The dynamics of labor markets in Europe and the US: Specific skills or employment protection?

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Abstract

We argue that the main difference between European and American labor markets is not so much in the unemployment rates, but maybe more importantly in the reduced flows into and out of unemployment, in Europe. Employment protection legislations (EPL) have been extensively studied in the literature to account for such differences. We emphasize a new channel through which EPL affect transitions. The presence of costly firing regulations increases job tenure and thus raises the expected duration over which any (match specific) investment can be recouped. Because of EPL, more stable matches will increase the incentive to accumulate SHC; but also more productive matches will be broken less frequently. This channel is introduced in Wasmer (2006), but we generalize it in a calibrated model of both quits and layoffs. The resulting implication that more "sclerotic" markets may feature more productive employed workers is broadly verified by looking at worker productivity figures in Europe and the U.S.

A by-product of the paper is to develop a model which distinguishes quits from layoffs, based on asymmetric information between workers and firms. The model exhibits convenient close-form solutions reminiscent of complete information axiomatic bargaining theory.

1 Introduction

Two stylized facts emerge from the comparison of labor markets in Europe and the U.S. First, the unemployment rate is typically higher in Europe than in the U.S. (OECD 2004). This statement should be qualified though as there is a lot of variability across European countries and some European countries do in fact have a lower unemployment rate than the U.S. Second, the flows of workers between employment and unemployment (as a percentage of the active population) are much smaller in Europe than in the U.S. That is to say, employed European workers tend to keep their jobs longer and unemployed European workers tend to take a longer time finding a new one. This second stylized fact does not have to be qualified as the first one does, since (almost) all European countries have smaller flows than the U.S.

These facts are well established and numerous authors (Bertola and Bentolila (1990), Blanchard and Portugal (2001), Delacroix (2003), Millard and Mortensen (1997)) have attributed the contrasted labor market outcomes to differences in labor market policies. In particular, to account for what is sometimes refereed to as "Eurosclerosis," the literature has focused on employment protection legislations (EPL) - i.e. firing costs - to explain the differences across countries. All such explanations are based on the fact that firing restrictions render layoffs more costly, thus reducing flows into unemployment. However, if firms anticipate that their expected lifetime surplus will be negatively affected by EPL, they will less actively look for workers, who hence will stay unemployed longer on average. Flows back into unemployment will thus be reduced as well. The two mechanisms have opposite effects on the unemployment rate. In fact, using a matching model, Blanchard and Portugal have developed such an argument to show how calibrated Portuguese and American economies can exhibit similar unemployment rates, but very different flows - much smaller in the case of Portugal. These authors have even shown that both quits and layoffs are reduced by EPL. As in the above literature, the reason is similar: EPL reduce market tightness and thus makes it relatively more costly not only to be laid off, but also to quit.

The fact that both flows in and out of unemployment are smaller in Europe implies offsetting effects on the unemployment rate. In fact, we do see that some European countries have an unemployment rate of the same magnitude or smaller than in the U.S. In addition, empirical works (OECD 2004, Nickell 1997) find that EPL do not have a significant effect on the unemployment rate. These regressions find that other types of labor market policies have significant effects on the unemployment rate, namely unemployment benefits and collective bargaining (these issues have been addressed theoretically in Delacroix, Millar and Mortensen, and Ljungqvist and Sargent among others.) Does that mean that we should refocus our attention away from EPL?

Our answer is that studying EPL matters exactly because of their effect on labor market transitions. First, one cannot contrast labor markets only by looking at their relative stocks of unemployed. The speed at which unemployed are reallocated to productive activities is also important since (*i*) "sclerotic" labor markets put more pressure on the unemployment insurance system, (*ii*) unemployed lose part of their skills (see Ljungqvist and Sargent,) and (*iii*) long-term unemployed can be stigmatized in their search for a new job (Blanchard and Diamond.) All these arguments imply that a labor market would benefit from having unemployed workers transit faster back to employment and thus benefit from a reduction in EPL, even if the effect on the unemployment rate is small. In this paper however, we emphasize a new channel why studying EPL and labor market transitions matters.

The presence of costly firing regulations increases job tenure and thus raises the expected duration over which any (match specific) investment can be recouped. Thus, EPL create an additional incentive to invest to improve current productivity. In fact, considering specific human capital (SHC) when modeling EPL is important since there is "complementarity" between two mechanisms which reinforce each other: because of EPL, more stable matches will increase the incentive to accumulate SHC; but also more productive matches will be broken less frequently.

This channel is introduced in Wasmer, but we generalize it in a calibrated model of both quits and layoffs. The resulting implication that more sclerotic markets may feature more productive employed workers is broadly verified by looking at worker productivity figures in Europe and the U.S. We argue that this would not hold in a model without match specific investment as EPL would keep unproductive matches alive longer.

To address these issues, the paper develops a simple model of labor turnover and SHC investment which is calibrated to "laissez-faire" and "welfare state" types of economies. In order to look at both types of flows into unemployment, we model quits and layoffs as two distinct transitions. We find that firing restrictions reduce both quit and layoff rates, and thus raise the return from SHC investment. However, general equilibrium effects render calibration necessary. We do have the traditional negative effect of EPL on vacancy posting by firms who anticipate the payment of firing cost. However, firms also expect that their workers will invest in SHC and that makes a filled vacancy more desirable for the firm. Finally, workers anticipate to have to repeat this investment in every future job, reducing separations.

A by-product of the paper is to develop a model based on asymmetric information between workers and firms (and thus no relying on imposing wage rigidity) that distinguishes between quits and layoffs. The model exhibits convenient close-form solutions reminiscent of complete information axiomatic bargaining theory.

The paper proceeds as follows. In section 2, we develop a simple model of quits and layoffs. In section 3.1, we enrich the model by adding a human capital decision upon entry into the match. The base case features investment by workers, but in an extension we consider investment by firms and joint investments. These SHC investments represent an implicit separation cost on the worker side. In section 3.2, we introduce explicit separation costs incurred by firms (EPL.) Section 4 calibrates the model to "laissez-faire" and "welfare state" economies. We conclude in section 5 and discuss possible extensions.

2 A simple model of quits and layoffs

2.1 Environment

Time is continuous. All agents are risk-neutral. Unemployed workers and vacant firms meet each other and form a match. Let U and V be their respective numbers. Then, we have as usual that the total number of contacts is described by a matching technology $x(U,V)$ with constant returns to scale, increasing and concave in each argument. The expected return to a vacancy, denoted by J_V is equal to zero, as there is free-entry of firms.

The firm has a revenue function y which is the sum of an idiosyncratic component ε and workers' skills h. Workers have in addition of valuation of the job in terms of utility, denoted by ν. Firms pay a wage w, so that the stream of income for the firm and utility for the worker are respectively:

$$
\begin{aligned}
\pi &= \varepsilon + h - w \\
\mathcal{U} &= w + \nu
\end{aligned}
$$

There are two relevant stage for a job. In stage 0, referred to as the entry stage, the worker and firm have met and know exactly the environment, notably firm's technology ε_0, worker's utility on the job ν_0 and the threat points of each side.

In stage 1, nature selects a new value of either ε or ν, and this occurs randomly according to a Poisson process with intensity λ. This generates asymetric information. Notably, with probability β, the new state of nature affects ν only. The value is randomly drawn with c.d.f. G. In such a case, ε unchanged at value ε_0. This is referred to as a shock to the firm. With probability $1-\beta$, instead, the new state of nature affects ε which is randomly drawn with c.d.f. F and leaves ν unchanged at value ν_0.

Assumption 1 (asymmetric information). *The eventual new value of ε is privately known to the firm. The eventual new value of ν is privately known to the worker.*

Assumption 2 (take-it-or-leave-it offers). *The party which does have the information cannot credibly exploit it. The party which does not have it has thus to make an offer, assumed to be take-it-or-leave-it. Denote it by w_k, $k = f, w$ the wage offer made in the second stage.*

In other words, upon the λ-shock, the firm makes an offer with probability β while its productivity is still ε_0, and the worker makes an offer with probability $1-\beta$ while its utility on-the-job is still ν_0. One an offer is made, there is no possible renegotiation. So, if one side makes an improper value of the wage (too high for the worker or too low for the firm), the other side may reject the offer, leading to inefficient separation. This is consubstantial to the asymmetric information environment.[1]

Finally, all market participants eventually retire. This is modelled as a process with Poisson intensity δ which destroys jobs and terminate job search. To preserve stationarity, we assume that a mass δ of new born workers enter the labor market. he next diagram sum up.

$$
\text{Search} \overset{x(U,V)}{\longrightarrow} \underset{(\varepsilon_0,\nu_0)}{\text{Entry stage}} \overset{\lambda}{\longrightarrow} \text{Information}
\begin{array}{l}
\overset{\beta}{\nearrow}(\varepsilon_0,\nu)\text{: firm makes an offer } w_f \;\rightarrow \begin{array}{l}\nearrow \text{Quit} \\ \searrow \text{No quit}\end{array} \\[2ex]
\underset{1-\beta}{\searrow}(\varepsilon,\nu_0)\text{: worker makes an offer } w_w \rightarrow \begin{array}{l}\nearrow \text{No layoff} \\ \searrow \text{Layoff}\end{array}
\end{array}
\overset{\delta}{\longrightarrow} \text{Exit}
$$

[1] Note also that Shimer (2005) proposes such a take-it-or-leave-it wage offer, but with a random side making the offer with probability β and $1-\beta$, in the conclusion of his article. Our information structure corresponds exactly to his wage determination and rationalizes it. His objective was to produce additional wage rigidity, ours is to generate a distinction between quits and layoffs.

At this stage, we do not introduce firing costs. This is postponed to next Sections (extension and calibration).

2.2 Stage 1 (continuation)

Consider first the continuation stage, after a decision of no-separation has been taken. Let $J(w_k, \varepsilon)$ be asset value of a firm which pays a wage w_f and has a productivity component ε. Let $W(w_k, \nu)$ be asset value of a worker paid a wage w_f and with a utility component ν (possibly negative). We have, denoting by $r' = r + \delta$ the implicit discount rate:

$$\begin{aligned} r'J(w_k, \varepsilon) &= \varepsilon + h - w_k \text{ for } k = f, w &(1)\\ r'W(w_k, \nu) &= w_k + \nu + \delta U \text{ for } k = f, w &(2) \end{aligned}$$

For a wage offer by the firm w_f, equation (2) delivers the expression for the reservation value of ν for which the worker will attempt to quit. Similarly, for a given wage offer w_w made by the worker, equation (1) delivers the expression for the reservation value of ε for which the firm will decide to layoff. We have, denoting by a superscript r the reservation value and by U the value of job search for workers:

$$\begin{aligned} \nu^r(w_f) &= r'U - w_f \\ \varepsilon^r(w_w) &= w_w - h \end{aligned}$$

which can now be introduced easily in the optimal wage offer strategies, to deliver straight away, from the previous section, the implicit equations for wage offers. Let us first derive the interior solution to wages. Calculation are in Appendix A.

$$\begin{aligned} w_f &= h + \varepsilon_0 - \frac{1 - G(r'U - w_f)}{g(r'U - w_f)} &(3)\\ w_w &= r'U - \nu_0 + \frac{1 - F(w_w - h)}{f(w_w - h)} &(4) \end{aligned}$$

which determines an implicit equation in the wage offer and relevant values of the parameters or endogenous values, notably rU, ν_0, ε_0 and h.

Can there be corner solutions? Take for instance the case in which the shock affects worker's utility ν. Assume that there is a finite lower bound to the utility $\nu_{\min} \leq 0$. The worker will never quit whenever the wage offer received is such that

$$w_f + \nu > r'U$$

Since $\nu \geq \nu_{\min}$, the firm does not need to offer a wage above $r'U - \nu_{\min}$ since the worker won't quit anymore. Similarly, it could be that there is a finite upper bound, so that, if the wage offer w_f is below $r'U - \nu_{\max}$, the firm knows for sure that the worker will leave. In other words, the solution for the firm has to be in the range $(r'U-\nu_{\max}; r'U-w_{\min})$ and reaches the bounds if the interior solution determined in (3) is outside that range. Through a similar reasoning, we know for sure that the wage offer by the worker has to be in the range $(\varepsilon_{\min}+h, \varepsilon_{\max}+h)$ and reaches the bounds if the interior solution determined in (4) is outside.

Proposition 1. *$\partial w_f/\partial h$, $\partial w_f/\partial \varepsilon_0$, $\partial w_f/\partial U$, $\partial w_w/\partial \nu_0$, $\partial w_w/\partial h$.*

Assumption 3 (exponential distributions). We assume that:

$$\begin{aligned} f(\varepsilon) &= \Phi e^{-\Phi\varepsilon} \text{ for all positive } \varepsilon \\ g(\nu) &= \Gamma e^{-\Gamma\nu} \text{ for all positive } \nu \end{aligned}$$

In Appendix, we derive some useful properties of these distributions. We notably show that the density divided by 1- the c.d.f. is constant. This convenient results implies that interior wage equations drastically simplify to:

$$w_f = h+\varepsilon_0-\Gamma^{-1} \tag{5}$$
$$w_w = r'U-\nu_0+\Phi^{-1} \tag{6}$$

Further, there is no upper bound to the distributions so that half the corner solutions disappear. Further, as $\nu_{\min}=\varepsilon_{\min}=0$, we can eliminate all corner solutions thanks to the next assumption:

Assumption 4 (initial value of the total surplus). Parameters are such that

$$\begin{aligned} r'U-h &\geq \nu_0-\Phi^{-1} \\ r'U-h &\geq \varepsilon_0-\Gamma^{-1} \end{aligned}$$

When Assumption 4 is satisfied, all take-it-or-leave-it offers are such that there is a strictly positive value of separation (either quit or layoff) and thus no corner solution. The intuition for the first inequality is that ν_0 has to be low enough so that the worker is not willing to make a too low wage offer, while the second inequality states that ε_0 has to be low enough so that the firm is not willing to make a too large enough offer.

We can now use the value of the various wages to derive the following intermediate results:

$$\nu^r(w_f) = r'U-h-\varepsilon_0+\Gamma^{-1} \tag{7}$$
$$\varepsilon^r(w_w) = r'U-h-\nu_0+\Phi^{-1} \tag{8}$$
$$r'[W(w_w,\nu_0)-U] = \Phi^{-1}>0 \tag{9}$$
$$r'[W(w_f,\nu_\nu)-U] = \nu-\nu^r(w^f)=\nu+\varepsilon_0+h-r'U-\Gamma^{-1} \tag{10}$$
$$r'J(w_f,\varepsilon_0) = \Gamma^{-1}>0 \tag{11}$$
$$r'J(w_w,\varepsilon) = \varepsilon-\varepsilon^r(w_w)=\nu_0+\varepsilon+h-r'U-\Phi^{-1} \tag{12}$$

Equations (9) and (11) show, interestingly, that the part making the offer obtain a strictly positive surplus from the match. Workers derive a surplus that is equal to Φ^{-1}, i.e. the mean of ε. A similar interpretation holds for the surplus derived by the firm when it makes the offer. When a part received an offer instead, it has either positive or negative surplus, depending on the difference between its private value and the reservation point, as shown in equations (10) and (12). Finally, from equations (7) and (8) we obtain the relevant flow rates:

$$\text{Quit:} \qquad Q = G(\nu^r) = G\left(r'U - \varepsilon_0 - h + \Gamma^{-1}\right) \tag{13}$$

$$\text{Layoff:} \qquad L = F(\varepsilon^r) = F\left(r'U - \nu_0 - h + \Phi^{-1}\right) \tag{14}$$

$$\text{Retirement:} \qquad R = \delta \tag{15}$$

To obtain gross flows we need to multiply those rates by the source population, that it the number of new entrants multiplied by $\lambda\beta$ for quits and by $\lambda(1-\beta)$ for layoffs and total population for retirement.

Among other things, one can see that the higher the outside option of workers, the higher the quit and layoff rate. At this stage, there is no asymmetry between quit and layoff in effect of labor market tightness.

Last remark: considering the ex-ante expected value of a wage offer $\overline{w} = (1-\beta)w_w + \beta w_f$, and using that, before the revelation of the new state of nature, we have, using the expected operator E, that $E\nu = (1-\beta)\nu_0 + \beta\Gamma^{-1}$ and $E\varepsilon = \beta\varepsilon_0 + (1-\beta)\Phi^{-1}$, so that we can transform the equation above and obtain

$$\overline{w} = (1-\beta)(r'U - E\nu) + \beta(h + E\varepsilon)$$

In other words, β which was intially the probability that the worker is hit by an unobservable utility shock has the interpretation of the bargaining power of the worker, that is, what fraction of total production is captured by the wage. Similarly, $1-\beta$ has the interpretation of the bargaining power of the firm, that is, how much of the outside option of the worker (net of compensating differential $E\nu$) is reflected into the wage.[2]

2.3 Stage 0 (entry)

We are now in position to derive the asset values of the entry stage. Denote by h_0 the entry human capital which possibly differs from continuation human capital h. We assume that the entry wage is determined through bargaining, $0 \leq \alpha \leq 1$ being the bargaining power of workers. We have

[2] This equivalence between Nash-bargaining and our bilateral asymmetric information model is valid only when corner were eliminated, When there are corner solutions, typically one party ends up with its utility equal to its threat point. Then, the solution for the ex-ante wage corresponds to Sutton's XX bargaining where the threat point matters only when it is binding, and lo longer hereafter.

then:

$$
\begin{aligned}
\text{Surplus sharing:} \quad & (W_0 - U) = \frac{\alpha}{1-\alpha} J_0 && (16)\\
\text{Free-entry:} \quad & J_V = 0 && (17)\\
\text{Matching (transition rates)} \quad : \quad & x(U,V)/U = p(\theta) = q(\theta)/\theta \text{ where } \theta = V/U && (18)
\end{aligned}
$$

Firm's side

$$
\begin{aligned}
& rJ_v = -\gamma + q(J_0 - J_V) = 0 && (19)\\
(r' + \lambda)J_0 \quad = \quad & \varepsilon_0 + h - w_0 + \lambda\beta \int_{\varepsilon^r(w_f)}^{+\infty} \frac{\varepsilon - \varepsilon^r(w_f)}{r'} dF(\varepsilon) + \lambda(1-\beta)(1-Q)\frac{\Gamma^{-1}}{r'} && (20)
\end{aligned}
$$

Worker's side

$$
\begin{aligned}
rU \quad = \quad & z + p(W_0 - U) && (21)\\
(r' + \lambda)(W_0 - U) \quad = \quad & w_0 + \nu_0 - r'U + \lambda\beta(1-L)\frac{\Phi^{-1}}{r'} + \lambda(1-\beta)\int_{\nu^r(w_w)}^{+\infty} \frac{\nu - \nu^r(w_w)}{r'} dG(\nu) && (22)
\end{aligned}
$$

where $z = b + l$ is the sum of unemployment compensation b and leisure l. Note that the non-pecuniary gain of working is $\nu - l$ which can be positive or negative, even though we assumed positive values for ν are not a strong assumption.

Combining the equations above as usual, we have the usual derived equations:

$$
\begin{aligned}
\frac{\gamma}{q(\theta)} \quad &= \quad J_0 && (23)\\
rU \quad &= \quad z + \frac{\alpha}{1-\alpha}\gamma\theta && (24)
\end{aligned}
$$

while the entry wage is derived in combining (20), (22) and (16).

2.4 Stock-flows

Denote by $E = 1 - U$ total employment where labor force is inelastic and normalized to 1. Denote by E_0 the number of new entrants, and E_c the number of employees in the continuation stage. We have, as usual, and denoting by T the endogenous turnover rate defined as $T = \lambda\beta Q + \lambda(1-\beta)L$:

$$
\begin{aligned}
\frac{\partial U}{\partial t} \quad &= \quad -(p+\delta)U + \delta + E_0 T && (25)\\
\frac{\partial E_0}{\partial t} \quad &= \quad -E_0(\delta + \lambda) + pU && (26)\\
\frac{\partial E_c}{\partial t} \quad &= \quad -\delta E_c + E_0(\lambda - T) && (27)
\end{aligned}
$$

where we check that the sum of these equations indeed implies $U + E_0 + E_c \equiv 1$.This implies that in a steady-state,

$$U = \frac{\delta + E_0 T}{\delta + p} \text{ and } E_0 = \frac{p}{\delta + \lambda} U$$

Eliminating, we obtain notably:

$$U = \frac{\delta}{\delta + p - \frac{pT}{\delta + \lambda}} \tag{28}$$

which is the conventional solution for steady-state unemployment if $T = 0$ (no rejection of offers) and is increasing in T (more inflows into unemployment in a frictional world).

3 A richer model: explicit and implicit separation costs

3.1 Specific skill investment

Specific human capital is an implicit separation costs incurred by workers, because they have to repay it upon starting a new job. So, it acts as the dual of conventional separation costs paid by firms. We model such a human capital investment here.

Prior the negotiation, workers invest in skills at a sunk cost $C(h)$ with $C' > 0$, $C'' > 0$. h_0 does not depend on effort, in other words all productivity gains from learning occur in stage 1, not in stage 0. This implies that $C(h_0) = 0$ and to normalize, we set $h_0 = 0$.

The optimal investment in skills is then such that

$$C'(h) = \frac{\partial W_0}{\partial h} \tag{29}$$

Given that skills are specific, we use $\partial U / \partial h = 0$ as formalized in Wasmer (2006). We can thus rewrite the problem as

$$\begin{aligned} C'(h) &= \frac{\lambda}{r' + \lambda} r'^{-1} \left[\beta(-\frac{\partial L}{\partial h}) \Phi^{-1} + (1 - \beta) \int_{\nu^r(w_w)}^{+\infty} -\frac{\partial \nu^r}{\partial h} dG(\nu) \right] \\ &= \frac{\lambda}{r' + \lambda} \left[\beta(1 - L) + (1 - \beta)(1 - Q) \right] \end{aligned} \tag{30}$$

The first line above shows the that the gain of the invesment for the worker is twofold: in case of an offer made by himself with probability β, the gain of a higher h is to reduce the layoff probability; in case of an offer by the firm with probability $1 - \beta$.

Denote by h^* the optimal level of effort. Then, we need to transform equation (21) and (24) as

$$r'U = z + p(W_0 - U - C(h^*)) = z + \frac{\alpha}{1 - \alpha} \gamma \theta - pC(h^*) \tag{31}$$

: workers anticipate they have to pay the training cost each time they are hired.

3.2 Explicit separation costs

We can now add explicit separation costs paid by firms. Note that we do not model trainig costs by firms (training is paid by workers only, for convenience). So here, separation costs are assumed to be a pure tax to the firm. Whenever the firm rejects an offer of the worker and lay him off, it has to pays F_L (administrative burden). Whenever the worker reject a too low wage by the firm, the firm has to pay F_Q. Since the worker reject the offer, can we consider that $F_Q = 0$? This cannot be the right assumption since it would imply that a firm can lay off at no cost in simply cutting wage down so as to obtain a "voluntarily" quit. So, we will assume that both F_L and F_Q are positive. Finally, upon a δ-shock, there is no layoff cost.

We then have the following modified reservation rules:

$$\begin{aligned} \nu^r(w_f) &= r'U - w_f \\ \varepsilon^r(w_w) &= w_w - h - r'F_L \end{aligned}$$

In the separation decision represented by these two reservation rules, it appears that firms take firing costs into account, workers don't. However, firing costs may matter in their wage offer w_w. In the program of the worker (see Appendix A), we can simply replace h by $h + r'F_L$. With exponential distribution however, we obtain the same expression for wages as in (4). For the firm, the program is now modified as follows:

$$\underset{w_f}{\text{Max}} \frac{\varepsilon + h - w_f}{r + \delta} \{1 - G[\nu^r(w_f)]\} - G([\nu^r(w_f)]F_Q$$

the new last term now reflects the additional cost of worker's quit decision. This is thus equivalent to replacing h by $h + r'F_Q$ in the wage equation:

$$w_f = h + r'F_Q + \varepsilon_0 - \Gamma^{-1} \tag{32}$$

Interestingly, the quit and layoff rates are affected in a similar fashion by separation costs, as follows:

$$\text{Quit:} \qquad Q = G(\nu^r) = G\left(r'U - \varepsilon_0 - h - r'F_Q + \Gamma^{-1}\right) \tag{33}$$

$$\text{Layoff:} \qquad L = F(\varepsilon^r) = F\left(r'U - \nu_0 - h - r'F_L + \Phi^{-1}\right) \tag{34}$$

3.3 The impact of specific human capital and firing costs on turnover

Combining firing costs and human capital investments brings now interesting interactions. The first order condition on human capital investment in specific skills is affected directly by firing costs: since those reduce Q and L (the quit and layoff rates), the marginal return is automatically higher, ceteris paribus.

In addition, layoff costs have a general equilibrium effect through $r'U$. This effect is the sum of various mechanisms:

- higher values of F_K, $K = Q, L$ reduce the direct value of a job J_0 for firms and thus reduce job creation and tightness
- but, in raising the efficiency of a job and its duration, this contributed to a higher J_0. Hovewer, the first effect (likely) dominates and equilibrium θ is higher.
- On top of that, workers expect a higher value of h^* in the future, and thus a higher re-investment cost. This additionally lowers further $r'U$.

The combination of these effects (direct negative effect on turnover decisions and higher attachment throuh lower outside value of unemployment) strongly affects turnover. Among other things, **this implies that specific human capital investments amplify the role of layoff costs**.

4 Calibration

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Appendix

A Optimal wage offers

A.1 Workers

The program of the worker is:

$$\underset{w_w}{\text{Max}} \frac{w_w + \nu}{r + \delta} \{1 - F[\varepsilon^r(w_w)]\} + UF[\varepsilon^r(w_w)]$$

where the first term is the surplus of the worker on the job multiplied by the probability to remain employed and the second part is the value of being laid-off multiplied by the probability the firm lay the worker off. Substituting ε^r by $w_w - h$ and taking the first order condition, we obtain equation (4).

A.2 Firms

The program of the firm is:

$$\underset{w_f}{\text{Max}} \frac{\varepsilon + h - w_f}{r + \delta} \{1 - G[\nu^r(w_f)]\}$$

reflecting the expected value of the surplus of the firm multiplied by the probability to retain the worker. Substituting ν^r by $r'U - w_f$ and taking the first order condition, we obtain equation (3).

A.3 Properties of exponential distributions

$$\frac{1 - F(\varepsilon)}{f(\varepsilon)} = \Phi^{-1} \text{ for all positive } \varepsilon, \tag{A1}$$

$$\text{where } F = 1 - e^{-\Phi\varepsilon}, \int_0^{+\infty} \varepsilon dF(\varepsilon) = \Phi^{-1} \text{ and } \frac{1}{F(x)} \int_0^x \varepsilon dF(\varepsilon) = x + \Phi^{-1}. \tag{A2}$$

$$\frac{1 - G(\nu)}{g(\nu)} = \Gamma^{-1} \text{ for all positive } \nu, \tag{A3}$$

$$\text{where } G = 1 - e^{-\Gamma\nu}, \int_0^{+\infty} \nu dG(\nu) = \Gamma^{-1} \text{ and } \frac{1}{G(x)} \int_0^x \nu dG(\nu) = x + \Gamma^{-1}, \tag{A4}$$