Wage discrimination and partial compliance with the minimum wage law

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Abstract

This paper presents a simple model to characterize the discriminatory behavior of a non-complying firm in a minimum-wage economy. In the analysis, the violating firm pays one "favored" group of workers the statutory minimum and the other "non-favored" group of workers a sub-minimum. We find conditions under which law enforcement is ineffective in improving the between-group wage differentials. We show that an increase in the minimum wage raises the sub-minimum wage and employment of workers in the non-favored group, but reduces the employment of workers in the favored group. The effect of the minimum wage increase on total employment is unambiguously negative, however.

1. Introduction

Since the seminal work of Ashenfelter and Smith (1979), considerable attention has been paid to analyzing issues related to compliance with and enforcement of the minimum wage law. Of particular concern is the effect of enforcement intensity on sub-minimum wage and employment level. Interestingly, contrasting results regarding the effect of minimum wage law enforcement have been found in the literature. Given the objective of a minimum wage policy, how important is enforcement in making the policy successful? What is the effect of law enforcement on the employment decisions of the non-complying employers subject to the minimum wage law? Answers to these questions are important considerations in any such policy. The purpose of this paper is to present a simple model for analyzing the employment effect of partial compliance with the minimum wage law. Specifically, we discuss partial compliance that arises from the case in which a firm pays a "favored" group of workers the statutory minimum and the other "non-favored" group of workers a sub-minimum. We wish to examine how minimum wage increases and law enforcement intensity affect the sub-minimum wage and the composition of workers in different demographic groups, as well as the employment of all the workers taken together.

Chang and Ehrlich (1985) develop a model of minimum wage compliance and show that the effectiveness of the law depends crucially on the size of deterring monetary sanctions upon the employment decision of a violating firm. In their analysis, the labor market for minimum-wage workers is assumed to be characterized by perfect competition. Yaniv (1988) examines how a firm's decision to comply with the minimum wage law changes with different minimum wages and corresponding degrees of enforcement for the case of monopsony. The author contends that partial enforcement may reduce the gap between minimum wage and sub-minimum wage in a monopsonistic labor market. Yaniv (2001) examines the "portfolio-choice" of a non-complying employer who pays a minimum wage to one subset of workers and a sub-minimum wage to another subset of workers. He shows that partial compliance may reduce total employment down to the level equivalent to the negative employment effect of full compliance. Yaniv (2004) further finds that minimum wage laws can only improve the market situation, from the standpoint of labor suppliers, if they have strong enforcement polices to complement them. Otherwise, workers may be better off without a minimum wage law.

Law enforcement is an important component of any government regulation. Past literature shows that, in a situation where a minimum wage law is not properly enforced, the existing market wage rate is positively related to the minimum wage. Basu, Chau, and Kanbur (2005) develop a monopsonistic labor market model to simultaneously determine the minimum wage and degree of enforcement. They find that the sub-minimum wage is endogenously determined given the minimum wage and that a higher minimum wage leads to greater enforcement efforts.

In one sense, a minimum wage law is a tool used by governments to curb any kind of discrimination in the labor market. Using the notions of monopsony and employer wage discrimination (Robinson, 1969; Becker, 1971) and adding a component of risk, Tobol (2005) examines how making labor discrimination illegal affects the wage differential in either monopolistic or competitive markets. He finds that a high degree of enforcement can reduce or eliminate discrimination in a monopolistic setup. However, a high degree of enforcement is counter-effective in competitive markets. High enforcement increases the risk of getting caught for the employer. In response, employers are less likely to hire people from the discriminated

group. In contrast to Tobol (2005), our model shows that under certain conditions law enforcement can be totally ineffective in competitive markets. Ransom and Boal (1997) show that the main determinant of the effect of minimum wage law on total employment level is the market labor supply curve whereas the level of exploitation in a given firm is determined by the firm's labor supply curve. Bhaskar, Manning, and To (2004) find conditions under which the impact of minimum wage law on total employment increases in the level of oligopsony power in a labor market.

In this paper, we pay particular attention to the case of partial compliance with the minimum wage law due to wage discrimination. As in Yaniv (2001), we assume that a non-complying firm chooses to pay a sub-minimum wage to a subset of employed workers. The firm thus divides its labor stock "between risky and non-risky employment" (Yaniv 2001, p. 597). But unlike Yaniv, we assume that noncompliance decision arises from the employer's "taste for discrimination" (Becker, 1957) and discriminatory monopsony (Robinson, 1969). We wish to examine the effectiveness of minimum wage enforcement in reducing the wage gap between different demographic groups of workers. Our results show that, given a minimum wage economy in which firms hire two types of workers, weak law enforcement is *ineffective* in improving the between-group wage differentials. We then look at the effects of minimum wage increases on the sub-minimum wage and employment levels of two distinct worker groups. We find that increases in minimum wage have a positive effect on the sub-minimum wages of workers subject to discrimination, as well as their employment. However, minimum wage increases have a negative effect on the employment composition of non-discriminated workers. These results are unique within the literature and thus force us to re-examine how minimum wage increases and enforcement affects discriminated sub-groups of the labor supply.

The remainder of the paper is organized as follows. Section 2 presents a simple model of noncompliance decisions of a firm with wage discrimination. In Section 3, we present comparative statics of the model. Further, we discuss implications of minimum wage law and enforcement for the sub-minimum wage and composition of labor employment. Section 4 contains concluding remarks.

2. The Model

We examine the employment decisions of a non-complying firm that is subject to the minimum wage law. We consider the scenario in which the firm hires two types of workers, denoted as L_1 and L_2, who are identical in productivity but are different in demography. To account for elements of worker discrimination à la Becker (1971) and Arrow (1972a, 1972b), we assume that the firm pays type-1 workers (L_1) the statutorily determined minimum wage, M, and type-2 workers (L_2) a sub-minimum wage, w. In this case, type-1 workers are "favored" whereas type-2 workers are "non-favored" by the employer of the firm. The wages of type-2 workers are thus subject to discrimination. To allow for discriminatory monopsony à la Robinson (1969), let labor supply of type-2 workers to the firm be given as $w = w(L_2)$, where $\partial w / \partial L_2 > 0$. The production function of the firm is given as $y = f(L_1 + L_2)$, which is strictly concave ($f'(L_1 + L_2) > 0$ and $f''(L_1 + L_2) < 0$).[1]

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[1] As in Tobal (2005), we ignore the possibility that workers in one group have a distaste for working with those in the other group.

Under the minimum wage law, the non-complying behavior of the firm in paying type-2 workers a sub-minimum is illegal. Denote λ as the probability that the firm is apprehended and punished for violating the minimum wage law. The firm's expected profit function is given as follows:[2]

$$\pi = pf(L_1 + L_2) - ML_1 - w(L_2)L_2 - \lambda k[M - w(L_2)]L_2 \qquad (1)$$

where p denotes competitive price of the firm's output, k represents the size of penalty for each unit of labor supplied by type-2 workers that is underpaid.[3]

The Kuhn-Tucker conditions for profit maximization are:

$$\frac{\partial \pi}{\partial L_1} = pf'(L_1 + L_2) - M \le 0; \text{ if } \frac{\partial \pi}{\partial L_1} < 0, \; L_1 = 0; \qquad (2)$$

$$\frac{\partial \pi}{\partial L_2} = pf'(L_1 + L_2) - \{(1 - \lambda k)[w'(L_2)L_2 + w(L_2)] + \lambda kM\} \le 0; \text{ if } \frac{\partial \pi}{\partial L_2} < 0, \; L_2 = 0; \qquad (3)$$

Equation (2) indicates that for an interior solution for $L_1 (> 0)$, it is necessary that

$$pf'(L_1 + L_2) = M. \qquad (4)$$

The firm will not hire type-1 workers if the value of their marginal product of labor is less than the minimum wage. Equation (3) indicates that for an interior solution for $L_2 (> 0)$, the following condition must be satisfied:

$$pf'(L_1 + L_2) = (1 - \lambda k)[w'(L_2)L_2 + w(L_2)] + (\lambda k)M. \qquad (5)$$

The terms on the right-hand side of equation (5) define the firm's expected marginal cost of hiring type-2 workers, which is denoted as MC_{L_2}. This MC_{L_2} is given by the weighted sum of the marginal factor cost (MFC_2), $[w'(L_2)L_2 + w]$, and the statutory minimum, M, with the weights being equal to $(1 - \lambda k)$ and λk, respectively. Thus, if

$$pf'(L_1 + L_2) < MC_{L_2}, \qquad (6)$$

then $L_2 = 0$.

It follows from conditions (4)-(6) that the firm will not hire type-2 workers if the intensity of law enforcement (defined as λk) is such that

$$(1-\lambda k)[w'(L_2)L_2 + w(L_2)] + (\lambda k)M > M.\tag{7}$$

Interestingly enough, the above inequality condition implies that

$$[w'(L_2)L_2 + w(L_2)] > M,\tag{8}$$

which is independent of enforcement intensity. Thus, as long as the MFC_2 is no greater than the minimum wage, the firm will hire type-2 workers.

The second-order conditions (SOCs) for an interior solution ($L_1 > 0$ and $L_2 > 0$) require that the expected profit function in (1) be strictly concave or that the Jacobian matrix given below be strictly negative-definite.

$$[J_2] = \begin{bmatrix} \dfrac{\partial^2 \pi}{\partial L_1^2} & \dfrac{\partial^2 \pi}{\partial L_1 \partial L_2} \\[2mm] \dfrac{\partial^2 \pi}{\partial L_2 \partial L_1} & \dfrac{\partial^2 \pi}{\partial L_2^2} \end{bmatrix} = \begin{bmatrix} pf'' & pf'' \\ pf'' & pf'' - (1-\lambda k)[w''(L_2)L_2 + 2w'(L_2)] \end{bmatrix}.$$

Under the assumption of diminishing marginal productivities of labor ($f'' < 0$), the SOCs for interior solutions ($L_1 > 0$ and $L_2 > 0$) require that the intensity of law enforcement be $\lambda k < 1$.[4] That is,

$$|J_1| = \frac{\partial^2 \pi}{\partial L_1^2} = pf'' < 0 \ ;$$

$$|J_2| = -pf''(1-\lambda k)[w''(L_2)L_2 + 2w'(L_2)] > 0.$$

To explicitly characterize the discriminatory behavior of the non-complying employer, we consider the case of interior solutions for L_1 and L_2. By combining equations (4) and (5), we have $M = (1-\lambda k)[w'(L_2)L_2 + w(L_2)] + \lambda kM$, which can easily be rewritten as

$$M = [w'(L_2)L_2 + w(L_2)].\tag{9}$$

From (9), it follows that

$$\frac{M - w(L_2)}{w(L_2)} = \frac{1}{\varepsilon_B},\tag{10}$$

where $\varepsilon_B (\equiv (dL_2/dw)(w/L_2))$ is the wage elasticity of labor supply by type-2 workers. Interestingly, the expression in (10) is consistent with the traditional optimality condition for

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monopolistic discrimination.[5] The employment decisions of the violating firm are as follows. First, the firm use equation (10) to determine its demand for services by type-2 workers. Second, the firm uses the marginal productivity condition in (4) to determine its demand for services by type-1 workers.

Based on the above analyses, we have

PROPOSITION 1: *In a minimum-wage economy where law enforcement is low $(\lambda k < 1)$ and a non-complying firm is capable of practicing discriminatory monopsony against a demographic group of workers, the wage differential between the non-favored and favored groups of workers is <u>inversely</u> related to the labor supply elasticity of the non-favored group. The sub-minimum wage that the non-complying, discriminating firm chooses to pay is independent of the law enforcement intensity, however.*

3. A Comparative Static Analysis and Its Implications

In this section, we discuss how the optimal employment decisions of the non-complying firm change in response to changes in the minimum wage and enforcement intensity level. To do so, we take the total differentiation of the FOCs in (4) and (5) to obtain

$$\left[J_2\right]\begin{bmatrix} dL_1 \\ dL_2 \end{bmatrix} = \begin{bmatrix} dM \\ \left\{M - \left[w'(L_2)L_2 + w\right]\right\}d(\lambda k) + \lambda k dM \end{bmatrix}, \tag{11}$$

noting that $\left|J_2\right| = -pf''(1-\lambda k)[w''(L_2)L_2 + 2w'(L_2)] > 0$ when $\lambda k < 1$. From (11), it follows that

$$\frac{\partial L_1}{\partial M} = \frac{(1-\lambda k)\left\{pf'' - \left[w''(L_2)L_2 + 2w'(L_2)\right]\right\}}{|J|} = -\frac{1}{w''(L_2)L_2 + 2w'(L_2)} + \frac{1}{pf''} < 0; \tag{12}$$

$$\frac{\partial L_2}{\partial M} = -\frac{(1-\lambda k)pf''}{|J|} = \frac{1}{w''(L_2)L_2 + 2w'(L_2)} > 0. \tag{13}$$

Thus, an increase in the minimum wage unambiguously increases the employment of type-2 workers and reduces that of type-1 workers.

What is the effect of an increase in minimum wage on total employment $(L = L_1 + L_2)$ of the economy? To answer the question, we have from (12) and (13) that

$$\frac{\partial L}{\partial M} = \frac{\partial L_1}{\partial M} + \frac{\partial L_2}{\partial M} = \frac{1}{pf''} < 0. \tag{14}$$

It is straightforward to show that an increase in the minimum wage raises the sub-minimum wage of workers in the group subject to discrimination. This is because

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[5] For the case in which there is only a homogeneous group of workers (L), a monopolistic firm hires labor that maximizes $\pi = pf(L) - w(L)L$. The FOC is $[pf'(L) - w]/w = 1/\varepsilon$, where $\varepsilon \equiv (dL/dw)(w/L)$.

$$\frac{\partial w(L_2)}{\partial M} = w'(L_2)\frac{\partial L_2}{\partial M} > 0. \tag{15}$$

It should come as no surprise that law enforcement intensity has no effect on labor decisions of the firm. To see this, we have from the system in (11) that

$$\frac{\partial L_1}{\partial(\lambda k)} = \frac{\partial L_2}{\partial(\lambda k)} = \frac{pf''\{M - [w'(L_2)L_2 + w]\}}{|J|} = 0, \tag{16}$$

given that $M = [w'(L_2)L_2 + w]$ in (9).

The findings of the above analyses allow us to establish the following proposition:

PROPOSITION 2: *If a non-complying employer is able to practice discriminatory monopsony against a demographic group of workers in a minimum-wage economy, an increase in the minimum wage unambiguously raises the demand for labor services by the non-favored group. Consequently, the sub-minimum wage increases. The minimum wage increase, however, not only reduces the employment of favored workers but also the total employment of the workers taken together.*

It is instructive to use a diagrammatical approach to show the implications of the above analyses. Figure 1 illustrates the composition of favored and non-favored workers hired by the non-complying firm. The firm's demand curve for labor is given by $D_L = pf'(L_1 + L_2)$. The labor supply curve of type-2 workers is given by $w = w(L_2)$ which also defines the firm's average factor cost (AFC_2) curve. The marginal factor cost curve corresponding to the labor supply curve is given by MFC_2. When the minimum wage level is M', the firm hires type-2 workers up to L_2' at which $M' = MFC_2(L_2')$. The sub-minimum wage that the firm pays type-2 workers is determined by the AFC_2 curve, i.e., $w = w(L_2')$. Apparently, the sub-minimum wage is lower than the statutory minimum. At M', the total number of workers that the firm hires is determined by its labor demand curve, i.e., $M' = pf'(L_1' + L_2')$.

The composition of labor employment, $\{L_1', L_2'\}$, depends crucially on the level of the minimum wage. An exogenous increase in the minimum wage has opposite effects on the two distinct types of workers. On one hand, minimum wage increases lead the firm to hire more type-2 workers along the MFC_2 curve (as shown by the arrowheads). Increases in the sub-minimum wage are along the AFC_2 curve. On the other hand, minimum wage increases lead the firm to reduce its employment of type-1 workers along the firm's demand curve (as shown by the arrowheads). For the case in which the minimum wage increases up to M'', the firm hires type-2 workers, but not type-1 workers. That is, $L_1 = 0$ and $L_2 = L_2''$. For the level of minimum wage above M'', the firm starts to hire less type-2 workers. Thus, when a firm is able to practice discriminatory monopsony against a sub-group of labor supply, minimum wage increases affect not only the structure of the firm's demands for favored and non-favored workers but also the

sub-minimum wage. It turns out that increases in minimum wage work against favored workers and benefit non-favored workers, despite the fact that the latter are paid below the statutory minimum.

Because profits of firms decrease as they comply with the minimum wage law, firms have an incentive for noncompliance (Chang and Ehrlich, 1985).[6] In our analysis, we further examine the case where non-complying firms may have "a taste of discrimination" (Becker, 1971; Arrow, 1972a, 1972b) in that they desire to pay demographic groups of workers differential wages. We find that the effect of minimum wage law on the composition of discriminated and non-discriminated workers depends crucially on the labor supply curve of the discriminated workers. In our model, monopsonistic discrimination against a subset of workers constitutes a major cause of wage differentials. Increases in minimum wage not only affect the between-group wage differentials but also the between-group labor employment.

We further find that under partial compliance, minimum wage increases have a negative effect on total employment. This finding complements the negative employment effect as found in Yaniv (2001), where a non-complying firm pays differential wages (a legal minimum and a sub-minimum) to fractions of employed workers. Yaniv (2001) indicates that, despite partial compliance, a minimum wage law may reduce total employment to a level that is equivalent to the negative employment effect when the firm fully complies with the law. It should be mentioned that partial compliance in Yaniv's analysis arises from a portfolio-choice consideration, while that in our analysis stems from employer wage discrimination related to monopolistic power.

4. Concluding Remarks

In this paper, we present a model to characterize the discriminatory behavior of a non-complying employer in a minimum-wage economy. In the analysis of partial compliance, workers in the favored group receive the minimum wage, whereas workers in the non-favored group receive a sub-minimum. For the case in which minimum wage enforcement is weak, law enforcement is shown to be ineffective in improving wage differentials between demographically different groups of workers. We provide an explanation of how increases in minimum wage may lead a profit-maximizing discriminating firm to raise sub-minimum wages for and employment of non-favored workers. Nevertheless, minimum wage increases unambiguously reduce total employment of workers.
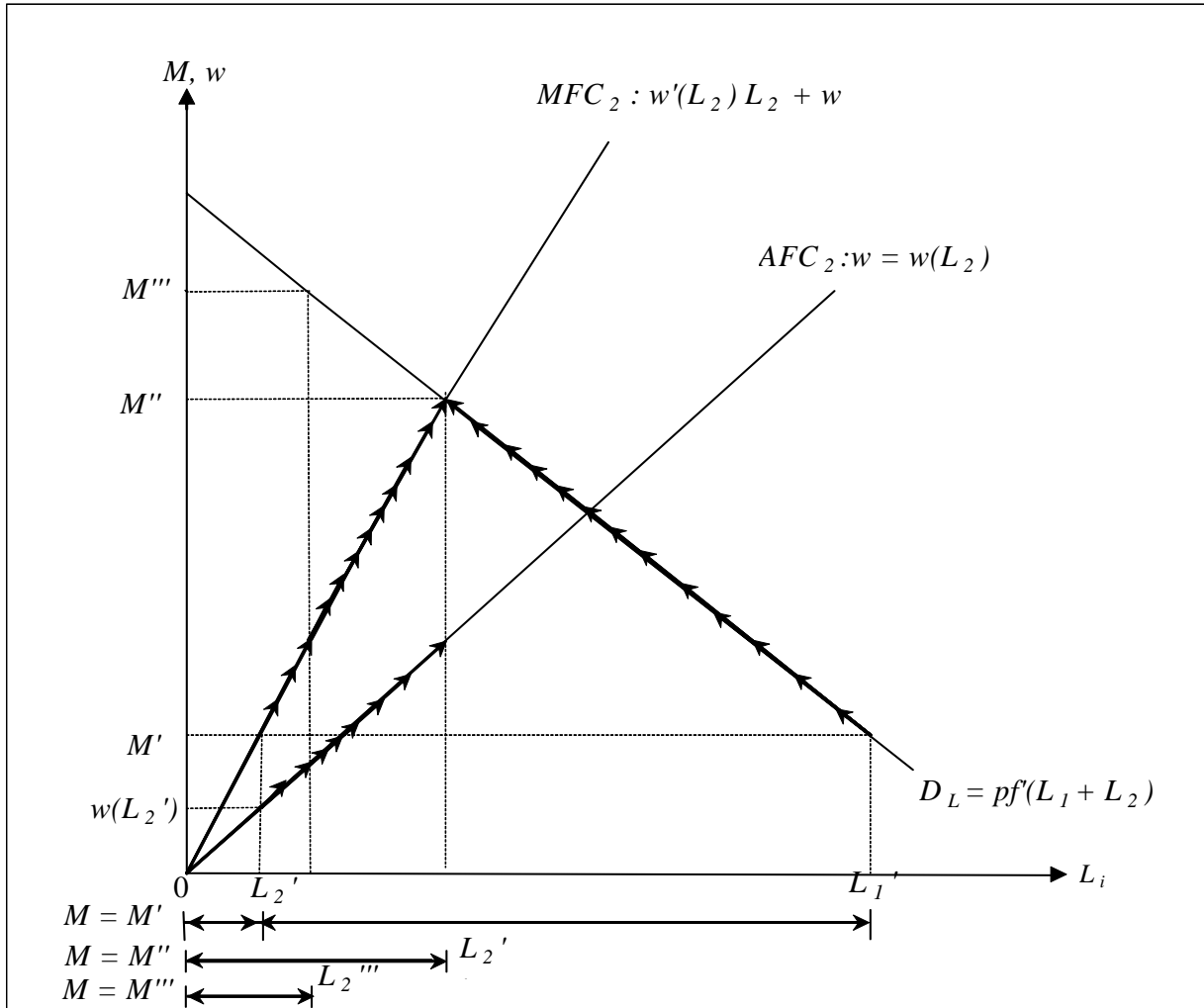
It should be mentioned that in our simple analysis, we do not examine issues related to the optimal enforcement of the minimum wage law. Further, we abstract from the possibility of legal resources on the part of a sub-minimum wage worker. A more general framework is required that is capable of taking into account the design of an enforcement scheme in terms of the probability of apprehension and the severity of punishment. Moreover, efficient allocations of socially costly enforcement resources to detecting firms that are more likely to violate the law are interesting issues for future research.

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[6] The incentives not to comply with the minimum wage law increases with the discrepancy between the wage that a violating firm desires to pay his workers and the legal minimum wage. Chang and Ehrlich further remark that "a minimum wage enforcement policy requiring the violating firm to pay only a fraction of the difference between the statutory minimum and the market wage per unit labor will not constitute an effective deterrent" (p. 87). For studies on public enforcement of laws see, e.g., Stigler (1970) and Polinsky and Shavell (2000).

Figure 1. Effects of minimum wage increases on the composition of favored and non-favored workers

M, w

$MFC_2 : w'(L_2) L_2 + w$

$AFC_2 :w = w(L_2)$

M'''

M''

M'

$w(L_2')$

$D_L = pf'(L_1 + L_2)$

0 L_2' L_1' L_i

$M = M'$

$M = M''$ L_2'

$M = M'''$ L_2'''

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