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Effects of Job Security Laws in a Shirking Model with Heterogeneous Workers

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This paper explores the policy implications of job security laws. It extends Carter and De Lancey's (1997) efficiency wage model from the assumption of two types of workers to allow for infinite types of workers. One key difference between the models is that the proportion of nonshirking workers in equilibrium is an exogenous constant in their model, whereas it is an endogenous variable in this study. They find that a job security law increases the welfare of both shirkers and nonshirkers without reducing output. In this setting, it is shown that the law may increase the welfare of both shirkers and nonshirkers at the cost of lower output, or it may result in higher output, but the welfare effect of workers is uncertain.

1. Introduction

Job security (or just-cause employment) laws require firms to provide sufficient evidence before firing a worker suspected of shirking. Like many other labor policies, a job security law is a two-edged sword. It decreases unjust dismissals at the expense of reducing just discharges. It seems possible that this mandate will hurt the firms' welfare by interfering with managers' personnel policies. However, it is not very clear whether this regulation can improve the workers' welfare, for example, by increasing the wage or employment.[1]

The development of the shirking model of efficiency wages has recently provided a framework for investigating the effects of job security laws. The canonical shirking model of Shapiro and Stiglitz (1984) assumes that workers are homogeneous and that work efforts can only take two values (zero effort and a positive effort level, i.e., shirking and nonshirking). Since workers prefer shirking to working and monitoring is costly and imperfect, there must be some incentive device to prevent shirking. Their study focuses on the device of *the threat of firing*. To make firing an effective worker discipline device, Shapiro and Stiglitz show that a necessary condition is that the labor market equilibrium must be characterized by involuntary unemployment.

Since reducing unjust terminations is the main concern of job security laws, it is no surprise that several previous studies have investigated the policy implications of job security laws in line with Shapiro and Stiglitz. In a one-period version of the Shapiro and Stiglitz model, Sjostrom

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[1] See Stieber (1980), Savarese (1980), Epstein (1984), and Rosen (1984) for some relevant debates regarding the advantages and disadvantages of job security laws. Ehrenberg (1986) surveyed the theoretical implications of the employment at-will doctrine. Krueger (1991) proposed a political economic hypothesis to explain the evolution of unjust-dismissal legislation in the United States. Levine (1991) used an adverse-selection model to show that when there is an externality that prevents firms from switching to just-cause contracts, a regulation that forces all firms to operate under job security policies may increase efficiency. For relevant empirical papers, please see the references cited by Groenewold (1999).

(1993) focuses on the disadvantage arising from the fact that the law makes it more difficult for an employer to fire a shirker. This increased difficulty raises the expected utility of shirking, and the firm is thus forced to increase its wage offer and reduce its employment in response. By using the infinitely lived workers model of Shapiro and Stiglitz (1984), both Levine (1989) and Carter (1992) hypothesize that some nonshirkers may be unjustly fired in equilibrium. They capture the advantage of reducing unjust dismissals, resulting in increased employment. One key feature of these models is that all workers are homogeneous and will not shirk in equilibrium. As a result, no just discharges of shirkers will occur in equilibrium.

Carter and De Lancey (1997) adopt another one-period version of the Shapiro and Stiglitz model with two types of workers. One of these types of workers places such a high value on leisure that he/she is always shirking, and the other of these types chooses not to shirk in equilibrium. Although the proportion of nonshirkers within a firm in equilibrium is an exogenous constant,[2] Carter and De Lancey successfully capture both dismissals. They find that job security laws lead to greater worker welfare with no reduction in output or profits. It is probably not an exaggeration to state that they find that job security laws may result in an equilibrium Pareto superior to the competitive equilibrium.[3]

This paper extends the Carter and De Lancey model from the assumption of two types of workers to allow for infinite types of workers. As in Carter and De Lancey, workers in this study are heterogeneous in view of their different preferences with regard to leisure. The difference is, however, that the proportion of nonshirking workers in equilibrium is *an exogenous constant* in their setting, whereas it is *an endogenous variable* in this setting. In other words, in this paper the equilibrium proportion is affected by the firm's wage and monitoring policies, whereas it is not in their study. It is shown here that the proportion of nonshirkers plays an important role in the determination of policy effects. When a job security regulation reduces the proportion of nonshirkers, it leads to greater worker welfare at the cost of reducing the employment of nonshirkers, output, and even profits. By contrast, it increases the employment of nonshirkers as well as output, but profits may fall and the welfare effect of workers is ambiguous. In sum, this paper does not find sufficient reason to support the argument that when workers are heterogeneous job security regulations may result in an equilibrium Pareto superior to the competitive equilibrium.

The following two sections analyze the worker's and the firm's optimization problems, respectively. Concluding remarks are presented in the final section.

2. The Worker

Consider a very simple economy where firms are identical and hire a number of heterogeneous workers to produce a single commodity. The worker enjoys a wage (W) and on-the-job leisure (L). In line with Carter and De Lancey (1997), the utility of a type λ worker can be set as:

$$U(W, L; \lambda) = W + \lambda L, \tag{1}$$

[2] By definition, this is the ratio of the number of nonshirkers (workers placing a low value on leisure) to the total number of all recruited workers (shirkers and nonshirkers). Carter and De Lancey assume that the ratio within a firm is equal to the market ratio. Since the ratio of the two types of workers is exogenously determined in the market, the ratio of nonshirkers within a firm in equilibrium is thus an exogenous constant.

[3] In a static and continuous effort model, Groenewold (1999) recently found that the effect of increasing employment security increases the wage, but does not necessarily increase unemployment.

where λ is the worker's preference with regard to leisure. Workers are heterogeneous in view of the difference in λ. The higher the value that a worker places on leisure, the more likely it is that the worker will shirk. The employers cannot reject workers with a higher λ when recruiting employees, since they are unable to observe this *hidden characteristic* as a result of asymmetric information.[4]

A worker, when hired, must decide whether to shirk or not. As a shirker, he or she contributes zero effort and enjoys on-the-job leisure L; otherwise, the worker provides a positive fixed effort level e, and the corresponding on-the-job leisure time is zero. Again, the firm cannot accurately observe an individual worker's effort level (*hidden action*) because of imperfect information. Because workers dislike putting forth effort and monitoring is imperfect, there must be some probabilistic penalty to discourage shirking. According to the shirking models of Levine (1989), Carter (1992), and Carter and De Lancey (1997), the firm sets up a minimum acceptable effort level M, and fires any worker whose observed effort level fails to meet the requirement. They further assume that the law requiring firms to provide more evidence before firing a worker can be equivalently viewed as setting a ceiling $\bar{M}$ to lower the firm's requirement.

Suppose more specifically that there is an observation error ε, which is a random variable with a cumulative distribution function F and a corresponding density function f. When a firm monitors a worker, the firm observes an effort level $e + \varepsilon$ if the worker does not shirk (provides e), and observes ε if the worker shirks (provides zero effort). When the firm monitors each recruited employee only once in the period, the probabilities that a shirking and nonshirking worker will be fired, p^s and p^n, respectively, are

$$p^s = F(M) = \text{prob}(\varepsilon < M), \tag{2}$$

$$p^n = F(M - e) = \text{prob}(e + \varepsilon < M). \tag{3}$$

Since $M > M - e$, it follows that $F(M) > F(M - e)$ and $p^s > p^n$. That is, the probability of justly firing a shirker is larger than that of unjustly laying off a nonshirker. The marginal effects of a change in M on p^s and p^n, respectively, are

$$p^s_M = f(M) > 0, \tag{4}$$

$$p^n_M = f(M - e) > 0. \tag{5}$$

A worker will choose not to shirk only if the expected utility of being a nonshirker (V^n) is not smaller than that of being a shirker (V^s). Dismissed workers are paid nothing, whereas all others are paid W. Hence, the nonshirking condition (NSC), defined as $V^n \geqslant V^s$, turns out to be:

$$W(1 - p^n) \geqslant (W + \lambda L)(1 - p^s) + \lambda L p^s. \tag{6}$$

When workers are identical, the NSC is used to determine the lowest wage or nonshirking wage that prevents all workers from shirking. Since the firm in this paper cannot screen the heterogeneous workers, it cannot pay them according to their particular nonshirking wage. Given that all retained workers receive the same wage, the NSC determines the critical type of workers ($\hat{\lambda}$) who are indifferent between shirking and nonshirking, and $\hat{\lambda}$ can be derived from Equation 6 when the equality part holds.

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[4] Carter and De Lancey (1997) made the same assumption in their model with two types of workers. The setting of the two types of workers model can be traced back to Strand (1987).

Workers with a λ smaller than $\hat{\lambda}$ will choose not to shirk. For the sake of simplicity, λ is assumed to be a uniform distribution between 0 and 1. Its cumulative density function H is $H(\lambda) = \lambda$. In this situation, the critical value $\hat{\lambda}$ is the ratio of the number of nonshirkers to the total number of the firm's recruited workers. By letting e equal 1, then $\hat{\lambda}$ also represents the average effort of all of the firm's recruited workers. Accordingly, the marginal type of workers or the proportion of nonshirkers, $\hat{\lambda}$, is:

$$\hat{\lambda} = \hat{\lambda}(W, M) = (p^s - p^n)W. \tag{7}$$

The marginal effects with respect to W and M are $\hat{\lambda}_W = (p^s - p^n) = \hat{\lambda}/W > 0$ and $\hat{\lambda}_M = (p^s_M - p^n_M)W \gtreqless 0$.

The result $\hat{\lambda}_W > 0$ indicates that a higher wage raises the relative benefit of nonshirking to shirking due to $p^s > p^n$ (by using Eqn. 2 and 3). This reduces the proportion of shirkers and consequently raises the average effort of all of the recruited workers. "The higher the wage the higher the effort" is the basic tenet of the efficiency wage theory. Since a decrease in M decreases the probability of dismissals of both shirkers and nonshirkers simultaneously, the sign of $\hat{\lambda}_M$ is thus generally ambiguous. When $p^s_M > p^n_M$, the regulation increases the relative benefit of being a shirker. In such circumstances, more workers will choose to shirk, and the average effort of recruited workers will decrease ($\hat{\lambda}_M > 0$). By contrast, the average effort of recruited workers will increase ($\hat{\lambda}_M < 0$) when $p^s_M < p^n_M$.

3. The Firm

Since firms cannot distinguish among different types of workers, they recruit their employees from the labor market at random. A typical firm recruiting N workers expects that there will be $\hat{\lambda}N$ nonshirking workers, and among these nonshirkers $(1 - p^n)\hat{\lambda}N$ workers will be retained and be productive. According to Carter and De Lancey, all retained workers are paid W, whereas all dismissed workers are paid nothing. By taking the firm's monitoring costs (cN) into account, a risk-neutral firm's profit function π is (the output price is 1):

$$\pi = q[k^n(W, M)N] - [k^n(W, M) + k^s(W, M)]WN - cN, \tag{8}$$

where c is the unit (constant) monitoring cost per employee,[5] and $q(\cdot)$ is the production function with the usual property of diminishing marginal returns ($q' > 0$ and $q'' < 0$). To facilitate later analysis, the notations k^n and k^s are introduced to stand for the proportions of nonshirkers and shirkers who keep their jobs, respectively. By definition, they are:

$$k^n(W, M) = [1 - p^n(M)]\hat{\lambda}(W, M), \tag{9}$$

$$k^s(W, M) = [1 - p^s(M)][1 - \hat{\lambda}(W, M)]. \tag{10}$$

Their marginal effects with respect to W and M are $k^n_W = (1 - p^n)\hat{\lambda}_W = k^n/W$, $k^n_M = (1 - p^n)\hat{\lambda}_M - p^n_M\hat{\lambda}$, $k^s_W = -(1 - p^s)\hat{\lambda}_W$, and $k^s_M = -(1 - p^s)\hat{\lambda}_M - p^s_M(1 - \hat{\lambda})$.

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[5] Equation 8 is an approximation rather than an exaction; see Carter and De Lancey (1997) for further discussions. Since the firm monitors each recruited employee only once in the period, the total monitoring cost is the product of the monitoring cost per employee (c) and the number of recruited workers (N). For simplicity, it is assumed that the monitoring cost per employee is a constant.

Without job security regulation, the firm's goal is to maximize its profits in Equation 8 by choosing the levels of M, N, and W. The corresponding first-order conditions are:

$$\pi_M = k^n_M Nq'(k^n N) - (k^n_M + k^s_M)WN = 0, \tag{11}$$

$$\pi_N = k^n q'(k^n N) - (k^n + k^s)W - c = 0, \tag{12}$$

$$\pi_W = k^n_W Nq'(k^n N) - (k^n + k^s)N - (k^n_W + k^s_W)WN = 0. \tag{13}$$

The firm's optimal levels of M, N, and W can be solved from Equations 11–13, provided that the second-order conditions are satisfied. A second-order condition for an interior solution regarding the minimum acceptable effort level (M^*) requires that $\pi_{MM} < 0$. That is, $\hat{\lambda}$ must be a concave function of M around M^*. A job security law sets a ceiling on M to lessen the firm's requirement, and when the ceiling $\bar{M}$ is set too high ($\bar{M} > M^*$ and $\pi_M < 0$), it is not binding. A binding ceiling must be set at a level where it is not larger than M^* ($\bar{M} \leqslant M^*$ and $\pi_M \geqslant 0$). More precisely, let $\pi_{\bar{M}}$ represent the marginal profit of M at $\bar{M}$. A regulation mandates that a moderate decrease in $\bar{M}$ from M^* implies that $\pi_{\bar{M}} = 0$, while a large enough decrease leads to $\pi_{\bar{M}} > 0$. In the analysis that follows, we first investigate the case where $\pi_{\bar{M}} = 0$ and then the case where $\pi_{\bar{M}} > 0$.[6]

By substituting $\bar{M} = M$ into Equations 12 and 13, the wage (W) and the recruited employment (N) under a small decrease in $\bar{M}$ (i.e., $\pi_{\bar{M}} = 0$) can be solved as:[7]

$$N = N(\bar{M}); \qquad N_{\bar{M}} = \frac{p^n_M}{(1-p^n)}N > 0, \tag{14}$$

$$W = W(\bar{M}); \qquad W_{\bar{M}} = -\frac{\hat{\lambda}_M}{\hat{\lambda}_W} \gtreqless 0; \quad \hat{\lambda}_M \leqslant 0.^{8} \tag{15}$$

Proposition 1. A just-cause employment law (a smaller $\bar{M}$) decreases the number of recruited workers ($N_{\bar{M}} > 0$). On the other hand, the law increases the firm's wage offer ($W_{\bar{M}} < 0$), provided $\hat{\lambda}_M > 0$; otherwise, the wage decreases.

Because the number of retained nonshirking (productive) workers is $E^n = k^n N$ and the output level is $q(E^n) = q(k^n N)$, the corresponding policy effects are thus:

$$E^n_{\bar{M}} = (1-p^n)\hat{\lambda}_M N \gtreqless 0; \quad \hat{\lambda}_M \gtreqless 0,^{9} \tag{16}$$

$$q_{\bar{M}} = (1-p^n)\hat{\lambda}_M Nq' \gtreqless 0; \quad \hat{\lambda}_M \gtreqless 0. \tag{17}$$

By substituting Equations 14 and 15 into Equation 8, we obtain the firm's profit function π^*. Thus, the effect of a small decrease in $\bar{M}$ (i.e., $\pi_{\bar{M}} = 0$) on profits (by using Equations 12 and 13 where $\pi_N = \pi_W = 0$) is:

$$\pi^*_{\bar{M}} = \pi_N N_{\bar{M}} + \pi_W W_{\bar{M}} + \pi_{\bar{M}} = \pi_{\bar{M}} = 0. \tag{18}$$

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[6] It is worth noting that $\hat{\lambda}_M < 0$ does not imply that $\pi_M < 0$, since a decrease in the minimum acceptable effort not only affects the average effort $\hat{\lambda}$ (the revenue), but also the number of fired workers (the labor cost).

[7] The second-order conditions are fulfilled, because $(k^n)^2q'' < 0$ and $-2(k^n)^2(\hat{\lambda}_W)^2Nq'' > 0$. A detailed derivation of the main results can be obtained from the author upon request.

[8] From Equation 11, it is easy to show that $\pi_{\bar{M}} = 0$ implies $\hat{\lambda}_M = (p^n_M\hat{\lambda}q' - p^s_M W)/[1 - p^n)q' - 2\hat{\lambda}]$. Since $\hat{\lambda}_M \gtreqless 0$, we cannot judge the sign of $\hat{\lambda}_M$ by using the condition $\pi_{\bar{M}} = 0$.

[9] From Equations 14 and 16, the policy effect in relation to the number of retained shirkers ($E^s = N - E^n$) is $E^s_{\bar{M}} = N_{\bar{M}} - E^n_{\bar{M}}$. This leads to $E^s_{\bar{M}} \gtrless 0$ when $\hat{\lambda}_M > 0$; otherwise $E^s_{\bar{M}} > 0$.

PROPOSITION 2. The number of retained productive workers and output decrease ($E^n_{\bar{M}} > 0$ and $q_{\bar{M}} > 0$), provided that a smaller required effort leads to $\hat{\lambda}_M > 0$; otherwise, the number of productive workers and output increase. Moreover, a moderate decrease in the required effort has no impact on the firm's profits ($\pi^*_{\bar{M}} = 0$).

The expected utilities of a nonshirker (with a given λ and $\lambda < \hat{\lambda}$) and of a shirker, respectively, are $V^n = (1 - p^n)W$ and $V^s = (1 - p^s)W + \lambda L$. The welfare effects of the law are:

$$V^n_{\bar{M}} = -(1-p^n)\frac{\hat{\lambda}_M}{\hat{\lambda}_W} - p^n_M W \gtreqless 0; \qquad \hat{\lambda}_M \lesseqgtr -\frac{p^n_M \hat{\lambda}}{(1-p^n)} < 0, \tag{19}$$

$$V^s_{\bar{M}} = -(1-p^s)\frac{\hat{\lambda}_M}{\hat{\lambda}_W} - p^s_M W \gtreqless 0; \qquad \hat{\lambda}_M \lesseqgtr -\frac{p^s_M \hat{\lambda}}{(1-p^s)} < 0. \tag{20}$$

Moreover, the relative welfare changes between nonshirkers and shirkers are:

$$V^n_{\bar{M}} - V^s_{\bar{M}} = (p^s - p^n)W_{\bar{M}} + (p^s_M - p^n_M)W = 0. \tag{21}$$

PROPOSITION 3. The welfare of the individual recruited shirker and nonshirker increases ($V^n_{\bar{M}} < 0$ and $V^s_{\bar{M}} < 0$), provided that a smaller $\bar{M}$ leads to $\hat{\lambda}_M > 0$; otherwise, the welfare effect is ambiguous. Furthermore, the nonshirkers' and shirkers' respective gains (or losses) are of equal amounts ($V^n_{\bar{M}} = V^s_{\bar{M}}$).

Propositions 1–3 are confined to the case where the regulation causes a moderate decrease in $\bar{M}$. It is interesting to see what will happen when there is a large enough decrease in the required minimum effort (i.e., $\pi_{\bar{M}} > 0$).[10] In fact, some of the results in Equations 14–21 remain the same, whereas others do not, as in the case of:

$$N_{\bar{M}} = -\frac{\pi_{\bar{M}}}{(k^n)^2 N q''} + \frac{p^n_M}{(1-p^n)} N > \frac{p^n_M}{(1-p^n)} N, \tag{14$'$}$$

$$E^n_{\bar{M}} = -\frac{\pi_{\bar{M}}}{k^n N q''} + (1-p^n)\hat{\lambda}_M N > (1-p^n)\hat{\lambda}_M N, \tag{16$'$}$$

$$q_{\bar{M}} = -\frac{\pi_{\bar{M}} q'}{k^n N q''} + (1-p^n)\hat{\lambda}_M N q' > (1-p^n)\hat{\lambda}_M N q', \tag{17$'$}$$

$$\pi^*_{\bar{M}} = \pi_{\bar{M}} > 0. \tag{18$'$}$$

Since the *new* terms in these equations generated by $\pi_{\bar{M}} > 0$ are all positive, this leads to:

PROPOSITION 4. A large enough decrease in the required minimum effort lowers profits. A fall in profits decreases the levels of the firm's recruited workers, retained nonshirkers, and output, while having no impact on the wage and welfare of recruited workers.

In Carter and De Lancey (1997), there are only two types of workers and the ratio of nonshirking workers to total recruited workers in equilibrium is *an exogenous constant* since the equilibrium ratio is independent of the firm's personnel policies. Carter and De Lancey find that a law that mandates a small decrease in the required minimum effort will result in a lower wage. How-

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[10] Carter and De Lancey (1997) have mentioned this interesting case in footnote 4 of their paper, but they do not explore the possible implications in their paper.

ever, both shirkers and nonshirkers gain at no cost to the firm in terms of profits and at no cost to the country in terms of output.

This model assumes that there are infinite types of workers and that the proportion of nonshirking workers in equilibrium is *an endogenous variable,* because this proportion depends upon the firm's wage and monitoring policies. Propositions 1–3 indicate that a law that mandates a small decrease in the required effort lowers the total number of the firm's recruited workers, and has an equal impact on the welfare of recruited workers regardless of whether they shirk or not. In the determination of other effects, the proportion of nonshirkers (the average effort of recruited workers) plays an important role. When a job security law lowers the average effort ($\hat{\lambda}_M > 0$), the firm raises its wage offer and reduces the number of retained nonshirkers. Greater job security and a higher wage increase the welfare of all recruited workers regardless of whether they shirk or not. A smaller number of productive workers decreases the output level, while the firm's profits are unchanged (in the case of a small decrease). On the other hand, if a job security law increases the average effort ($\hat{\lambda}_M < 0$), then it induces the firm to lower its wage offer and retain more productive (nonshirking) workers. The output level therefore increases, even though the firm's profits remain unchanged. The welfare effect of the recruited workers is ambiguous since job security rises, but the wage falls.

Proposition 4 states that the firm's profits will decrease rather than remain unchanged when the law interferes with managers' personnel policies over a moderate range. A fall in profits further creates an incentive for the firm to lower the levels of its recruited workers, retained productive workers, and output. A decrease in profits has no impact on the wage and welfare of recruited workers, however.

4. Concluding Remarks

The imposition of job security laws decreases unjust discharges at the cost of reducing just dismissals. Several previous studies have used shirking models in which workers are assumed to be homogeneous to explore the effects of such regulations. Surprisingly, these models either assume that no nonshirking workers are unjustly fired or result in an equilibrium where no shirking workers are justly fired. Carter and De Lancey (1997) successfully capture both dismissals in a one-period version of the Shapiro and Stiglitz model with two types of workers. They find that both shirkers and nonshirkers gain at no cost to the firm in terms of profits and at no cost to the country in terms of output. In other words, they find that job security regulations may result in an equilibrium Pareto improvement over the competitive equilibrium.

One restriction of their model is that the proportion of nonshirkers in equilibrium is an exogenous constant. This paper extends their model to allow for infinite types of workers. The result is that the proportion of nonshirkers is an endogenous variable and its value is influenced by the firm's wage and monitoring policies. It is shown that the proportion of nonshirkers (the average effort of the recruited workers) plays a crucial role in determining the policy effects. When the law worsens the average effort, it increases the welfare of the recruited workers, at the cost of reducing output and even profits. Alternatively, it results in a higher output level, but profits may fall and the effect on workers' welfare is uncertain. In a nutshell, this paper does not find sufficient grounds for supporting the argument that when workers are heterogeneous, job security regulations may result in a Pareto equilibrium superior to the competitive equilibrium.

It is worth emphasizing that this study does not claim that these findings in this setting must hold in reality. However, a lesson drawn from this paper is that different settings lead to different effects as the result of the introduction of a just-cause employment law. We must therefore be more prudent when drawing any conclusions regarding the policy implications of job security laws in the absence of further studies.

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