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Layoff costs, tenure, and the labor market

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Abstract

This paper investigates the effects of layoff costs on the labor market. In contrast to the previous literature, it lets firing costs be a function of tenure. The model shows that when layoff costs are an increasing function of tenure, stricter job security might increase job destruction and unambiguously affect the unemployment rate.

Keywords: Layoff costs; Tenure; Job destruction; Unemployment

JEL classification: J63; J64

1. Introduction

This paper investigates the effects of layoff costs on the labor market. Recent studies (e.g., Bertola and Rogerson, 1997; Blanchard and Portugal, 2001; Ljungqvist, 2002) have shown that, in general, layoff costs not only increase job tenure, but they also have a negative impact on labor demand. When firms decide to hire a worker, they take into account the expected cost of hiring, and dismissal costs are clearly part of it. Therefore, to avoid layoff costs, firms hire workers less frequently. While the rates of job creation and job destruction decrease with layoff costs, the equilibrium unemployment rate is ambiguously affected by job security.

In these studies layoff costs are independent of tenure. Nevertheless, protection provisions both in terms of time and money vary widely by length of service (OECD, 1999). Then, an important issue is:

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are the previous findings about the effects of layoff costs on the labor market robust when employment protection is a function of tenure? The idea is that firms might increase job destruction when firing costs are a positive function of tenure in order to avoid future increasing costs. If this is the case, unemployment would unambiguously increase, since both unemployment duration and job destruction would increase.

2. The model

The model is based on Mortensen and Pissarides (1998) augmented with firing costs,[1] which depend on job tenure. The economy is inhabited by a continuum of workers and firms in the unit interval. It is assumed that each firm can hire at most one worker. A firm posts a new job vacancy at cost $p(t)c$, where $p(t)=e^{gt}$ and g is a common growth factor. When the job is filled the firm incurs a creation cost $p(t)K$ and adopts the current technology frontier, $p(t)x$. When matched, the job's productivity remains at $p(\tau)x$, where τ is the date on which the job was filled. Jobs are destroyed either because they reach the age of obsolescence or because of an exogenous event δ, whose arrival rate follows a known Poisson distribution. Let r be the economy-wide and subjective rate of discount. In order to ensure finite present values, we must assume that $r+\delta>g$.

Let v and u be the measure of vacant firms and unemployed workers, respectively. The aggregate number of meetings is summarized by a matching function $m(v,u)$, where $m(v,u)$ is continuously differentiable, increasing in both arguments and homogeneous of degree 1.

2.1. Job destruction

2.1.1. Firms

The value of creating a new vacancy, $V(t)$, at date t is given by the following asset equation:

$$rV(t)=\frac{m(v,u)}{v}[J(t,t)-V(t)-p(t)K]-p(t)c+\dot{V}(t). \tag{1}$$

The interpretation of this equation is standard and therefore a brief explanation is sufficient. The other value functions have a similar interpretation. A vacant job is similar to holding an asset: $(m(v,u))/v$ is the probabilistic rate at which a job is filled and the term in brackets is the expected value of filling this job; the second term $-p(t)c$ is the cost associated with a vacant job; and the last term is the change in the asset value. Let $\theta=(v/u)$ be the tightness of the labor market. In any competitive equilibrium (free entry), we have that $V(t)=0$. Therefore Eq. (1) implies that

$$\frac{\theta c}{m(\theta,1)}+K=\frac{J(t,t)}{p(t)}. \tag{2}$$

[1] A similar model is also used by Saint-Paul (2002) to study the political economy of employment protection.

Let $w(\tau,t)$ be the wage rate at t of a job created at τ. The asset equation, $J(\tau,t)$, that represents the value of a filled job for a firm at time t created at τ is

$$rJ(\tau,t) = \max\{p(\tau)x - w(\tau,t) - \delta J(\tau,t) + \dot{J}(t), rV(t) - p(t)f(\tau,t)\}, \tag{3}$$

where $f(\tau,t)$ represents the layoff costs of a job with tenure $t-\tau$. The expression after the comma on the *max* operator is the firm's outside option of a match.

2.1.2. Workers

At t the value to a worker of a filled job created at τ, $W(\tau,t)$, is

$$rW(\tau,t) = \max\{w(\tau,t) - \delta[W(\tau,t) - U(t)] + \dot{W}(\tau,t), rU(t)\}, \tag{4}$$

where $rU(t)$ is the worker's outside option.

Let b be unemployment benefits. In order to guarantee positive values in a match, assume that $b<x$. The value of being unemployed is represented by

$$rU(t) = p(t)b + m(\theta,1)[W(t,t) - U(t)] + \dot{U}(t). \tag{5}$$

2.1.3. Wage determination

We assume that the surplus of a match $S(\tau,t)$ is divided between the firm and the worker in a fixed proportion. Let β be the worker's share of a match. This sharing rule implies that

$$\beta[J(\tau,t) - V(t)] = (1-\beta)[W(\tau,t) - U(t)]. \tag{6}$$

From Eqs. (2)–(6) it can be shown that

$$w(\tau,t) = \beta[p(\tau)x + p(t)f(\tau,t)] + (1-\beta)p(t)\psi(\theta), \tag{7}$$

where

$$\psi(\theta) = \left[b + \frac{\beta}{1-\beta}(c\theta + Km(\theta,1))\right].$$

As is standard, the wage rate is a weighted average of the worker's share of a match and the expected value of its outside option.

2.1.4. The date of job destruction

The optimal date of job destruction solves

$$J(\tau,t) = \max_T\left\{\int_t^{T+\tau}[p(\tau)x - w(\tau,s)]\mathrm{e}^{-(r+\delta)(s-t)}\mathrm{d}s - \mathrm{e}^{-(r+\delta)(\tau+T-t)}p(\tau+T-t)f(\tau,\tau+T-t)\right\}, \tag{8}$$

which is the sum of present value profits minus layoff costs. Substituting Eq. (7) into Eq. (8) yields:

$$J(\tau,t)=\max_T\left\{\int_t^{T+\tau}(1-\beta)\left[p(\tau)x-\frac{\beta}{1-\beta}p(s)f(\tau,s)-p(s)\psi(\theta)\right]e^{-(r+\delta)(s-t)}ds\right.$$
$$\left.-e^{-(r+\delta)(\tau+T-t)}p(\tau+T-t)f(\tau,\tau+T-t)\right\}. \tag{9}$$

Mortensen and Pissarides (1998) show that the method of guess and verify is straightforward in the solution of this problem. Following them, guess that $J(t,t)=p(t)J$. Then for $\tau=t$, we have that

$$J=\max_T\left\{(1-\beta)\int_0^T\left[x-\frac{\beta}{1-\beta}e^{gt}f(0,t)-e^{gt}\psi(\theta)\right]e^{-(r+\delta)t}dt-e^{-(r+\delta)T}p(T)f(0,T)\right\}. \tag{10}$$

Notice that when θ increases, the right-hand side of Eq. (10) decreases, which implies that Eq. (10) defines implicitly J as a decreasing function of θ. From Eq. (2) we also have that

$$J=\frac{\theta c}{m(\theta,1)}+K, \tag{11}$$

which is an increasing function of θ. Since Eqs. (10) and (11) are continuous in θ, it must be the case that they will cross in the θ–J space. In addition, as f increases, Eq. (11) remains unchanged and Eq. (10) decreases for each value of θ. Therefore, the tightness of the labor market, θ, decreases as layoff costs, f, increase.

Proposition 1. *Let firing tax be an increasing function of tenure and assume that $f(\tau,t)=(t-\tau)^\alpha f$, with $\alpha\geq 0$ and $f>0$.*

0.1. If $\alpha=0$, then tenure increases with layoff costs (f).
0.2. If $\alpha>0$, then tenure might decrease with layoff costs (f).

Proof. The optimal date of job destruction, T, solves[2]

$$(1-\beta)\left(\frac{x}{e^{gT}}-\psi(\theta)\right)=-(r+\delta-g-\beta)fT^\alpha+\alpha T^{\alpha-1}f. \tag{12}$$

[2] It is assumed that the worker's share of a match is small enough, such that $r+\delta-g>\beta$.

Using the implicit function theorem, it can be shown that

$$\frac{\partial T}{\partial f}=\frac{\dfrac{-(1-\beta)\psi'(\theta)\frac{\partial\theta}{\partial f}}{T^{\alpha-2}}+(r+\delta-g-\beta)T^{2}-\alpha T}{\dfrac{(1-\beta)xg\mathrm{e}^{-gT}}{T^{\alpha-2}}-\alpha(r+\delta-g-\beta)Tf+\alpha(\alpha-1)f}.$$

Notice that when α goes to zero tenure increases with layoff costs, since $\lim_{\alpha\to 0}\frac{\partial T}{\partial f}>0$. However, when α is "large enough" we have that tenure decreases with stricter job security, since $\lim_{\alpha\to 0}\frac{\partial T}{\partial f}<0$. □

Substituting Eq. (12) into Eq. (10) yields

$$J=x\int_0^T(1-\mathrm{e}^{g(t-T)})e^{-(r+\delta)t}\mathrm{d}t-\beta f\int_0^T t^{\alpha}\mathrm{e}^{-(r+\delta-g)t}\mathrm{d}t+T^{\alpha-1}f\frac{[(r+\delta-g-\beta)-\alpha]}{r+\delta-g}$$
$$\times[\mathrm{e}^{-(r+\delta-g)T}-1]-\mathrm{e}^{-(r+\delta-g)T}T^{\alpha}f. \qquad (13)$$

When α goes to zero, we have that

$$J^0=(1-\beta)x\int_0^{T^0}(1-\mathrm{e}^{(t-T^0)g})\mathrm{e}^{-(r+\delta)t}\mathrm{d}t-f. \qquad (14)$$

Given that the exogenous rate of job destruction is δ, we have that the flow of jobs that survives until the age of obsolescence is given by $\mathrm{e}^{-\delta T}$. In a steady-state equilibrium, job creation must equal job destruction, and therefore

$$JC=m(\theta,1)u=\delta(1-u)+JC\mathrm{e}^{-\delta T}=JD,$$

which implies that

$$u=\frac{\delta}{\delta+(1-\mathrm{e}^{-\delta T})m(\theta,1)}. \qquad (15)$$

Notice that labor market tightness increases with higher layoff costs. Then, for a large α, unemployment will unambiguously increase because both the unemployment in flow rate and unemployment duration increase[3] with stricter job security. This stands in contrast to the previous literature, in which layoff costs are independent of tenure. In this case, the unemployment rate is ambiguously affected by layoff costs, since unemployment duration increases but unemployment spells decrease with dismissal costs.

[3] Unemployment duration is the inverse of the exit rate from unemployment.

2.1.4.1. Intuition behind Proposition 1. When f increases there are two opposing effects on tenure. First, for any given tenure, layoff costs increase. This *level* effect makes employers more reluctant to fire their workers, therefore increasing job tenure. Second, the difference in layoff costs between long- and short-term jobs increases. This *substitution* effect makes firms more reluctant to keep a worker for a long period, which decreases job tenure. If the *level* effect dominates the *substitution* effect, layoff costs increase tenure and the unemployment rate is ambiguously affected.[4] However, when the *substitution* effect dominates, layoff costs decrease job tenure and unambiguously increase the unemployment rate.

Notice also that the qualitative results above do not depend on the specific functional form of the layoff costs. As long as there are these two opposing effects, the unemployment rate might increase unambiguously with dismissal costs. Any function such as $F(T)f$ would give the same qualitative results depending on the assumptions on $F'(T)$ and $F''(T)$.

The results might also be displayed in other theoretical frameworks. In the search model, for instance, when layoff costs are independent of tenure, we have that these costs reduce job turnover but make jobs less attractive, which lowers job search intensity (see Ljungqvist, 2002). However, if layoff costs vary positively with tenure, job turnover might increase (e.g., if the *substitution* effect dominates the *level* effect) instead of decrease. In this case, the unemployment rate might unambiguously increase. In the model with employment lotteries, as in Hopenhayn and Rogerson (1993), the *level* effect implies that layoff costs are equivalent to a less productive technology, which in general tends to reduce employment. Labor turnover also decreases due to this effect (see Ljungqvist, 2002). The *substitution* effect implies that the long-term jobs are less productive than the short-term jobs. This increases the demand for short-term hiring and increases job turnover. The overall impact on the labor market will depend on these two effects.

Proposition 2. *Let firing tax be a step function. Then job tenure might decrease with dismissal tax.*

Proof. Without loss of generality, let $f(\tau,t)=f$ if $t-\tau\geq t_0$ and $f(\tau,t)=0$ otherwise. We can rewrite Eq. (10) such that:

$$J(t,t)=\max_T\left\{(1-\beta)\int_0^T\left[x-\frac{\beta}{1-\beta}\mathrm{e}^{gt}gfI(t\geq t_0)-\mathrm{e}^{gt}\psi(\theta)\right]\mathrm{e}^{-(r+\delta)t}\mathrm{d}t-\mathrm{e}^{-(r+\delta)T}p(T)f\mathcal{I}(T>t_0)\right\},\tag{16}$$

where $\mathcal{I}(T\geq t_0)$ is an indicator function, which takes value one when $T\geq t_0$ and zero otherwise. Notice that as f increases, Eq. (11) remains unchanged and Eq. (16) decreases only if $T\geq t_0$, otherwise it will not change. The solution of Eq. (16) is

$$(1-\beta)\left(\frac{x}{\mathrm{e}^{gT^0}}-\psi(\theta)\right)=-(r+\delta-g-\beta)f\quad\text{or}\quad\frac{x}{\mathrm{e}^{gT'}}=\psi(\theta),\tag{17}$$

[4] There is no substitution effect when a is zero. Notice that labor demand is negatively affected by layoff costs.

depending on whether $T \geq t_0$ or not. Then, we have that

$$J' = (1-\beta)x\int_0^{T'}(1-e^{(t-T')g})e^{-(r+\delta)t}dt, \quad \text{for} \quad T' < t_0, \tag{18}$$

and

$$J^0 = (1-\beta)x\int_0^{T^0}(1-e^{(t-T^0)g})e^{-(r+\delta)t}dt - f, \quad \text{for} \quad T^0 \geq t_0. \tag{19}$$

Clearly $T^0 > T'$. Notice that Eq. (18) is independent of f, while Eq. (19) is negatively related to f. Thus, there must be an $\bar{f}$ such that $J^0 = J'$, and for $f < \bar{f}$, the solution is Eq. (19) and for $f > \bar{f}$, the solution is Eq. (18). Suppose an initial situation in which $f < \bar{f}$, then assume that the firing cost increases to f', such that $f' > \bar{f}$. Then, T will decrease, and θ will increase. □

In this case, layoff costs might decrease job tenure, increase the incidence of unemployment and decrease unemployment duration. The effects of layoff costs on the unemployment rate are ambiguous again, but for the opposite reason of when $a = 0$.[5] The above example can also shed some light on the effects of partial labor market reforms, such as the introduction of flexible contracts only, for new jobs with duration up to a certain number of periods. For instance, we could have considered a function such as $f(\tau,t) = f$ if $t - \tau \geq t_0$ and $f(\tau,t) = af$, with $a \in [0,1)$ and $t - \tau < t_0$, and investigated the effects of a reduction on layoff costs with jobs with tenure less than t_0, i.e., a reduction in a. As expected, such reform could decrease job tenure and increase the incidence of fixed term and temporary contracts, while the effects on unemployment are ambiguous. This is in accordance with Blanchard and Landier (2000) who investigate the effects of partial labor market reform on the labor market.

3. Concluding remarks

This paper shows the effects of layoff costs on the labor market when these costs vary with tenure. In contrast to the case when employment protection provisions are independent of tenure, it was shown that stricter job security *might* decrease tenure, increase job destruction, and positively affect the unemployment rate. Therefore, it can be the case that both the unemployment in flow rate and the unemployment spells would increase with stricter regulations for dismissal. Indeed Lazear (1990) shows that the unemployment rate increases with advanced notice periods and mandated severance pay. The model also shows how de-regulation strategies can increase labor market flexibility at the margin.

[5] Job creation (labor demand) and job destruction increase.

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