K, L) - [Lw(q, L) - \int_0^L w(q, v)dv],$$

where the bracketed term is the worker surplus V. But this objective function simplifies to the same functional form as in the conventional monopsony case (equation 1) since the $\int_0^L w(q, v)dv$ terms cancel. The enterprise consequently will behave no differently than would a standard monopsonist.

The fundamental problem with the wage discrimination solution to the welfare losses associated with monopsonies is that workers have no incentive to reveal their preferences unless they are compensated appropriately. If workers are compensated sufficiently, enterprises have no incentive to behave in a socially optimal fashion. Worker revelation of preferences will neither be a desirable nor an effective method of promoting worker interests.

As Freeman (1976a) has noted, it is almost exclusively in unionized contexts where one observes the use of worker "voice" to express worker preferences through grievance procedures, collective bargaining agreements, and the more informal ongoing labor-management relations. Individual voice options, such as exit interviews, are seldom utilized and are generally unproductive. Although the analysis in this section has provided some insight into the shortcomings of individual voice options, I have yet to provide a formal basis for collective activities of that type through trade unions. That matter will be addressed in the next section.

III. The Potential for Union Action

A. *Unions as Labor Market Monopolies*

In the subsequent analysis, I will treat the labor union as being the labor market equivalent of a monopoly. The objective of the union is assumed to be the maximization of total worker surplus, where wages, work quality, and the quantity of labor are the three variables of interest. The union determines two of these, such as work quality and the quantity of labor, while the third variable is determined by the labor demand curve.

In actual practice, unions have considerable, but partial influence over each of the three variables. The impact of unions on working conditions is a major union effect stressed in both the institutional labor economics literature and in current empirical work as was outlined in Section I. The union's impact on relative wages of 10-15% is equally well documented.[12] Union influence over the quantity of labor hired by an enterprise is perhaps most diverse. Labor supply can be controlled directly, as in the case of the American Medical Association and craft unions. However, the importance of union control of entry into apprenticeship programs does not appear to be widespread. Perhaps the most

[12]See, in particular, the classic investigation of the relative wage effect by Lewis (1963).

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pervasive control over labor supply is through union influence over the employment of workers once they are hired. Seniority provisions, layoff procedures, and union involvement in firing decisions all enable unions to impinge on the amount of labor employed through control of workforce reductions.[13] Although union control over none of the three variables considered is complete, the treatment of unions as exerting monopolistic control over two of the three variables of interest appears to be a reasonable approach to formalizing union actions.

Many previous attempts to formulate an objective function focused on the wage rate and level of employment as the key variables of interest. Dunlop (1944), for example, specified seven possible variants of this type. Efforts along these lines have been criticized both because of their neglect of the nonpecuniary aspects of work and because they did not yield testable implications.[14] The total worker welfare function that I am utilizing extends Dunlop's analysis by making work quality and worker preferences regarding the type and amount of work matters of central concern. In addition, the implications of the analysis are quite specific and potentially testable.

Although any effort to impute an objective function and consistent choices to a collective organization is at best a hazardous undertaking, my approach appears to be the simplest technique for gaining some insight into the role unions serve in influencing work quality. An alternative formulation of union behavior that has gained some recent popularity is the majority rule voting model in which median worker preferences determine union actions. That approach shares with the surplus maximization format a concern with the preferences of the inframarginal workers. However, unlike the total worker welfare approach, this formulation neglects the intensity of worker preferences. In reality, union actions appear to be quite responsive to strongly held attitudes of minorities of the membership as most union contracts include a diverse mix of benefits that make the entire package attractive to all groups of workers. It should be noted that the surplus maximization approach also makes strong assumptions particularly those regarding the union's knowledge of worker preferences, its responsiveness to workers' desires, and the division of the surplus in multiemployer contexts. The principal advantage of the surplus-maximizing format is its greater analytic tractability.

B. *Unionization of a Competitive Industry*

The analysis of unions begins with an examination of the unionization of a competitive firm. To analyze unionization of the entire industry in a multiemployer bargaining situation, one need only interpret the labor demand and supply curves as those of an industry rather than the firm. Let $u(q, L)$ represent the inverse demand curve for labor, that is, the wage what will be offered for L

[13]Slichter, Healy and Livernash (1960) provide a very detailed description of these techniques for controlling the level of employment. Unions' influence on layoff policies is documented in Medoff (1976).

[14]Rees (1962) provides a critique of such formulations and opts for a more qualitative discussion of union actions.

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workers at work quality q.[15] Similarly, let $w(q, L)$ be the wage at which labor will supply L workers at work quality q. These demand and supply functions are used in calculating producer surplus, given by

$$E = \int_0^L u(q, v)dv - Lu(q, L),$$

while worker surplus V is of the form

$$V = Lu(q, L) - \int_0^L w(q, v)dv.^{16}$$

The total worker and employer surplus is the sum of the two surplus values, or

$$S = E + V = \int_0^L u(q, v) - w(q, v)dv,$$

which is simply the area between the labor supply and demand curves.

Unlike the competitive situation in which workers exert no market power, the surplus-maximizing union will select L and q to maximize V, so that

$$\frac{\partial V}{\partial L} = 0 = u(q, L) + Lu_L(q, L) - w(q, L), \text{ and} \tag{6}$$

$$\frac{\partial V}{\partial q} = 0 = u_q(q, L) - \int_0^L u_q(q, v)dv. \tag{7}$$

Equation 6 represents the standard market failure of a monopolist since the level of L is not determined by equating $w(q, L)$ with $u(q, L)$. Rather, the union takes into account the effect of additional labor supply in lowering the wage rate and consequently sets $w(q, L)$ equal to a lower value — $u(q, L) + Lu_L(q, L)$. For fixed q, this condition implies that unions will restrict employment and raise wages paid above the reservation wage of the marginal worker hired. These are well known and documented impacts.

The union's choice of work quality is of primary interest here. For fixed values of L, the level of q selected by the union yields a value of

$$\frac{\partial S}{\partial q} = \frac{\partial E}{\partial q} + \frac{\partial V}{\partial q} = \frac{\partial E}{\partial q} + 0 = \int_0^L u_q(q, v)dv - Lu_q(q, L),$$

since $\partial V/\partial q$ equals zero when equation 7 is satisfied. The level of q is socially optimal if $\partial S/\partial q$ equals 0, or

$$u_q(q, L) = \frac{1}{L} \int_0^L u_q(q, V)dv.$$

Thus, as q is increased, the marginal reduction in wages the enterprise is willing to offer must equal the average of these marginal reductions.

Work quality is too low if

$$u_q(q, L) < \frac{1}{L} \int_0^L u_q(q, v)dv,$$

[15]I have assumed that the firm has solved for the optimal levels of K and x as functions of q and L. As a result, the analysis of profits can focus on the derived demand curve for labor rather than the fuller version of the problem.

[16]Each of these surplus values can be expressed differently by integrating over w instead of L. For example, if $D(q, w)$ represents the total labor demand at wage w and work quality level q, producer surplus E can be rewritten as $E = \int_{w(q, L)}^{\infty} D(q, v)dv$.

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and conversely. The welfare implications of the work quality level chosen by the union depend on the shape of the inverse labor demand curve. One would expect the sign of $u_q(q, L)$ to be negative since the firm will offer a lower wage if it provides higher levels of work quality since it is sacrificing additional product output and/or incurring additional costs in increasing q. However, the primary matter of interest is how $u_q(q, L)$ varies with the level of L, or in particular, what the sign of u_{qL} (q, L) is. In general, one cannot assign an unambiguous sign to this cross partial term.[17] If the marginal wage reduction is more negative than the average marginal wage reduction, work quality is too low, and conversely. In the monopoly case it is the shape of the firm's wage offer curve in the inframarginal region that is neglected by the optimizing union since its economic incentives are affected only by the properties of the labor demand curve on the margin.

It is important to note that while social welfare may be reduced by unions, worker welfare will be maximized. When workers have heterogeneous preferences with respect to work quality, unions will be able to increase worker rents if they can select q as well as another variable, such as L or w. This result is quite general. Collective bargaining agreements typically include provisions relating to wages, fringe benefits, grievance procedures, promotion policies, and other features of the employment relationship. No existing conceptual framework would suggest that there is any economic motivation for bargaining over a diverse group of concerns rather than wage rates alone, apart from the strategic advantage of being able to bargain with respect to several issues.[18] The analysis provided here indicates that when workers have heterogeneous preferences with respect to the different pecuniary and nonpecuniary components of their jobs, unions can increase worker rents by influencing aspects of employment other than wage rates.

C. *Bilateral Monopoly*

Although unionization of an otherwise competitive industry can serve no socially productive purpose, unionized enterprises typically are characterized by the types of features that were identified as sources of monopsony power in Section IIA.[19]. In particular, workers at unionized enterprises have more years of experience at their current place of employment than do non-union members.

[17]More specifically, one must make very strong assumptions about the second and third partial derivatives and cross-partials of the implicit production function G in order for u_{qL} to be unambiguous. Even within the context of specific numerical examples, the sign of u_{qL} cannot be determined under a set of plausible restrictions on the shape of G.

[18]See Schelling's (1960) definitive treatment of bargaining for elaboration of this point.

[19]Unions' positive impact on worker tenure is documented in Freeman (1976b) and Viscusi (forthcoming). The impact of unions in promoting seniority rights is discussed by Slichter, Healy, and Livernash (1960) and tested more formally by Jerome Culp in a dissertation in progress (Harvard Univ.). Finally, union influence on the level and probability of fringe benefit coverage is documented by Freeman (1978) and Viscusi (1976). The analysis presented here takes the monopsonistic power as being exogenously determined. However, in a more complete model one would make monopsonistic influences such as seniority rights and fringe benefits endogenous. Workers are more willing to accept these immobilizing influences if unions are present to bargain on behalf of their interests.

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This additional experience reflects not only differences in enterprise-specific skills, but also is accompanied by differences in seniority rights and pension benefit rights that will be lost if the worker leaves the enterprise. It is in such situations that monopsony power is most likely to be present since the firm has, in effect, acquired its own internal labor market.

To analyze the implications of unions in monopsonistic contexts, let the surplus accruing to the workers and the company be given by

$$V = Lu(q, L) - \int_0^L w(q, v)dv, \text{ and}$$

$$E = \int_0^L u(q, v)dv - Lw(q, L).$$

If the monopsonist is dominant in that he controls the choice of L and q, the result is no different than the monopsony model in Section II. Similarly, if the union's power is sufficiently great, the analysis reduces to the monopoly model. In either case, the element of market concentration can never raise the surplus value above that reaped if the competitive outcome prevailed and will usually result in a non-optimal level of work quality.

The case of greatest interest is the cooperative solution to the bilateral monopoly situation in which the parties select the levels of q and L that maximize their joint surplus S given by

$$S = V + E = Lu(q, L) - \int_0^L w(q, v)dv + \int_0^L u(q, v)dv - Lw(q, L), \text{ or}$$

$$S = \int_0^L u(q, v)dv - \int_0^L w(q, v)dv$$

since $u(q, L)$ equals $w(q, L)$ at the market-clearing wage rate. This equation for S is identical to that for the wage discrimination case. The parties choose the levels of L and q that maximize the area between the inverse supply and demand curves, thus maximizing social welfare.

For any given value of L, the level of the optimal q satisfies the condition that

$$\frac{\partial S}{\partial q} = 0 = \frac{\partial}{\partial q} \int_0^L u(q, v) - w(q, v)dv, \text{ or}$$

$$\int_0^L u_q(q, v)dv = \int_0^L w_q(q, v)dv.$$

The optimal level of q is obtained where the partial derivative with respect to q of the area between the supply and demand curves (i.e., the total surplus) equals 0. Unlike the monopsony and monopoly solutions, the optimal q is not set at a level that is unresponsive to the preferences of the inframarginal workers and the shape of the demand curve at levels of L lower than that selected.

The principal result is that while the cooperative solution need not prevail, it may. If it does, unions will have served a productive function by leading a monopsonistic enterprise to choose a socially optimal level of work quality and employment. Moreover, unlike the wage discrimination solution, the optimality of the outcome does not depend on the union's ability to ascertain the reservation wage of each worker. Since all that is required is that the general shape of the labor supply curve be known, there are no special informational requirements for productive union action. The source of unions' beneficial effects

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is that it may represent the preferences of inframarginal workers which would otherwise be ignored.[20]

IV. Union Impacts on Job Risks

A potentially instructive case study of unions' impact on work quality is their impact on the health and safety risks of employment. It is shown in Viscusi (1978b) that as a worker's wealth increases, his willingness to accept health risks associated with a job will diminish. If unions promote the welfare of inframarginal workers as the previous analysis assumes, the observed tradeoff of additional wages for job risks should reflect this difference. In particular, the wage received per unit of risk should be greater in unionized contexts. This effect in turn should result in a lower level of risk for the firm, other things equal, since the cost of job risks to the firm will be increased.

This latter effect is difficult to assess since unions have traditionally organized workers in high risk firms and industries. This inability to distinguish the motivation for unionization from the effects of unions is reflected in the absence of any net union effect on the job risks incurred by workers.[21] Since the wage premium effect can be assessed using available data, it will be the focus of the analysis here.

The presence of hazard premiums in unionized contests is reflected in the tabulations presented in Table 1. Most collective bargaining agreements include provisions for pay of injured workers, while a substantial number also include premiums for particular hazards specified in the contract. Even when the hazards are not identified, the negotiated wage scales typically include provisions for rating jobs that incorporates an assessment of the risk in determining the pertinent job grade used in setting the wage.

Differential pay for hazardous jobs would be expected in competitive markets irrespective of the presence of unions. Consequently, the institutional arrangements specified in collective bargaining agreements may simply formalize the types of outcomes one would observe in the absence of unions. To ascertain whether in fact unions do exert a net impact on labor market outcomes, I will investigate whether there is any evidence that unions alter the wage-risk tradeoff, as predicted.

The data set used will be the 1969-1970 University of Michigan Survey of Working Conditions (SWC), which includes detailed information concerning the individual and his job. In particular, I will focus on 496 full-time blue collar workers in the sample since the work quality questions in the survey were most appropriate for that group. The sample characteristics and equations estimated are identical to those presented in earlier work, with the exception of the union-job risk interaction terms, so I will not reiterate this material here.[22]

[20]Unions may, of course, have an informational advantage over the enterprise. In situations in which the labor supply curve is uncertain since the response of workers to different levels of q may be unknown, the union may have better knowledge of workers' preferences than does the company. This situation is discussed by Freeman (1976a).

[21]See Viscusi (1976) for supporting data.

[22]See Viscusi (1976, 1978a, 1978b) for additional background.

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Table 1

*Collective Bargaining Provisions Affecting Job Risk Premiums, 1974-75**

Provision	Total with Such Provisions	
	Agreements	Thousands of Workers Covered
Hazardous Duty Differentials	260	1005.3
Falling Risks	161	575.3
Excessive Heat or Fire	21	76.7
Radiation Hazards	12	30.6
Electrical Work	13	25.0
Acid, Fumes or Chemicals	109	372.9
Explosives	42	249.7
Compressed Air	80	293.9
Unable to Determine	4	31.3
Compensation for Job-Related Injuries	1038	4655.2
Temporary Continuation of Wages	634	2904.9
Supplemental Pay for Time Not Worked	710	3338.8
Red Circle Rate in Transfer	83	250.5
Total Sample Size	1724	7878

*Source: U.S. Dept. of Labor, Bureau of Labor Statistics, *Major Collective Bargaining Agreements: Safety and Health Provisions,* Bulletin 1425-16 (Washington: U.S. Government Printing Office, 1976), pp. 63-64.

The earnings equation will be estimated both in its linear form with annual earnings as the dependent variable and in the semilogarithmic form with the natural log of earnings as the dependent variable. The explanatory variables include a quite extensive group of variables pertaining to the individual and his job, which are summarized in the footnote to Table 2. Since their coefficients are almost identical to those reported in Viscusi (1978a), I will not discuss on them here. It should be noted that all equations include a union membership variable (UNION) so union wage premiums for risks will be distinguished from the more traditional union wage effect.

Four different job characteristic variables were used. The first of these was the worker's self-assessed job hazard variable (DANGER), which assumes a value of 1 if the worker's job exposes him to dangerous or unhealthy conditions and a value of 0 otherwise. Although this variable offers the advantage of pertaining to the individual's particular job, it does not distinguish differing levels of riskiness.

Three objective measures of risk were constructed using information regarding the worker's (three-digit) industry and published BLS (1971) data for 1969. The variable INJRATE is the number of fatal or disabling on-the-job in-

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Table 2

*Estimates of Union Hazard Premiums, Earnings Equations**

Equation	Hazard Variables' Coefficients and Std. Errors				Interaction Variables' Coefficients and Standard Errors			R^2, SSR
	INJRATE	DEATH	NONFATAL	DANGER	UNION × DEATH	UNION × NONFATAL	UNION × DANGER	
1	+10.66 (11.04)	—	—	—	+44.99 (13.31)	—	—	.616, $1565E+6$
2	−27.71 (14.82)	—	—	—	—	+.916 (.188)	—	.626, $1526E+6$
3	−27.99 (14.79)	—	—	—	+23.55 (14.25)	+.785 (.203)	—	.628, $1517E+6$
4	—	−10.32 (21.11)	—	—	+60.38 (24.05)	—	—	.616, $1567E+6$
5	—	−22.21 (23.06)	+.154 (.121)	—	+64.63 (24.26)	—	—	.617, $1562E+6$
6	—	—	−.282 (.149)	—	—	+.918 (.187)	—	.626 $1526E+6$
7	—	—	—	+60.00 (246.29)	—	—	+650.06 (353.20)	.644 $1452E+6$

*Each equation also includes a constant term, the worker's age, age squared, sex, race, years of schooling, health status, enterprise size, union membership, years of experience, seven job characteristic variables, three regional economic condition variables, and four occupational dummy variables. Equation 7 also includes 25 industry dummy variables.

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juries per million hours worked in a particular worker's industry. This aggregative measure was then divided into fatal (DEATH) and nonfatal (NONFATAL) injuries, where each of these variables was constructed by multiplying INJRATE by the industry's percentage of fatal or nonfatal injuries. The mean annual risk for the sample was 1.18×10^{-4} for the risk of death and .0317 for a nonfatal injury.

The principal matter of interest is whether unions alter the wage premiums for these risks. The union-risk interaction terms presented in the Tables 2 and 3 for the linear and semilogarithmic forms of the earnings equations, respectively, provide strong support for the hypothesis that unions alter the structure of wage compensation in a manner preferred by inframarginal workers.

The findings in Table 2 are especially noteworthy. The union-risk interaction terms are consistently positive and statistically significant, whereas there are no positive wage premiums for the job risk variables themselves. The interaction terms' coefficients can be converted into implicit values of life and nonfatal injuries in unionized contexts by multiplying the UNION × DEATH and UNION × FATAL coefficients by 50,000.[23] The implicit value of life estimates for unionized workers range from $1.2 million (equation 3), to $3.2 million (equation 5), while the implied value of injuries ranges from $39,000 equation 3) to $46,000 (equation 6). These estimates are well in excess of the average value of life and limb for the sample as a whole equal to roughly $1 million for life and $10,000 for nonfatal injuries reported in Viscusi (1978a). Moreover, the value of life estimates are several times larger than the $220,000 estimate (in 1969 dollars) found by Thaler and Rosen (1976).

The findings for the log earnings equations in Table 3 are not quite as strong. However, the only evidence of significant wage premiums is in the set of union interaction terms. The UNION × NONFATAL risk interaction is consistently positive and statistically significant. Although the other results are somewhat mixed, the interaction variables always have larger positive coefficients than do their hazard variable counterparts, which is consistent with what we have predicted.

In short, the available evidence for an important work quality attribute — the health and safety risk of a worker's job — suggests that unions alter the wage premium for these risks, particularly for the risks of nonfatal injury. Since the inframarginal workers will possess a greater aversion to such hazards, this divergence of market outcomes from what one would otherwise observe is consistent with the underlying model of union action.

V. Conclusions and Extensions

Although unions can serve no socially productive purpose in competitive contexts, matters are quite different in market situations in which there are elements of monopsony power, such as those present within internal labor markets.

[23]This figure was calculated assuming 50 weeks of work per year and is based on the metric used to measure job risks, e.g., injuries per million hours worked. See Viscusi (1978a) for additional discussion.

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Table 3

*Estimates of Union Hazard Premiums, Logearnings Equation**

Equation	Hazard Variables Coefficients and Std. Errors				Interaction Variables' Coefficients and Standard Errors			R^2, SSR
	INJRATE	DEATH	NONFATAL	DANGER	UNION × DEATH	UNION × NONFATAL	UNION × DANGER	
1	$+.24E-2$ ($.18E-2$)	—	—	—	$+.45E-2$ ($.21E-2$)	—	—	.664, 40.4
2	$-.16E-2$ ($.24E-2$)	—	—	—	—	$+.94E-4$ ($.30E-4$)	—	.668, 40.0
3	$-.16E-2$ ($.24E-2$)	—	—	—	$+.22E-2$ ($.23E-2$)	$+.82E-4$ ($.33E-4$)	—	.669, 39.9
4	—	$+.17E-2$ ($.34E-2$)	—	—	$+.40E-2$ ($.39E-2$)	—	—	.661, 40.8
5	—	$-.19E-2$ ($.37E-2$)	$+.25E-4$ ($.19E-4$)	—	$+.47E-2$ ($.39E-2$)	—	—	.646, 40.2
6	—	—	$-.16E-4$ ($.24E-4$)	—	—	$+.95E-4$ ($.30E-4$)	—	.668, 40.0
7	—	—	—	+.035 (.039)	—	—	+.041 (.056)	.698, 36.3

*See the footnote to Table 2 for a list of the other variables included.

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Union bargaining on behalf of the work quality preferences of inframarginal workers may not only promote worker interests but also those of society at large since the cooperative solution to the bilateral monopoly problem will be socially efficient.

An analysis of this type is applicable to aspects of employment other than work quality, such as fringe benefits.[24] Fringe benefits will be undersupplied by a monopsonist if the inframarginal workers' valuation of fringes is greater than that for the marginal worker, and conversely. The marginal workers tend to be the lower income, inexperienced employees. Since there is a strong positive income elasticity of demand for fringes, union actions that boost the level of fringe benefits may lead to a socially efficient outcome, just as in the case of union influence over work quality.[25] Even if the socially optimal outcome is not realized, the direction of union influence is beneficial and will enhance social welfare for given levels L provided that the level of fringes or work quality does not exceed the socially optimal level by too great an amount.

Union bargaining over fringe benefits, working conditions, and other aspects of employment will typically result in greater worker rents than if unions focused on wages alone. The mix of compensation, not just its level, has important implications for worker welfare when workers have heterogenous preferences. If unions serve as a source of countervailing power in an otherwise monopsonistic contest, these impacts may also promote the efficiency of the resulting mix and level of compensation.

[24]In particular, one need only let q be the level of fringe benefits and $c(q, L)$ be the cost of providing fringe benefits at level q to L workers. The new profit function for a monopsonist will be given by $pF(K, L) - w(q, L)L - rK - c(q, L)$ where F is a conventional production function. The remainder of the analysis is qualitatively similar to that presented in the text for work quality.

[25]Work by Freeman (1978), Goldstein and Pauly (1976), and Viscusi (1976) document these union impacts on the level of fringe benefits and probability of fringe benefit coverage.

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