Abstract

This article is concerned with the law evasion (reduced wages) and law avoidance (modified employment) aspects of noncompliance behavior by risk-averse firms under the minimum wage law. It demonstrates that the adverse disemployment effects of a legal minimum wage under the conventional "full compliance" assumption should be modified by an "employment effect" of noncompliance, although it is shown that risk-averse violating firms would employ less labor than they would if they were risk-neutral. Findings suggest that the most effective strategy for motivating risk-averse firms to comply with minimum wage laws is imposing stiffer penalty fees.

NONCOMPLIANCE BEHAVIOR OF RISK-AVERSE FIRMS UNDER THE MINIMUM WAGE LAW

YANG-MING CHANG
Kansas State University

A growing literature is concerned with issues of compliance with and enforcement of the U.S. federal minimum wage law (see, e.g., Ashenfelter and Smith 1974, 1979; Gramlich 1976; Siskind 1977; Ehrenberg and Schumann 1981; Gordon 1981; Sellekaerts and Welch 1984; Chang and Ehrlich 1985a). In particular, Ashenfelter and Smith analyze the determinants of compliance behavior by profit-maximizing risk-neutral employers under minimum wage legislation and provide a set of compliance estimates with which to evaluate the government's enforcement strategies for the years 1973 and 1975. Their findings suggest that there is incomplete compliance, although government's inspection efforts are not random and are allocated to eliminate market incentives for noncompliance. Using an econometric approach to test their theory of noncompliance, Sellekaerts and Welch

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investigate employer noncompliance with the federal minimum wage provisions of the Fair Labor Standards Acts (FLSA) in the period 1973-1980. Their estimates suggest that minimum wage enforcement does not constitute an effective deterrent for violating employers. Chang and Ehrlich further develop an economic model of compliance in which the effects of the level of the minimum wage and the structure of monetary sanctions on noncompliance behavior by risk-neutral firms are analyzed.

In the presence of uncertain detection and conviction, the decision of a firm for or against compliance depends not only on the government's policing efforts and penalty schemes but also on the preferences of the firm toward risk. Ehrlich (1973) has shown that even risk-averse individuals may demand "risk" and thus undertake "gambling" activities if existing environments or opportunities are sufficiently favorable. This article, based on the expected utility maximization approach, attempts to provide an analysis on minimum wage compliance mechanisms by considering the important case of risk aversion by employers. In the process, it will deal with several interesting questions yet unanswered: In the current enforcement system of de facto partial wage restoration and absence of penalties, will risk-averse firms that choose not to abide by the law be fully deterred from paying their workers "free market," or competitive, wage rates—those that would prevail in the absence of minimum wage legislation? If not, what are the conditions under which they will be motivated to pay higher wage rates? With unchanged government inspection efforts and legal sanctions, will a violating firm hire less labor and pay a higher wage rate when it is risk-averse than when it is risk-neutral? Under what conditions will the incentives for noncompliance be completely eliminated for risk-averse firms that would otherwise attempt to pay low, competitive wage rates? What would be the impact of the government's direct inspection efforts and indirect deterring fines on the choice of wage and employment by a risk-averse firm? These questions are significantly related to the law evasion aspect (the effects on wage paid) and the law avoidance aspect (the effect on labor employed) of the noncompliance decisions by risk-averse firms under minimum wage legislation. Answers to these questions will have behavioral implications for wage evasion and employment effect of noncompliance, on one hand, and policy implications for the design of government's compliance mechanisms on the other.

In what follows, a simple model of noncompliance behavior by risk-averse firms is developed. Then, the wage and employment responses of violating firms to changes in the government's inspection activities and penalty schemes are examined. Some concluding remarks can be found in the final section.

THE SIMPLE MODEL OF NONCOMPLIANCE

I begin by characterizing the optimal behavior under minimum wage legislation of a representative risk-averse firm. The firm is assumed to maximize its expected utility from profits, $EU(\pi)$. $U(\pi)$ is a von Neumann-Morgenstern utility function assumed to be strictly concave, continuous, and twice differentiable, so that $U'(\pi) > 0$, reflecting the positive marginal utility of profit, and $U''(\pi) < 0$, capturing the firm's behavior toward risk. For methodological simplicity, it is assumed that the firm is faced with the (subjective) probability λ of being detected and convicted if it chooses not to abide by the law, that is, if it pays its workers a wage rate (w) that is lower than the legislatively established minimum (M). The probability of detection and conviction is assumed to be a monotonically increasing function of compliance resources. Under effective enforcement of the law, outright evasion of minimum wage legislation is punishable by a legal sanction. It is further assumed that the risk-averse firm, when caught and convicted of violating the law, is required to pay back a multiple, k (> 0), of the difference between the legal minimum wage and the wage actually paid for each unit of labor. As a result, the potential total cost of noncompliance would be $F = k(M - w)L$, where L is the quantity of labor hired.

Let the market price of the firm's product be p, its production function $y = f(L)$ be a strictly increasing concave function of labor (L), and the total costs of fixed capital be H. The expected utility of profits for the noncomplying firm then will be given by:[1]

$$EU(\pi) = (1 - \lambda)U(\pi_0) + \lambda U(\pi_1), \tag{1}$$

where $\pi_0 = pf(L) - wL - H$, representing the level of profits when the violating firm avoids being detected and punished, and $\pi_1 = pf(L) - wL - k(M - w)L - H$, representing the amount of profits when the firm is convicted for violating the minimum wage law. Under expected-utility-maximizing behavior, the incentive for noncompliance can be measured by the excess expected utility from noncompliance, $V = EU(\pi) - U[pf(L) - ML - H]$. However, risk-averse firms may incur some additional "fixed" utility costs of noncompliance beyond the prescribed legal sanctions in the forms of loss of federal contracts or public goodwill, and these costs may vary in magnitude across risk-averse firms. It is assumed that the actual frequency of violations of the minimum wage provisions is a monotonically increasing function of the excess expected utility from noncompliance.

Let w^o be the "free market," or competitive, wage rate that would prevail in the absence of minimum wage legislation. In order to examine whether the noncomplying firm would be motivated to pay a wage rate above the competitive level, assume that the firm solves the maximization problem by choosing w and L to maximize the expected utility from profits in equation (1), subject to the constraint that w is no less than the free market wage, w^o. The first-order Kuhn-Tucker conditions are:

$$\begin{aligned}\partial EU(\pi)/\partial L = (1 - \lambda)U'(\pi_0)[pf'(L) - w] + \lambda U'(\pi_1)(pf'(L) - \\ [w + k(M - w)]) \leq 0; L[\partial EU(\pi)/\partial L] = 0; L \geq 0\end{aligned} \tag{2}$$

$$\begin{aligned}\partial EU(\pi)/\partial w = (1 - \lambda)U'(\pi_0)(-L) + \lambda U'(\pi_1)(k - 1)L + \mu \leq 0; \\ w[\partial EU(\pi)/\partial w] = 0; w \geq 0\end{aligned} \tag{3}$$

$$\partial EU(\pi)/\partial \mu = w - w^o \geq 0; \mu[\partial EU(\pi)/\partial \mu] = 0; \mu \geq 0 \tag{4}$$

where $U'(\pi_i) = dU(\pi_i)/d\pi_i$ (for $i = 0, 1$), $f'(L) = df/dL$, and μ is the Lagrange multiplier for the constrained maximization problem.

WAGE AND EMPLOYMENT RESPONSES TO GOVERNMENT'S COMPLIANCE STRATEGIES

I now examine the effects on the wage (the law evasion aspect) and labor employment (the law avoidance aspect) of noncompliance behavior by the risk-averse firm under alternative enforcement schemes. Unless full compliance is achieved by widespread, resource-consuming, enforcement activities (work-site inspections, prosecutions, trials) such that the probability of detection and conviction, λ, is socially costly set at unity, the wage and employment decisions will be directly affected by the potential losses from noncompliance that, in turn, depend on the magnitude of k, the "penalty rate." It is therefore instructive to discuss the following three different cases associated with deterring monetary fines:

$$0 < k < 1. \tag{i}$$

This case appears to reflect the actual enforcement practices by the U.S. Department of Labor's Wage and Hours Divisions under which a firm convicted of violating the law is required to pay back only a fraction of the difference between the minimum wage and the wage actually paid for each unit of labor (see Gordon 1981; Sellekaerts and Welch 1984, 245). This suggests the following proposition:

Proposition 1: (a) (Wage Evasion): A risk-averse firm that decides against compliance would not be deterred from paying its workers the free-market wage rate if minimum wage enforcement policy is based on the requirement that a convicted firm pay back a fraction of the difference between the statutory minimum and the actual wage paid for each unit of labor. (b) (Employment Effect of Noncompliance): The violating firm will hire more labor than it would have hired if it had complied with the law, although the firm will hire less labor at the free-market wage rate in the face of minimum wage enforcement than it would have hired if there had been no legislative minimum wage.

Proof: To prove Proposition 1(a), note that $\partial EU(\pi)/\partial L = 0$ in equation (2) as long as $L > 0$. Because $w > 0$, equation (3) states that $[(1-\lambda)U'(\pi_0)(-L) + \lambda U'(\pi_1)(k-1)L + \mu]$ equals 0. This implies that $\mu > 0$ because $0 < k < 1, L > 0$, and $U'(\pi_i) > 0$ $(i = 0, 1)$. It then follows that $\partial EU(\pi)/\partial\mu = 0$ in equation (4), implying that the wage rate actually chosen, w^*, will be equal to w^o. To prove 1(b), the objective function in equation (1) is used. Now that the firm takes the free-market wage rate to pay its workers, the expected utility function of profits can be rewritten as

$$EU(L; w^o, \lambda, k) = (1-\lambda)U[pf(L) - w^o L - H] + \lambda U[pf(L) - (w^o + k(M - w^o))L - H]. \tag{5}$$

The firm then employs labor at L^*, the employment level that satisfies the following necessary condition:

$$dEU(L; w^o, \lambda, k)/dL = (1-\lambda)U'(\pi_o)[pf'(L) - w^o] + \lambda U'(\pi_1)(pf'(L) - [w^o + k(M - w^o)]) = 0. \tag{6}$$

The sufficient condition for the maximization problem requires that $d^2E[U(L; w^o, \lambda, k]/dL^2 < 0$ or that $\Delta < 0$, where $\Delta \equiv pf''(L^*)[(1-\lambda)\,U'(\pi_0) + \lambda U'(\pi_1)] + (1-\lambda)U''(\pi_0)[pf'(L^*) - w^o]^2 + \lambda U''(\pi_1)\,(pf'(L^*) - [w^o + k(M - w^o)])^2$. The assumptions of risk aversion and a strictly concave production function guarantee that this condition will hold. It then follows that $dEU(L; w^o, \lambda, k)/dL$ is *less* than zero when evaluated at L^o where $pf'(L^o) = w^o$, and is *greater* than zero when evaluated at L where $pf'(L) = w^o + k(M - w^o)$. In other words, the expected-utility-maximizing level of employment, L^*, should satisfy the following condition: $w^o < pf'(L^*) < w^o + k(M - w^o) < M$. If the firm had complied with the law, it would have employed labor up to the level of $\bar{L}$ at which $pf'(\bar{L}) = M$. If, however, there had been no minimum wage law, the firm would have employed labor up to the level of L^o at which $pf'(L^o) = w^o$. Because the quantity of labor actually hired is L^* where $w^o < pf'(L^*) < M$, then $pf'(L^o) < pf'(L^*) < pf'(\bar{L})$. This further implies that $L^o > L^* > \bar{L}$ due to the strict concavity of the production function. Q.E.D.

Thus, under current system of partial wage restoration with no additional sanction, risk-averse violators who perceive noncompliance as a favorable game would not be deterred from paying their workers the low, free-market wage. Because each unit of labor is paid less than its marginal contribution to output by noncomplying firms, it appears that workers are forced to share the "costs of risk"—the potential costs of monetary sanctions—facing violating firms. This sort of "risk-sharing" between workers and employers is obviously not socially or legislatively justifiable because it stems not from pure production uncertainty, such as breakdown or malfunction of equipment, but from noncompliance decisions by firms.[2] But it should especially be noted that it is the enforcement scheme that causes gamble, not noncompliance. Moreover, Proposition 1(b) has another important implication: the expected adverse disemployment effects of a legal minimum wage under the conventional "full compliance" assumption must to some degree be modified by an "employment effect" of noncompliance. It is then interesting to see how the firm would modify its labor employment in response to changes in λ or k. This leads to the proposition given below:

Proposition 2: Any ceteris paribus increase in the probability of inspection and conviction, λ, or the magnitude of penalty rate, k, will further reduce labor employment provided λ and k are still less than one.

Proof: Totally differentiating equation (6) and rearranging terms yields the following two comparative-static derivatives:

$$dL^*/d\lambda = (\Delta)^{-1}(U'(\pi_0)[pf'(L^*) - w^o] - U'(\pi_1)(pf'(L^*) - [w^o + k(M - w^o)])); \tag{7}$$

$$dL^*/dk = (\Delta)^{-1}\lambda[U'(\pi_0)(M - w^o) + U''(\pi_1)(pf'(L^*) - [w^o + k(M - w^o)])(M - w^o)L^*] \tag{8}$$

As expected, both $dL^*/d\lambda < 0$ and $dL^*/dk < 0$, followed by the sufficient condition that $\Delta < 0$, the result in 1(b) that $pf'(L^*) < [w^o + k(M - w^o)]$, as well as the risk-aversion assumption that $U'' < 0$. Q.E.D.

One question of concern is whether a violating firm would hire less labor when it is risk-averse than when it is risk-neutral. To analyze this problem, first note that Chang and Ehrlich (1985a) have shown that a noncomplying, risk-neutral firm will employ labor up to the quantity of L^{**} at which the value of the marginal product of labor equals the expected wage of noncompliance, namely, $pf'(L^{**}) = w^o + \lambda k(M - w^o)$. Next, evaluate $dEU(L; w^o, \lambda, k)/dL$ in equation (6) at $L = L^{**}$. This gives, after rearranging terms, $(1 - \lambda)k(M - w^o)[U'(\pi_0) + \lambda U'(\pi_1)]$, which is positive when $0 < \lambda < 1$. Because the expected utility function of noncompliance is strictly concave in L, the quantity of labor hired under risk aversion, L^*, will be less than that under risk neutrality, L^{**}. This result is summarized below before the examination of the second case when $k = 1$.

Proposition 3: Other things equal, a risk-averse, noncomplying firm will employ less labor than it would if it were risk-neutral when $0 < k < 1$ and $0 < \lambda < 1$.

$$k = 1. \qquad \text{(ii)}$$

This is the enforcement scheme that requires a convicted firm to fully pay back the difference between the minimum wage and the wage actually paid for each unit of labor. The noncomplying firm is still not likely to pay at a wage rate higher than the competitive level. Note that for $w > 0$ and $\partial EU(\pi)/\partial w = 0$ in equation (3), $\mu = (1 - \lambda)U'(\pi_0)L$, which is positive. This in turn implies that $\partial EU(\pi)/\partial \mu = 0$, and thus $w = w^o$ in equation (4).

Due to the fact that the preceding two enforcement schemes cannot eliminate evasion of the minimum wage law, a natural question is whether a system of severe penalties for noncompliance decisions would be more successful. Considered in the analysis is Becker's (1968) concept of deterring fines. This is based on the recognition that monetary sanctions, according to Becker, are essentially transfer payments and thus socially costless relative to the production of direct enforcement activities through resource-consuming inspecting and prosecutorial efforts. Such a notion of fines leads to the examination of the third case in which the penalty rate is set above one.

$$k > 1. \qquad \text{(iii)}$$

When $k > 1$, the risk-averse firm is likely to be motivated to pay a higher wage rate above the low, competitive market wage level. However, one cannot rule out the possibility that workers might get paid at free-market wage rate unless the structure of the deterring fines is appropriately designed. To see these results, note that when $k > 1$, the value of μ can be either positive or zero for $[(1-\lambda)U'(\pi_0)(-L) + \lambda U'(\pi_1)(k-1)L + \mu]$ in equation (3) to be equal to 0. Consequently, from equation (4), $w = w^o$ for $\mu > 0$ and $w > w^o$ for $\mu = 0$, given that wage evasion is considered to be a favorable risky game. The question of policy significance, then, is the level of punitive fines necessary to induce firms to comply with the minimum wage provisions of the FLSA.

If the noncomplying firm decides to pay its workers at a wage rate of $w(w^o \leq w \leq M)$, then for each unit of labor hired, the expected monetary losses from noncompliance, $[w + \lambda k(M - w)]$, will be greater than or equal to M when, and only when, $\lambda k \geq 1$.[3] In this case,

$$\begin{aligned}(1-\lambda)U[pf(L) - wL - H] + \lambda U[pf(L) - wL - k(M-w)L - H] \\ < U(pf(L) - [w + \lambda k(M-w)]L - H)\end{aligned} \tag{9}$$

due to Jensen's inequality theorem for a strictly concave function of utility. Let

$$\Delta Z = U[pf(\bar{L}) - M\bar{L} - H] - U(pf(L) - [w + \lambda k(M-w)]L - H) \tag{10}$$

where $\bar{L}$ is defined as before the quantity of labor hired under full compliance, and taking the first-order Taylor expansion of equation (10) around L and $w + \lambda k(M - w)$,

$$\Delta Z \approx U'(.)([pf'(L) - M](\bar{L} - L) - L[(1 - \lambda k)(M - w]). \tag{11}$$

For $L < (>) \bar{L}$, $pf'(L) > (<) pf'(\bar{L}) = M$, and hence $[pf'(L) - M](\bar{L} - L)$ is positive. ΔZ will then be nonnegative if $\lambda k \geq 1$. Thus the utility of profit from compliance, $U(pf(\bar{L}) - M\bar{L} - H)$, exceeds the expected utility of profit from noncompliance, $EU(\pi)$, implying that compliance will be better off than noncompliance when $k \geq 1/\lambda$. This has policy implications for the design of government's enforcement schemes, as the following proposition states:

Proposition 4: (Compliance Mechanisms): Market incentives for noncompliance for risk-averse firms would be eliminated if the package of compliance strategies, (λ, k), is designed such that the deterring penalty rate k is set to be critically equal to the inverse of the probability λ of detection and conviction.

Thus, as far as monetary efficiency in enforcement efforts is concerned, the effective strategy for motivating risk-averse, violating firms to comply with minimum wage laws is imposing stiffer punitive fines. This is consistent with Becker's (1968) argument and finding that social welfare is increased if deterring fines are used whenever feasible.

CONCLUDING REMARKS

This article has been concerned with the noncompliance behavior of risk-averse firms under minimum wage legislation. It has examined the conditions under which noncomplying firms are likely to pay wages above the free-market levels that would prevail in the absence of a minimum wage law.

Furthermore, it has shown that, as long as noncompliance is a favorable game, firms that are averse to risk may even attempt to pay their workers wages at competitive levels if minimum wage penalty schemes require a partial or full back payment with no additional sanction. At this point, outright evasion of the minimum wage might become an increasingly serious problem when one further recognizes the fact that direct enforcement through policing and prosecutorial activities is socially costly. In addition, minimum wage evasion leads workers to be paid under their marginal contributions to output. Put alternatively, workers appear to be forced to bear a portion of the potential costs of punishment facing violating firms. Wage evasion, however, has been shown to be accompanied by some increase in labor employment compared to the amount of labor hired when there is full compliance. Such an employment effect of noncompliance would consequently offset to some degree the adverse disemployment effect of minimum wage laws under the "traditional" assumption of complete compliance, depending on both the government's inspection efforts and the requirement for either partial or full wage restoration.

Based on the analysis of noncompliance behavior under risk aversion, this article has an implication for government's compliance mechanisms concerning the stiffer penalty schemes for deterring minimum wage violations. Although it is apparent that the federal minimum wage enforcement authority is reluctant to impose high monetary fines on convicted firms to achieve monetary efficiency in enforcement efforts, it is not clear whether such a reluctance is related to the "employment effect" of noncompliance with the minimum wage law.

NOTES

1. The model in equation (1) is basically the two-state-preference framework that has been widely employed to analyze choices under uncertainty (see, e.g., Arrow 1984; Hirshleifer 1965, 1966; Allingham and Sandmo 1972; Ehrlich 1973; Routhschild and Stiglitz 1976; Lippman and McCall 1981; Chang and Ehrlich 1985b).

2. Workers under pure production uncertainty are paid less than their marginal contributions to output and therefore bear some portion of the costs of risk associated with "nature." In addition, the demand for labor curve will not be given by the value-of-marginal-product curve when production involves risk. For a detailed analysis, see McKenna (1986, 42-45).

3. Because $[w + \lambda k(M - w)] - M = (1 - \lambda k)(w - M)$ and $w < M$, $w + \lambda k(M - w) \geq M$ if and only if $\lambda k \geq 1$.

REFERENCES

Allingham, Michael G., and Agnar Sandmo. 1972. Income evasion: A theoretical analysis. *Journal of Public Economics* 1:323-38.

Arrow, Kenneth J. 1984. *Individual choice under certainty and uncertainty* (Collected papers of K. J. Arrow). Cambridge, MA: Belknap.

Ashenfelter, Orley, and Robert S. Smith. 1974. Compliance with the minimum wage law. Technical Analysis Paper No. 19A, ASPER, U.S. Department of Labor.

———. 1979. Compliance with the minimum wage law. *Journal of Political Economy* 87:333-50.

Becker, G. S. 1968. Crime and punishment: An economic approach. *Journal of Political Economy* 67:169-217.

Chang, Yang-Ming, and Isaac Ehrlich. 1985a. On the economics of compliance with the minimum wage law. *Journal of Political Economy* 93:84-91.

———. 1985b. Insurance, protection from risk, and risk-bearing. *Canadian Journal of Economics* 18:574-86.

Ehrenberg, Ronald G., and Paul L. Schumann. 1981. The overtime pay provisions of the Fair Labor Standards Act. *The economics of legal minimum wages*, edited by Simon Rottenberg. Washington, DC: American Institute for Public Policy Research.

Ehrlich, Isaac. 1973. Participation in illegitimate activities: A theoretical and empirical investigation. *Journal of Political Economy* 80:623-48.

Gordon, Kenneth. 1981. The impact of minimum wages on private household workers. In *The economics of legal minimum wages*, edited by Simon Rottenberg. Washington, DC: American Enterprise Institute for Public Policy Research.

Gramlich, Edward M. 1976. Impact of minimum wages on other wages, employment, and family incomes. *Brookings Papers on Economic Activities* 2:409-51.
Hirshleifer, Jack. 1965. The investment decision under uncertainty: Choice theoretic approach. *Quarterly Journal of Economics* 79:509-36.
———. 1966. The investment decision under uncertainty: Application of the state-preference approach. *Quarterly Journal of Economics* 80:252-77.
Lippman, Steven A., and John J. McCall. 1981. The economics of uncertainty: Selected topics and probabilistic methods. Chapter 6 in *Handbook for Mathematical Economics*, Volume 1, edited by K. J. Arrow and M. D. Intriligator. New York: North-Holland.
McKenna, C. J. 1986. *The economics of uncertainty*. New York: Oxford University Press.
Routhschild, Michael, and Joseph E. Stiglitz. 1976. Equilibrium in competitive insurance markets: An essay on the economics of imperfect information. *Quarterly Journal of Economics* 90:629-50.
Sellekaerts, Brigitte H., and Stephen W. Welch. 1984. An econometric analysis of minimum wage noncompliance. *Industrial Relations* 23:244-59.
Siskind, Frederic B. 1977. Minimum wage legislation in the United States: Comment. *Economic Inquiry* 15:135-38.

Yang-Ming Chang is Associate Professor of Economics at Kansas State University. His research interests include microeconomic theory, economics of minimum wage legislation, industrial organization and public policy, and international economics. He has published articles in Managerial and Decision Economics, Canadian Journal of Economics, *and* Journal of Political Economy.