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Abstract

We consider a firm that is subject to employment protection laws that limit the firm's ability to fire labor. In particular, we suppose that though a firm which shuts down can fire all its workers, it may fire no fewer. Compared to a firm that is subject to no employment protection, a firm constrained in firing will prefer a risk-free project over a risky one, but may prefer the riskier of two risky projects.

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The Effects of Employment Protection on the Choice of Risky Projects

1 Introduction

Much of the recent growth in rich countries appears in risky, entrepreneurial, industries. Flexible labor markets and high job mobility appear necessary to succeed in such industries, and indeed the better economic performance of the United States in the 1990s than performance in Japan or in western Europe has been attributed to the combination of entrepreneurship and ‡exible labor markets in the United States.

Workers, however, may fear the loss of jobs, and demand laws that protect them. Employment protection laws, common in western Europe, increase the costs to a …rm of …ring workers. The e¤ects of such laws are extensively studied, largely focusing on how employment protection a¤ects unemployment rates. Though such measures cannot a¤ect employment in perfect markets, they do matter otherwise. Theoretical works (notably Lindbeck and Snower (1986)), Bertola (1990), and Risager and Sorensen (1997)) suggest that …ring restrictions stabilize labor markets, as …rms which anticipate …ring less in bad times tend to hire less in good times. The e¤ect on trend employment appears to be small, somewhat sensitive to demand elasticity under endogenous capital formation (Risager and Sorensen (1997)), and sensitive to the persistence of shocks (Bentolila and Saint-Paul (1994)).

Scarbetta (1996) …nds that regulations protecting jobs raise equilibrium unemployment and slow labor market adjustment. Similarly, Nickel (1997) …nds that regulations protecting jobs reduce short-term unemployment but increase long-term unemployment. Though Lazear (1990) …nds that mandatory severance pay reduces employment, more recent work casts doubt on that result (see Addison, Teixeira and Grosso (2000)). For an excellent summary of the theoretical and empirical literature, see Bertola, Boeri, and Cazes (1999).

The studies described necessarily abstracted from some important issues, including choices among projects with di¤erent degrees of risk. For example, if employment protection induces …rms to engage in non-risky activities, then …rms may …re little, income equality may be high, but the economy may su¤er from sluggish growth. Our paper accordingly asks how restrictions on a …rm's ability to …re workers a¤ects its choice among risky projects. We thus o¤er a di¤erent approach to understanding the e¤ects of employment protection. The existing literature has not addressed this question.[1]

We shall contrast the behavior of a …rm which chooses between risky and risk-free projects in conditions where it is and is not constrained in its labor decisions ex post. The …rm encounters uncertainty because labor must be hired and trained before demand is revealed. The initial hiring and project

[1] Saint-Paul (1996) in studying international product cycles comes closest to our approach, concluding that a country with rigid labor markets will tend to produce relatively secure goods.

choices therefore depend on uncertainty of demand.

For our analysis it is important to consider how the costs of …ring vary with the number of workers …red. Many west European countries constrain both individual layo¤s and collective layo¤s, with formal rules which impose additional costs on collective layo¤s. But the e¤ective di¤erentials may be the opposite of the formal ones. For example, France consider an individual dismissal "fair" if made for such economic reasons as economic dif…culty, reorganization or technological change. Thus, a …rm which adopts a risky project which clearly failed may …re workers with greater ease than would a …rm whose di¢culties were less obvious, as employees could claim that the dismissal was unfair. In the United States, collective dismissals are mildly regulated by the Worker Adjustment and Retraining Noti…cation Act (WARN) of 1988, requiring covered …rms to provide employees with sixty days' advance notice of plant closures and large-scale layo¤s. But more importantly, in the United States the tax a …rm pays for unemployment insurance increases with the number of workers it had …red, subject to a maximum rate. Thus, …rms which dismissed many workers incur no increased liability for the unemployment insurance tax if they lay o¤ additional workers.

Other conditions also make collective dismissal easier than individual dismissal. For example, tenure at a university normally means that all the faculty in a Department can be …red if the Department is closed, but otherwise …ring any one faculty member can be most di¢cult. Anti-discrimination laws may also lead to such behavior. A …rm which …res only some workers may face charges of discrimination; but shutting down a whole unit makes proofs of discrimination di¢cult. In …ring individual workers the …rm faces the danger that they may engage in sabotage, as by stealing documents, speaking ill of the …rm, and so on. But if the unit is shut down, the damage from such sabotage is smaller.

Since our focus is on risk-taking, we shall consider employment protection laws which impose lower marginal costs on the …rm the greater the number of dismissals it makes. The opposite assumption clearly leads to reduced risk-taking: if following failure the …rm cannot …re workers, and thus incurs high costs, then the …rm will avoid risky projects. If, however, extreme failure allows the …rm to …re workers while moderate failure does not, then the …rm may prefer risky projects. Whether, how, and when this intuition holds is examined below. Moreover, our analysis may lead to better design of employment protections rules, since it shows that for a given average level of protection for workers, di¤erent rules on marginal costs of …ring can lead to di¤erent results.

For analytical simplicity, we shall …rst make the extreme assumption that a …rm may …re either all or none of its workers. Of course, our assumption on …ring restriction is an extreme one, which we introduce to derive some sharp results. We then relax this assumption by allowing any amount of …ring at …nite …ring cost. Our …rst result suggests that compared to a …rm is not subject to employment protection, a …rm constrained in …ring will always prefer a risk-free project over a risky one. We then consider a …rm which has a shut-down option under employment protection.[2] Our other main result suggests that a …rm which has no access to any risk-free project but which can shut down may prefer the riskier of two risky projects. One implication is that labor market institutions are relevant for risk taking.

2 Assumptions

2.1 Hiring

We consider a single …rm over two-periods. Production follows a constant returns technology, with output equal to labor employed. In period 1 the …rm hires labor, in the quantity L_1. In period 2 demand is realized; the …rm then produces and sells the good.

The amount of labor used in period 2 is L_2. The …rm cannot hire labor in period 2: labor must be trained and experienced to be productive, or there may be lags in hiring. Thus, in period 2 the …rm can use at most L_1 workers, or $L_2 \cdot L_1$. In period 2 an unconstrained …rm can …re any number of workers. A constrained …rm must …re all or none of its workers. So for a constrained …rm either $L_2 = L_1$ or else $L_2 = 0$.

2.2 Prices

The …rm pays labor in both periods. The wage rate per worker per period is exogenously set at w.[3] The …rm sells the good at the reservation price, r, of

[2] A bankruptcy option for a …rm with debt can e¤ectively transform share ownership into a call option, and so create an incentive for choosing risky projects. This mechanism, known as asset substitution, is analyzed by Jensen and Meckling (1976). We consider an all-equity …rm instead.

[3] The assumption of a …xed wage is made for simplicity. More generally, we would expect that the higher a worker's risk of dismissal, the greater is his reservation wage. If

consumers. We assume that $2w < r$.

3 Project choice

3.1 Risk-free project

It is simplest to begin with deterministic demand, $\bar{q}$. Then the firm will employ $L_1 = \bar{q}$ workers in period 1, and employ $L_2 = \bar{q}$ workers in period 2. In such a market, a constrained and an unconstrained firm would make the same choices and earn the same profits. Profits are

$$\pi(\bar{q}) = -wL_1 + (r - w)L_2; \quad \text{with} \quad L_2 \le \bar{q}; L_2 \le L_1. \tag{1}$$

This is a two-period optimization problem where L_1 is given when L_2 is chosen. A rational firm hires no excess labor; labor in period 2 is therefore $L_2 = L_1$. The condition for entry, or for non-negative profits, when demand is risk-free is

$$r - 2w > 0; \tag{2}$$

which holds by assumption. Optimal hiring satisfies $L_1 = \bar{q}$. Expected and realized profits are therefore

$$\pi^0 = (r - 2w)\bar{q}. \tag{3}$$

3.2 Risky project

Suppose next that the firm can choose between a risk-free project and a risky project. The risky project is subject to uncertain demand in period 2. Demand can be either High (indicated by H) or Low (indicated by L). The number of consumers willing to pay the reservation price r in state i is q^i, with $q^H > q^L$. Demand is High with probability θ, and Low with probability $1 - \theta$.

If a constrained and an unconstrained firm hired the same number of workers in period 1, L_1, then under High demand in period 2 each would sell $\min(L_1; q^H)$. But were demand Low, their employments and outputs could differ. An unconstrained firm would employ $L_2^u = q^L \le L_1$ workers.

risky jobs demand a premium, the firm would have greater incentive to adopt a risk-free project.

The constrained firm would either use L_1 workers, or else fire all its workers in period 2 and produce nothing. One natural interpretation is that a firm shuts down. Under Low demand a constrained firm could not earn more than an unconstrained firm.

A constrained firm, facing restrictions on firing in period 2, adjusts its hiring of labor in period 1 in anticipation of the restrictions becoming binding. Intuitively, we would expect it to hire fewer workers than does an unconstrained firm. Moreover, the restrictions on firing can induce the firm to choose a different project than would an unconstrained firm. Perhaps surprisingly, the constrained firm may choose the riskier of two risky projects. Though a constrained firm suffers a larger fall in profits when demand is Low than would a constrained firm, the relevant comparison is the difference in marginal incentives. If a firm faces Low demand so that it would fire all workers, then any lower demand would not further reduce profits, and so the firm can bear the added risk at low or no additional cost.

3.2.1 Unconstrained firm

The firm's problem involves two-stage maximization. In period 2, the firm chooses its state-dependent employments L_2^H or L_2^L. Anticipating that decision, it hires labor in period 1, L_1. The unconstrained firm maximizes expected profit

$$\max_{L_1, L_2^H, L_2^L} \pi^u = -wL_1 + \theta(r - w)L_2^H + (1 - \theta)(r - w)L_2^L \tag{4}$$

subject to $L_2^H = \min(L_1, q^H)$, and $L_2^L = \min(L_1, q^L)$. Under High demand the firm sets $L_2 = L_1$; the firm would therefore always set $L_1 \le q^H$. To find optimal hiring, note that if the firm considers High demand likely, then it will hire many workers.

Evaluating the expected profit over the two periods under the two hiring strategies, $\pi^u(L_1 = q^H)$ and $\pi^u(L_1 = q^L)$, gives

Lemma 1 Hiring by an unconstrained firm satisfies

$$L_1 = q^H \text{ if } \theta \ge \min\left\{ \frac{w}{r - w}, \frac{wq^H - (r - w)q^L}{(r - w)(q^H - q^L)} \right\}; \tag{5}$$

$$L_1 = q^L \text{ if } 0 < \theta < \frac{w}{r - w} \text{ and } r - 2w \ge 0 \tag{6}$$

$$L_1 = 0 \text{ if } r - 2w < 0. \tag{7}$$

Corresponding to these three choices of L_1 are the following expected profits:

$L_1 = q^H : \pi^u = [\theta r - (1+\theta)w]q^H + (1-\theta)(r-w)q^L$
$L_1 = q^L : \pi^u = [r - 2w]q^L$
$L_1 = 0 : \pi^u = 0$.

We denote the realized profits in states $j = H, L$ under hiring strategies $i = q^H, q^L$ by π^u_{ij}. If the future state is correctly anticipated, realized returns on the risky project are positive, as $\pi^u_{HH} = q^H(r - 2w) > 0$ and $\pi^u_{LL} = q^L(r - 2w) > 0$. We assume, however, that an unconstrained firm makes a loss if it hires much when demand becomes Low: $\pi^u_{HL} = q^L[r - w(1 + q^H/q^L)] < 0$.

3.2.2 Constrained firm: Produces under High and Low demand

Consider a constrained firm which is forbidden to fire only some of its workers in period 2: it must either shut down or else maintain its labor force. For a given risky project it hires fewer workers than would an unconstrained firm. If the constrained firm produces when realized demand is Low, its ex ante objective is

$$\max_{L_1, L_2^H, L_2^L} \pi^c = -wL_1 + \theta(r - w)L_2^H + (1-\theta)(r-w)L_2^L \tag{8}$$

subject to $L_2^H = L_2^L = L_1$ and $L_2^H \leq q^H$. Evaluating the expected profits over the two periods under the two hiring strategies, $\pi^c(L_1 = q^H)$ and $\pi^c(L_1 = q^L)$, gives

Lemma 2 Hiring by a constrained firm which produces under both High and Low demand satisfies

$$L_1 = q^H \quad \text{if } \theta \geq \min\left\{\frac{2w}{r}, \frac{2q^H w - q^L r}{(q^H - q^L)r}\right\} \tag{9}$$

$$L_1 = q^L \quad \text{if } 0 < \theta < \frac{2w}{r} \text{ and } q^L > 0 \tag{10}$$

$$L_1 = 0 \text{ otherwise.} \tag{11}$$

The constrained firm's expected profits are

$L_1 = q^H: \quad \pi^c = [\theta r - 2w]q^H + r(1 - \theta)q^L$

$L_1 = q^L: \quad \pi^c = [r - 2w]q^L$

$L_1 = 0: \quad \pi^c = 0.$

Thus, even a constrained firm may hire q^H workers in period 1. It will do so, however, for a narrower set of parameters than would an unconstrained firm. To see the difference, consider the conditions $\frac{w}{r-w}$ in (5) and $\frac{2w}{r}$ in (9). Now $\frac{w}{r-w} = \frac{2w}{r+(r-2w)} < \frac{2w}{r}$, which proves the claim. Another way to see this is to notice that even if both the unconstrained and constrained firms earn the same positive profit under High demand and with the hiring q^H, the realized losses under Low demand differ, as $\pi^c_{HL} = -wq^H + (rq^L - wq^H) = q^L[r - w\frac{2q^H}{q^L}] < q^L[r - w(1 + \frac{q^H}{q^L})] = \pi^u_{HL} < 0$:

3.2.3 Constrained firm with shut-down option: Produces only under High demand

A constrained firm may choose to shut down rather than produce when realized demand is Low. It aims to

$$\max_{L_1; L_2^H; L_2^L} \pi^c = -wL_1 + \theta(r - w)L_2^H \tag{12}$$

subject to $L_2^H \leq q^H$ and $L_2^H = L_1$. We then have

Lemma 3 Hiring by a constrained firm which shuts down under Low demand is

$$L_1 = q^H \quad \text{if} \quad \theta > \max\left\{\frac{w}{r-w}; \frac{q^H w}{(r-w)q^H}\right\} \tag{13}$$

$$L_1 = 0 \text{ otherwise.} \tag{14}$$

Proof. The result is obtained by comparing the expected profits over two periods under different hiring strategies, $L_1 = (q^H; q^L)$. The choice $L_1 = q^L$ maximizes expected profits only if

$$\frac{w}{r-w} < \theta < \frac{w}{r-w}; \tag{15}$$

which can never hold. Hence, $L_1 = q^L$ is suboptimal.

Expected profits of the constrained firm which shuts down under Low demand are

If $L_1 = q^H$ then $\pi^c = (\theta r - (1+\theta)w)q^H$

If $L_1 = 0$ then $\pi^c = 0$.

The shut-down option is valuable under some, but not all, conditions. Define $\omega \equiv r/w$. When realized demand is Low and the firm shuts down, its loss is $\pi^c_{HL} = -wq^H$. The condition for the loss of a constrained firm with no shut-down option to be larger then takes a simple form, $\omega < q^H/q^L$. When the shut-down option has value, the firm with such an option will, for some parameter values, hire q^H workers, whereas a firm which cannot shut down will not hire q^H. We see this by noting that $\frac{w}{r-w} = \frac{2w}{r+(r-2w)} < \frac{2w}{r}$ in (13) and (9).

Having determined a firm's hiring strategy under risk-free and risky projects, we can now address the problem of project choice.

4 Optimal choice between projects

Consider first a risky project as a Rothschild-Stiglitz transformation of a risk-free project with known demand, $\bar{q}$. This transformation takes the form of a mean-preserving spread, $q^L < \bar{q} < q^H$. It is convenient to assume that $q^H - \bar{q} = \bar{q} - q^L$ The payoffs when demand is uncertain are summarized in Table 1.

Table 1. Expected Profits Under Risky Project

	L_1	Expected profits
Unconstrained firm	q^H	$[\theta r - (1+\theta)w]q^H + (1-\theta)(r-w)q^L$
	q^L	$[r - 2w]q^L$
Constrained firm, with	q^H	$[\theta r - 2w]q^H + r(1-\theta)q^L$
no shut down	q^L	$[r - 2w]q^L$
Constrained firm, with	q^H	$(\theta r - (1+\theta)w)q^H$
shut-down option	0	0

Recall that profits under the risk-free project are $(r-2w)\bar{q}$. Depending on the probabilities of High and Low demand, both a constrained and an unconstrained firm may prefer the risky project. We can show, however, that if the constrained firm prefers the risky project then the unconstrained firm does also. For intuition, observe that under the risk-free project, the constrained and the unconstrained firm earn the same profits. Under the risky project then, the unconstrained firm earns higher expected profits than does the constrained firm: $\pi^u \geq \pi^c$; in the worst case the constrained firm just mimics the unconstrained one. So if the constrained firm prefers the risky over the riskless project, then the unconstrained firm also prefers the risky project. In corroboration, note that the fifth line in Table 1 shows that the constrained firm with a shut-down option chooses the risky project when $(\theta r - (1+\theta)w)q^H > (r - 2w)\bar{q}$, in which case it hires $L_1 = q^H$ workers. An unconstrained firm would then also choose the risky project (cf. the first line).

A mean-preserving spread in consumer demands on a risky project, however, makes it less attractive to a constrained firm with no shut-down option:

Proposition 1 A firm subject to employment protection and which may not shut down always prefers a risk-free project over a risky project which has the same expected demand.

Proof. Assuming that $q^H - \bar{q} = \bar{q} - q^L$, the expected profit of the constrained firm is $[\theta r - 2w]q^H + r(1-\theta)q^L = [r - 2w]\bar{q} - (\bar{q} - q^L)[r - 2w] < [r - 2w]\bar{q}$.

The shut-down option, however, may make a constrained firm choose the risky project. It will under two conditions. First, the probability, θ, of High demand may be sufficiently large. Second, the level of demand, q^H, may be sufficiently large. Algebraically, the conditions is that $(\theta r - (1+\theta)w)q^H > (r - 2w)\bar{q}$.

4.1 Comparison of two risky projects

Assume now that a firm must choose between two risky projects, and that it has not access to a risk-free project. We shall compare the effects of a mean-preserving spread of consumer demands under a risky project for the constrained and unconstrained firm.

To describe a mean-preserving spread, let $\theta q^L + (1-\theta)q^H$ equal some constant, say M. Let θ be fixed, but let q^L and q^H change. The condition $\theta q^L + (1-\theta)q^H = M$ yields $\partial q^L/\partial q^H = (\theta - 1)/\theta$.

Consider an unconstrained firm for which $\theta > \min\left\{\frac{w}{r-w}, \frac{wq^H - (r-w)q^L}{(r-w)(q^H-q^L)}\right\}$. Then $L_1 = q^H$ and expected profits are $\pi^u = (\theta r - (1+\theta)w)q^H + (1-\theta)(r-w)q^L$. The derivative of the unconstrained firm's expected profits with respect to q^H under a mean-preserving spread is

$$\frac{\partial \pi^u}{\partial q^H} = (\theta r - (1+\theta)w) + (1-\theta)(r-w)\frac{\theta - 1}{\theta}. \qquad (16)$$

Consider a constrained …rm with a shut-down option for which $\theta > \max\left\{\frac{w}{r-w}; \frac{q^H w}{(r-w)q^H}\right\}$. The …rm sets $L_1 = q^H$ and expects pro…ts $\pi^c = (\theta r - (1+\theta)w)q^H$. The derivative of the constrained …rm's expected pro…ts with respect to q^H under a mean-preserving spread is

$$\frac{\partial \pi^c}{\partial q^H} = \theta r - (1+\theta)w. \tag{17}$$

Suppose that $\theta r - (1+\theta)w$ is positive, so that for the constrained …rm the derivative of pro…ts with respect to q^H under a mean-preserving spread is positive. Suppose also that $\theta r - (1+\theta)w$ is small, so that for the unconstrained …rm the derivative of pro…ts with respect to q^H under a mean-preserving spread is approximately $(1-\theta)(r-w)(\theta-1)/\theta$, which is negative.

Here a mean-preserving spread increases the expected pro…ts of the constrained …rm but reduces the expected pro…ts of the unconstrained …rm. The mean-preserving spread of demand can thus make the constrained …rm prefer the riskier project, whereas the unconstrained …rm does not. In our model, this will occur when market uncertainty θ satis…es[4]

$$\frac{1}{\omega - 1} < \theta < \frac{\omega - 1}{2\omega - 3} \tag{18}$$

where $\omega \equiv r/w$. Such probabilities can easily be found, for example for any $\omega \geq 2.1$, If …rms are just indi¤erent between risk-free and risky projects initially, then increased uncertainty makes the unconstrained …rm with a shut-down option choose the less risky project whereas the constrained …rm chooses the riskier one:

Proposition 2 When $1/(\omega - 1) < \theta < (\omega - 1)/(2\omega - 3)$, the constrained …rm which may shut-down prefers the riskier of two risky projects, while the unconstrained …rm does not.

5 Costly …ring

Consider an intermediate case, where the …rm can …re any number, $L_1 - L_2$, of workers at a …nite cost $\gamma(L_1 - L_2)$, with $\gamma > 0$. The …rm's objective is

[4] To derive the right-hand inequality, we need to recognize that $2p - 3 > 0$. The inequality is satis…ed because $2\omega = 2(r/w) > 4 > 3$.

$$\max_{L_1;L_2^H;L_2^L} \pi^c = -wL_1 + \theta(r - w)L_2^H + (1 - \theta)(r - w)L_2^L - \gamma(1 - \theta)(L_1 - L_2^L): \quad (19)$$

We can show

Lemma 4 Optimal hiring by a constrained firm under costly firing satisfies

$$L_1 = q^H \text{ if } \gamma < \frac{\theta}{1 - \theta} r - w; \text{ and } r - 2w > 0 \quad (20)$$

$$L_1 = q^L \text{ if } \gamma > \frac{\theta}{1 - \theta} r - w; \text{ and } r - 2w > 0: \quad (21)$$

$$L_1 = 0 \text{ otherwise}: \quad (22)$$

We note first that a firm subject to firing cost is less willing to hire and train many workers than is an unconstrained firm. The constrained firm will hire q_H only if $\theta > (w + \gamma)=(r - w)$; the corresponding inequality for an unconstrained firm is $\theta > w=(r - w)$. In a sense, a cost of firing turns to a cost of hiring. What appears more striking is that a firm subject to a firing cost will hire q_H workers for a narrower set of parameter values than will a firm which can only fire workers by shutting down. The corresponding conditions are $\theta > (w + \gamma)=(r - w)$ and $\theta > w=(r - w)$. Intuitively, though a finite firing cost allows the firm more flexibility, it is less valuable than the shut-down option.

How does the hiring cost γ affect risk-taking? Clearly, a firing cost reduces the profitability of a risky project, and so reduces risk-taking. To demonstrate, suppose the unconstrained firm is indifferent between a risky project and risk-free project so that $\pi^u(L_1 = q^H) = (r - 2w)\bar{q}$. Then the expected profit of a which if chooses the risky project, faces the same market situation but is subject to a firing cost is $(r - 2w)\bar{q} - \gamma(1 - \theta)(q^H - q^L) < 0$. It therefore prefers the risk-free project.

6 Conclusion

One important but neglected effect of employment protection on firms' decisions is on risk taking. We found, as is intuitively plausible, that an increase in …ring costs reduces the expected pro…ts of a risky project while not affecting pro…ts from a risk-free project. More interesting is a comparison of a …rm's pro…ts from two risky projects. If a …rm which shuts down and …res all labor can earn zero pro…ts, then its maximum loss from a risky project are limited. A …rm which faces costs of …ring labor may then prefer the riskier of two projects, while a …rm which faces no restrictions on …ring labor would prefer the project which is less risky. Our results may be testable, since labor market institutions vary across countries, and may lead to a novel policy implication: employment protection may promote risk taking by employers.

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