

# Welfare improving employment protection

Michèle Belot\*, Jan Boone† and Jan van Ours‡

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## Abstract

This paper presents a theoretical model to show that in sectors where workers invest in firm specific knowledge employment protection legislation can raise employment, productivity and welfare. The model also predicts a U-shaped relation between firing costs and unemployment. Finally, it gives a rationale for the observation that more educated workers tend to have better protected jobs.

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## 1 Introduction

When labor markets in different countries are compared, the popular press tends to emphasize differences in employment protection. Employment protection legislation has long been blamed for the poor labor market performance in most European countries. To illustrate, the fact that unemployment is substantially lower in the US has often been attributed to the flexibility of the US labor market. Not only the popular press but also the economics literature has pointed out detrimental effects of employment protection. Because of the negative effect on the speed of reallocation, employment protection may have a negative effect on welfare. By slowing down the reallocation from old and declining sectors to new and dynamic sectors, employment protection may drive average productivity down and welfare. This is the central argument of Hopenhayn and Rogerson (1993). They stress the large magnitude of reallocation within developed economies and the negative welfare effects of policies increasing the costs of

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\*This paper has been written while she was at Tilburg University (The Netherlands), at the Department of Economics and CenterER. Contact address is now: CPB Netherlands Bureau of Economic Policy Analysis, Van Stolkweg 14, 2508 GM The Hague, The Netherlands, belot@cpb.nl

†Tilburg University, Department of Economics, TILEC, CenterER, ENCORE, IZA and CEPR, j.boone@uvt.nl. Jan Boone gratefully acknowledges financial support from NWO, KNAW and VSNU through a Vernieuwingsimpuls grant.

‡Tilburg University, Department of Economics and CenterER, CEPR, Institute for Labor Studies (OSA), IZA, vanours@uvt.nl

reallocation. They calibrate a general equilibrium model and show that a firing tax equivalent to one year's wages would reduce consumption by about 2 percent. The mechanism through which consumption losses arise is the fall in average productivity due to inefficient allocation of resources within the economy.

Although there is some consensus on the effects of employment protection on the speed of reallocation on the labor market (countries with high employment protection typically show higher unemployment durations and lower unemployment in- and outflows), the empirical evidence about the effects of employment protection on the level of unemployment is mixed. Differences in employment protection across countries are not very much related to differences in unemployment rates.

Furthermore, the literature provides several arguments legitimating the existence of employment protection. In the presence of market failures, employment protection could be a second-best instrument and foster welfare. Pissarides (2001) argues that severance payments can be justified in the presence of imperfect insurance markets. Kuhn (1992) shows that mandatory notice reduces inefficiencies in wage setting that arise otherwise, when firms have private information about their future activity (or closing decisions). In this imperfect environment, wages serve as a signalling device to reveal the future plans of firms. Workers use the information to decide whether to quit their firm or not. Firms who know they will remain active need to set sufficiently high wages to signal credibly their future to their workers, thereby wasting resources to provide information. Mandatory notice requires bad firms to inform their workers about future closures and good firms do not need a credible signal anymore.

Another rationale for the existence of employment protection is when the social value of a match is higher than its private value. Zoega and Booth (2003) show that employment protection increases welfare when the worker's human capital embodies more than match-specific skills. In their model, the human capital of workers include both firm-specific and industry-specific skills. Firms decide whether to lay off workers, knowing that workers will quit in the next period with a certain exogenous probability. Quitting workers leave the firm for another firm within the sector, and laid off workers become unemployed. If they quit, workers lose their firm-specific skills but keep the industry-skills. Because of this exogenous probability, firms discount the future more than it is socially optimal. As a consequence, too many workers are laid off. They show that the social optimum can be reached with positive redundancy payments.

Finally, non-contractibility of the behavior of workers could justify employment protection as well. Again, in a stochastic environment, where employment relationships end with a certain probability, and where workers can invest in firm-specific skills, employment protection can help stimulate this type of investments, that would otherwise be suboptimal because of hold-up problems (Teulings and Hartog (1998)). Some papers show that employment protection also determines the mix of skills workers invest in. Estevez-Abe et al. (2001) argue that employment protection gives workers incentives to invest in firm-specific skills, while the absence of employment protection would stimulate investments in general, portable skills. Wasmer (2002) uses a similar argument and suggests that American workers invest more in general skills while European workers invest more in firm-specific skills. Suedekum and Ruedmann (2003)

argue that employment protection has an ambiguous effect on specific investments though. They model employment protection as a redundancy payment. In that case, employment protection induces a lethargy effect, as the penalty associated with a redundancy is lower than without employment protection. The lower penalty discourages specific investments. On the other hand, employment protection increases the probability of obtaining the positive returns on specific investments (specific investments increase worker's earnings). Which effect dominates depends on the importance of the earnings' returns on specific investments. Nickell and Layard (1999) argue as well that employment protection may stimulate growth. The explanation they provide is that productivity improvements depend on the cooperation of workers, while also substantive participation requires training. To illustrate their argument they present cross-country estimates of productivity growth from which it appears that employment protection is the only institution that has a positive effect whereas the other labor market institutions do not seem to have any effect on growth.

The current paper makes three main contributions to the literature. First, we use the argument that employment protection stimulates worker's investments in firm-specific skills and integrate it in a general equilibrium search framework. Employment protection is modelled first as a firing tax, representing a direct cost at separation (paper work) for firms. We show that from a welfare point of view the optimal level of employment protection is strictly positive. At low levels of employment protection, the positive effect on worker's investments dominates the effect on separation costs. As the firing cost increases, the marginal benefit of employment protection falls because effort is increasingly costly and, at some point, the effect on separation costs dominates. Job creation falls, unemployment rises and therefore welfare decreases. The non-linear character of the relationship between employment protection and unemployment, derived from the model, could explain why the empirical evidence is mixed.

Second, we show that the optimal level of employment protection is not necessarily identical for all firms and workers. As Booth and Zoega (2003) and Suedekum and Ruedmann (2003), we argue that the positive welfare effects of employment protection are larger in sectors where firm-specific skills matter more. We also argue that optimal employment protection differs across workers. All else equal, low productive workers are more vulnerable to negative shocks and have therefore lower incentives to invest in specific skills. This remains true at any given level of firing cost. The marginal benefits of employment protection are higher for high productive workers than for low productive workers. Optimally, high productive workers should receive more protection.

Finally, we introduce a second type of externality which could justify the introduction of firing costs. We introduce a redistribution system from employed to unemployed workers. Taxes are levied on employed workers to finance unemployment benefits for unemployed workers. This redistribution system raises the social value of a match above its private value. In a world without employment protection, workers and firms would destroy too many matches compared to the social optimum.

The paper is set up as follows. Section 2 provides an overview of stylized facts on employment protection regulation. Section 3 analyzes formally the trade off of employment protection: more effort investment by the employee vs higher costs for firms and therefore less vacancies.

We use a one-shot version of the Mortensen and Pissarides (1994) matching model. Using such a static framework allows us to add a worker's training decision to the model. Section 4 uses simulations to illustrate that some job protection is better than no protection at all when firm specific human capital investments are important. Furthermore, it shows that the model can account for the empirical observation that more educated workers enjoy higher job protection. Section 5 provides empirical evidence of employment protection affecting economic growth. Using a data set of OECD countries we find that at low levels of employment protection growth increases as protection increases, at higher levels of employment protection an increase of protection has a negative effect on economic growth. Section 6 concludes.

## 2 Employment protection - stylized facts

Employment protection refers to regulations on hiring and firing of employees. It concerns conditions for using temporary or fixed-term contracts, training requirements but also redundancy procedures, mandated pre-notification periods and severance payments, special requirements for collective dismissals and short-time work schemes (see OECD (1999) for an overview). The common element in these rules is that they affect adjustment costs and thereby job tenure.

To measure the strictness of employment protection Belot and Van Ours (2001) have constructed an indicator. This EPL-indicator combines information with respect to open-ended contracts, fixed-term contracts and temporary work agencies. A higher value of the indicator denotes stricter employment protection, with 1 being the maximum. Table 1 presents this EPL indicator for a set of countries and time periods. We report here the OECD countries where changes have taken place between the beginning of the 60s and the early nineties. Australia, Canada, Ireland and the US feature low job protection over the whole period. Countries where job protection does not vary much over time are (in order of increasing protection) UK, Norway, Austria, Netherlands, Belgium and Sweden. Finland is the only country where protection only moved up. Denmark, France, Germany, Italy, Japan and New Zealand all experienced a considerable fall in protection in the 90s. We use this variation across countries and time in our empirical analysis below.

Temporary contracts are also a way for firms to avoid much of the cost of employment protection.<sup>1</sup> These contracts allow firms to adjust employment with relatively low costs to the variations in demand. Temporary contracts may also be used as a step in the screening process towards a permanent employment relationship, or as a form of active labor market policy (OECD, 1999).<sup>2</sup> More relevant for the purpose of this study, temporary employment is

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<sup>1</sup>Temporary employment covers in general two categories of contracts: fixed-term contracts and temporary work agency (TWA) contracts. Fixed duration contracts are employment relationships concluded directly between the employer and the worker. TWA contracts are employment relationships between a temporary work agency and the worker, the latter working for and under the control of a user firm (Peeters (1999)). See Delsen (1995) for an overview of the various definitions of temporary employment across OECD countries.

<sup>2</sup>The majority of temporary workers was employed the year before (OECD, 1996). However there is a reasonable part (varying between 8.7% in Spain and 31.9 % in Luxembourg, 1994) that was not participating to the labor market. When one looks at the status of temporary employed one year later, it appears that

unequally spread among the population and sectors of activities. Bentolila and Dolado (1994) argue that unskilled and semi-skilled workers are over-represented in this type of employment. De Grip et al. (1997) note that sixty-three percent of all temporary employed are in low-skilled occupations. More evidence goes in that direction. OECD (1999) shows that in many countries the regulation of contracts is different for blue and white collars. Blue collars are typically unskilled and benefit from less legal employment protection than white collars.

Furthermore, the OECD (1997) presents retention rates for various education levels in OECD countries. The retention rate is defined as the proportion of employees in a certain year who will still be with their current employer five years later. As shown in table 2, in most countries, retention rates rise with education levels. In particular, comparing primary-lower secondary education with university education, retention rates are higher for the latter category in all countries. To a large extent the same holds for white-collar workers that have higher retention rates than blue-collar workers in most of the countries presented in Table 2. The OECD (1997) concludes that "there is some tendency for low-educated workers to be less secure in their jobs in the majority of countries for which data are available".

These observations are in line with the predictions of our model. It is expensive to give high protection to unskilled workers because it is relatively likely that this firing cost will be incurred. Furthermore, firm specific human capital investments are less likely to be relevant for low skilled workers. The lower job protection explains the lower retention rates for low skilled workers. But even for given job protection, the lower productivity of less skilled workers makes it more likely that a negative industry shock brings the value of the match below the outside options for worker and firm. Hence even for given job protection, the model below predicts that job retention rates rise with educational achievement.

### 3 The model

This section presents a model formalizing the idea that firing costs stimulate firm specific training by the employee and hence can be welfare enhancing.<sup>3</sup> To make this point most forcefully, firing costs are assumed to be a pure waste (e.g. paper work involved in firing an employee). Below we also consider other possibilities for the firing costs and discuss other contractual arrangements between firm and worker.

The model is a one shot version of the Mortensen-Pissarides (1994) matching model. Similar one shot versions have been used by Boone and Bovenberg (2002) and Hosios (1990). The simplification allows us to introduce an additional decision margin (worker's training effort) while analytical results can still be derived. The model consists of four stages. The timing is as follows.

At  $t = 0$ , firms post vacancies  $v$  at a cost  $c_v$  per vacancy and workers supply inelastically one

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two-thirds are still under a temporary contract in Spain and Germany, while an important proportion of them benefits from a permanent contract in France (31.7%) and Great Britain (25.3%).

<sup>3</sup>See the appendix for the proofs of the results.

unit of search intensity.<sup>4</sup> Workers are distributed on the unit interval  $[0, 1]$  with measure one. The number of workers and firms that match is determined by a matching function  $m(u, v)$  where the number of unemployed  $u$  in this one shot game equals the total mass of workers,  $u = 1$ . Defining market tightness as  $\theta = \frac{v}{u} = v$ , the matching function can be written as  $m(\theta) = m(1, \theta)$ , with the usual assumptions:  $m(0) = 0, m'(\theta) > 0, m''(\theta) < 0$  and  $\frac{m(\theta)}{\theta}$  is decreasing in  $\theta$ . Once the worker and firm are matched, the suitability of the worker for the job,  $x$ , is revealed. We assume that  $x$  is the same for everyone.

Because workers are ex ante identical, all workers that are matched with a firm get a contract which stipulates a firing cost  $c_f$ .<sup>5</sup> The fraction  $(1 - m(\theta))$  of workers that are not matched, stay unemployed and receive unemployment benefit  $b \geq 0$ .

At  $t = 1$  the worker invests effort  $e$  at cost  $\gamma(e)$  to raise productivity in his match. Effort  $e$  is firm specific, nonverifiable by a court and therefore noncontractable. Further, the effort cost  $\gamma(e)$  is borne by the worker. One can think here of effort invested by the worker to get to know people working in the firm, the procedures used, effort to help colleagues or effort invested in a training program.

After effort  $e$  has been sunk, the industry conditions  $\iota$  are revealed at  $t = 2$ . The industry shock  $\iota \in \mathbb{R}$  is randomly distributed with density function  $g(\cdot)$  and distribution function  $G(\cdot)$ . Total output of the match,  $y$ , equals the sum of the suitability for the job, the effort choice and the industry shock. That is,

$$y = x + e + \iota. \quad (1)$$

After  $\iota$  has been revealed, it may be the case that  $\iota$  is so low that the worker and firm decide to split up. In that case, the firm pays the firing cost  $c_f$  and the worker becomes unemployed. These unemployed workers receive an unemployment benefit  $b$  (just as workers that did not match with a firm at  $t = 0$ ).

The worker and firm combinations that do not separate produce output  $y$  at  $t = 3$ . Furthermore, the firm and the worker bargain about the wage rate. The final output good is the numeraire ( $p_y = 1$ ) and we assume that there are no other production costs than labor.

In the following subsections, the model is solved using backward induction. First, the wage rate and profits are derived. Then we determine workers' effort choice  $e$  and number of vacancies posted by firms.

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<sup>4</sup>One could endogenize workers' search effort by introducing a search cost function for workers. This would complicate notation but does not affect the results. The reason for this is as follows. In this type of model, agents tend to search too little because part of the surplus created goes to the government as tax revenue. Firing costs in this context raise the wage for the worker and hence stimulates search. In this sense, the welfare enhancing effect of firing costs is strengthened by endogenizing workers' search effort.

<sup>5</sup>Strictly speaking there is also the possibility that  $x$  is so low that no one gets a contract. Since  $x$  is known ex ante this implies that no vacancies are posted at  $t = 0$ . This irrelevant case is ignored and  $x$  is assumed to be big enough.

### 3.1 Wages and profits

The surplus  $y$  is divided by the worker and the firm using Nash bargaining. That is, the wage  $w$  is determined by the following maximization problem

$$\max_w (w - b)^\beta (y - (1 + t)w - T + c_f)^{1-\beta}, \quad (2)$$

where  $\beta$  ( $1 - \beta$ ) is the bargaining power of the worker (firm),  $b$  is the unemployment benefit level,  $t$  and  $T$  denote components of the wage tax levied by the government and  $c_f$  is the firing cost. In terms of the Nash bargaining,  $b$  is the worker's fall back position and  $-c_f$  is the fall back position of the firm. If the worker and firm do not reach agreement on the wage, the worker is fired and receives  $b$  and the firm has to pay the firing cost  $c_f$ . From the Nash bargaining, it follows that the worker's wage and the firm's profit  $\pi$  equal

$$w = \frac{\beta}{1+t} (y - T + c_f) + (1 - \beta) b \quad (3)$$

$$\pi = (1 - \beta) (y - T - (1 + t) b) - \beta c_f. \quad (4)$$

Part of the surplus  $y$  that is not distributed to firm or worker goes to the government as tax income:

$$taxes = y - w - \pi \quad (5)$$

$$= tw + T. \quad (6)$$

The worker and firm separate after  $\iota$  has been revealed if and only if the joint surplus they generate is less than the sum of their outside options. Due to Nash bargaining, one can verify that the following two conditions are identical:

$$\pi \leq -c_f \quad (7)$$

$$w \leq b. \quad (8)$$

That is, the firm and worker always agree on when to separate: profits are below the outside option ( $-c_f$ ) if and only if wages are below the outside option ( $b$ ). Summarizing, we get the following result.

**Lemma 1** *The firm and the worker separate after  $\iota$  has been revealed if and only if*

$$y \leq \tilde{y}$$

where

$$\tilde{y} \equiv (1 + t) b + T - c_f. \quad (9)$$

Given  $x$  and  $e$ , the probability that the worker and firm separate is given by

$$\Pr(x + e + \iota \leq \tilde{y}) = G((1 + t) b + T - c_f - e - x). \quad (10)$$

Hence, the worker and firm continue after the industry shock  $\iota$  if and only if output  $y$  exceeds the gross wage costs of a wage equal to the unemployment benefit (worker's outside option) minus the firing cost (firm's outside option). For given values of  $e, b, t$  and  $T$ , a rise in the firing cost  $c_f$  implies that fewer matches are dissolved.

### 3.2 Effort choice

This section derives the effect of the firing cost on worker's effort investment. To do this, the wage rate in (3) is written explicitly as a function of effort  $e$  and industry shock  $\iota$ .

$$w(e, \iota) = \frac{\beta}{1+t} (x + e + \iota - T + c_f) + (1 - \beta) b \quad (11)$$

Note that the worker and firm bargain over the wage after the effort  $e$  has been sunk. In other words, there is a hold up problem. This is important for the welfare effects below. The worker choosing  $e$  solves the following maximization problem.

$$\max_e \left\{ -\gamma(e) + G(\tilde{y} - e - x) b + \int_{\tilde{y} - e - x}^{+\infty} w(e, \iota) g(\iota) d\iota \right\} \quad (12)$$

where the effort costs satisfy the assumptions  $\gamma(0) = 0, \gamma'(\cdot), \gamma''(\cdot) > 0$ . Raising the effort level  $e$  raises the effort cost  $\gamma(e)$  and has two beneficial effects. First, as  $e$  goes up, it becomes less likely that the worker is fired. Second, raising  $e$  raises the wage that the worker receives if the match is not dissolved. The first order condition<sup>6</sup> for this maximization problem implies that marginal costs are equal to marginal benefits:

$$\gamma'(e) = [1 - G(\tilde{y} - e - x)] \frac{\beta}{1+t}. \quad (13)$$

**Lemma 2** *The effects of the firing cost  $c_f$  and the suitability for the job  $x$  on effort  $e$  are as follows*

$$\begin{aligned} \frac{\partial e}{\partial c_f} &> 0, \\ \frac{\partial e}{\partial x} &> 0. \end{aligned}$$

The intuition for these results is as follows. As the firing cost  $c_f$  or the suitability  $x$  goes up, it becomes less likely that the worker is fired. Therefore, the worker is willing to invest higher effort  $e$ .

### 3.3 Vacancies

This section determines the number of vacancies that are created in the economy at  $t = 0$ . Profits can be written explicitly as a function of  $e$  and  $\iota$ :

$$\pi(e, \iota) = (1 - \beta) (x + e + \iota - T - (1 + t) b) - \beta c_f. \quad (14)$$

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<sup>6</sup>The second order condition is satisfied if  $\gamma''(e) - \frac{\beta}{1+t} g(\tilde{y} - e - x) > 0$ . If  $\gamma''(e) - \frac{\beta}{1+t} g(\tilde{y} - e - x) > 0$  holds for all  $e \geq 0$  then equation (13) has a unique solution.



Then the expected value of being matched with a worker equals

$$E(J) = -G(\tilde{y} - e - x)c_f + \int_{\tilde{y}-e-x}^{+\infty} \pi(e, \iota) g(\iota) d\iota. \quad (15)$$

We assume that there is free entry into the business of posting vacancies. Hence the vacancy cost equals the expected value of a vacancy.

$$c_v = \frac{m(\theta)}{\theta} E(J) \quad (16)$$

where  $\frac{m(\theta)}{\theta}$  is the probability that a firm is matched with a worker.

A rise in firing costs reduces a firm's expected profits for two reasons. First, it increases the direct cost of separation and second, the wage goes up since the firing cost improves a worker's bargaining position relative to the firm. This would suggest that a rise in firing costs is always bad news for the firm. The next lemma derives conditions under which that is the case. However, there is also a positive effect of the firing cost for the firm. Higher firing costs imply a higher effort investment by the worker and hence a higher surplus  $y$  to be divided. If effort  $e$  is sufficiently elastic (or equivalently,  $\gamma(\cdot)$  sufficiently linear), the last effect dominates and the firm gains as firing costs go up.

**Lemma 3** *If  $G(\tilde{y} - e - x)$  is close to 1 then  $\frac{\partial E(J)}{\partial c_f} < 0$ . There exist functions  $\gamma(e)$  such that  $\frac{\partial E(J)}{\partial c_f} > 0$ .*

The intuition for the first effect is as follows. The beneficial effect for the firm of a rise in  $c_f$  is that it raises worker's effort. However, if it is unlikely that the match survives ( $G(\tilde{y} - e - x)$  is close to 1) this effect on effort is small. On the other hand, if it is likely that the worker has to be fired, a rise in  $c_f$  raises expected firing costs substantially. The second result says that there are functions  $\gamma(\cdot)$  such that the elasticity of effort with respect to  $c_f$  is big. In that case, a small increase in firing costs leads to a big rise in effort and hence a big rise in a firm's profits. In that case, the rise in firing costs is beneficial to the firm, the firm posts more vacancies and we get lower unemployment.

### 3.4 Welfare and normative results

In the model there are two externalities which create beneficial effects of firing costs. First, there is a hold up problem which causes workers to underinvest in effort. A rise in firing costs induces a higher effort level and hence can be welfare enhancing, even though the firing cost is a pure waste from a social point of view (i.e. it is not a transfer). Second, because of taxation the social value of a match exceeds the private value of a match. This causes the private parties to dissolve too many matches. Some matches are dissolved which have a positive social value because of the tax revenues generated by it and the unemployment benefit  $b$  saved by having an employed worker instead of an unemployed one. Introducing a firing cost stops some of

these matches from being dissolved and hence can be welfare enhancing. This section derives conditions under which the welfare maximizing firing cost is strictly positive.

Welfare is defined as the sum of utilities of workers and firms. The expression for the expected value of a match for a firm is derived in equation (15) above. The analogous equation for expected value for a worker of being matched with a firm is

$$E(W) = -\gamma(e) + G(\tilde{y} - e - x)b + \int_{\tilde{y}-e-x}^{+\infty} w(e, \iota) g(\iota) d\iota. \quad (17)$$

Welfare  $\Omega$  can be written as

$$\Omega = (1 - m(\theta))b + m(\theta)E(W) + m(\theta)E(J) - c_v\theta. \quad (18)$$

Using the government budget constraint

$$taxes = g + [1 - m(\theta) + m(\theta)G(\tilde{y} - e - x)]b \quad (19)$$

we can write welfare as

$$\Omega = -g + m(\theta) \left[ -\gamma(e) - G(\tilde{y} - e - x)c_f + \int_{\tilde{y}-e-x}^{+\infty} (x + e + \iota) g(\iota) d\iota \right] - c_v\theta. \quad (20)$$

Maximizing welfare with respect to effort  $e$  yields that the first best effort level is determined by

$$\gamma'(e) = g(\tilde{y} - e - x)((1 + t)b + T) + [1 - G(\tilde{y} - e - x)]. \quad (21)$$

Simple comparison of this equation with (13) yields the following result.

**Lemma 4** *If  $t > 0$  and  $(1 + t)b + T > 0$  then the first best effort level exceeds the effort in the private outcome.*

There are two reasons for this effect. First, there is the hold up problem at the firm level ( $\beta < 1$ ): the worker bears all the cost of the effort  $e$  but gets only a fraction of the gains. However, not only is part of the additional output of the worker's effort shared with the firm, it is also shared by the government if  $t > 0$ . Hence, even if the firm and worker could write a contract that solves their hold up problem, we still have a hold up problem with the government if the marginal wage tax is positive. Second, the matches with  $y \in \langle 0, (1 + t)b + T - c_f \rangle$  are dissolved because they yield no private surplus although they do yield social surplus if  $y > 0$ . By raising  $e$  such matches with strictly positive social value are saved. Note that  $(1 + t)b + T < 0$  implies that the private value of a match is higher than social value. This works in the direction of the government wanting to destroy more matches than private partners.

Next the socially optimal number of vacancies (or tightness) is compared with the private outcome. Maximizing welfare with respect to  $\theta$  yields

$$m'(\theta) \left[ -\gamma(e) - G(\tilde{y} - e - x)c_f + [1 - G(\tilde{y} - e - x)](x + e) + \int_{\tilde{y}-e-x}^{+\infty} \iota g(\iota) d\iota \right] = c_v.$$

Multiplying both sides with  $\frac{\theta}{m(\theta)}$  and defining the elasticity of the matching function as  $\alpha = \frac{m'(\theta)\theta}{m(\theta)}$  this equation can be written as

$$\frac{c_v\theta}{m(\theta)} = \alpha \left[ -\gamma(e) - G(\tilde{y} - e - x)c_f + [1 - G(\tilde{y} - e - x)](x + e) + \int_{\tilde{y} - e - x}^{+\infty} \iota g(\iota) d\iota \right]. \quad (22)$$

Comparing this equation with the market outcome in equation (16) one gets the following result.

**Lemma 5** *If the following two inequalities hold*

$$\begin{aligned} \alpha &\geq 1 - \beta, \\ [1 - G(\tilde{y} - e - x)](T + (1 + t)b) + \frac{\beta}{1 - \beta}c_f &\geq \gamma(e). \end{aligned}$$

*then the socially optimal tightness  $\theta$  exceeds tightness in the private outcome (as determined by (16)).*

The intuition for these conditions is as follows. The first inequality is related to the Hosios condition (see Hosios (1990)) and says that the firm's bargaining power should not be too big. The reason is that creating vacancies causes a negative external effect (congestion externality): if a firm opens an additional vacancy, the probability that other firms are matched with a worker is reduced ( $\frac{m(\theta)}{\theta}$  is decreasing in  $\theta$ ). If the elasticity of the matching function  $\alpha$  equals firm's bargaining power ( $1 - \beta$ ) this externality is internalized and firms do not create too many vacancies from a social point of view. Clearly, if firm's bargaining power is even lower ( $1 - \beta \leq \alpha$ ) firms are not overinvesting in vacancies. The second inequality compares parts of the social surplus overlooked by the firm. First, tax revenues on surviving matches do not add to the firm's surplus and hence the firm tends to underinvest in vacancies. Second, part of the firing cost that is subtracted in firm's profits goes in fact to the worker ( $c_f$  raises worker's wages) and is not lost from a social point of view. Finally, since the worker bears all of the effort cost  $\gamma(e)$  the firm does not take this cost into account when creating vacancies. This effect tends to work in the direction of the firm overinvesting in vacancies. The inequality implies that the first two effects dominate the latter and hence the firm underinvests in vacancies.

**Proposition 1** *There exist effort functions  $\gamma(\cdot)$  such that*

$$\frac{d\Omega}{dc_f} > 0$$

*for  $c_f \in [0, \bar{c}_f)$  where  $\bar{c}_f > 0$ .*

This result implies that the socially optimal firing cost is strictly positive, although the firing cost is a pure waste from a social point of view. The intuition is that by raising the firing

cost (from  $c_f = 0$ ) workers' effort is increased which is below the social optimum and fewer matches are destroyed which have a strictly positive social value.

This result cannot hold for all effort functions. Suppose for instance that effort is costless until  $e = 1$  and infinitely expensive for  $e > 1$ .<sup>7</sup> Then all workers invest the socially optimal effort level already and raising  $c_f$  just raises costs for the economy (as firing costs are a pure waste). Hence, it must be the case that effort is sufficiently elastic to changes in  $c_f$  to get the positive welfare effect of  $c_f$ .

The welfare maximizing firing cost is finite, because as  $c_f \rightarrow +\infty$ , profits are reduced to zero and hence no vacancies will be created.

### 3.5 The nature of firing cost and contractual incompleteness

So far firing costs were assumed to be a pure waste, say paper work needed to fire an employee. Alternatively, one can distinguish firing cost as a firing tax paid to the government and severance pay which is a firing cost paid to the employee. For each of these types of firing costs the welfare effects of a rise in the firing cost and the sort of contractual incompleteness one needs to assume to defend government intervention in these cases are discussed.

In all three of these cases one needs to assume that the effort  $e$  of the worker is too low from a social point of view. This can happen (as noted above) because the marginal wage tax  $t$  is positive. Hence the social value of the surplus created by worker and firm exceeds the private value.<sup>8</sup> Another reason why the worker underinvests in effort is the hold up problem at the firm level. This happens if  $\beta < 1$  and effort is not contractible. We think here of a worker's effort to cooperate with colleagues or to behave towards customers, which is indeed very hard to verify in court. However, if this effort level were contractible, the hold up problem at the firm level would disappear and this would no longer be an argument in favor of firing costs.

To defend government intervention in the case where the firing cost is a pure waste (created by the government), it is necessary to answer the question 'if this firing cost creates additional private surplus, why don't the worker and firm write a contract themselves saying that money should be burned in case the worker is fired?' There are two answers to this question. First, although the firing cost may create additional welfare, it may be the case that the firm loses due to the firing cost (i.e.  $\frac{\partial E(J)}{\partial c_f} < 0$ ). The only way in which the worker can induce the firm to sign a contract stipulating a firing cost is to compensate the firm ex ante. In other words, the worker bribes the firm to sign such a contract. Assuming that the worker has a liquidity constraint rules out such a contract and necessitates government intervention. Another argument why government intervention is needed even if the firm would gain from the firing cost (i.e.  $\frac{\partial E(J)}{\partial c_f} > 0$ ) is given by Nickell and Layard (1999). They claim that adverse selection problems may be an important reason why private firms in the US do not offer employment protection themselves. The idea is here that there are two types of workers: one type likes an easy life and job security, the other is willing to work hard and does not mind a bit of risk.

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<sup>7</sup>That is,  $\gamma(\cdot)$  is of the form:  $\gamma(e) = \begin{cases} 0 & \text{if } e \in [0, 1] \\ +\infty & \text{otherwise} \end{cases}$ .

<sup>8</sup>Since we assume that effort  $e$  is not verifiable by court, it is reasonable to assume that  $\gamma(e)$  is not tax deductible.

By offering (unilaterally) a contract with high  $c_f$ , a firm attracts disproportionately the wrong type of worker. Hence firms only offer contracts with low firing costs.

If the firing cost takes the form of a transfer to the government (firing tax), then it is less surprising that a higher firing cost can raise welfare because the firing cost is not a waste from a social point of view. If there is a hold up problem, the firing tax is an excellent way for the government to raise revenue as it raises efficiency instead of decreasing it.

If the firing cost is a transfer to the employee (severance pay), it is again easier to get a welfare enhancing rise in the firing cost because it is not a waste from a social point of view. Note that in this case the level of the firing cost will be lower than in the two other cases because of the following moral hazard problem on the worker's side. One reason why the worker exerts effort is to avoid bankruptcy by the firm. If the worker gets severance pay  $c_f$  in case the match is dissolved, there is less incentive to try to avoid bankruptcy since the worker now gets  $b + c_f$  instead of just  $b$ .

Summarizing, to get the welfare enhancing effect of firing costs one needs to assume that the worker's effort is too low from a social point of view. This happens if there is a positive marginal tax rate and effort is not contractible. In order to make a case for the government to stipulate contracts with firing cost one can assume either that the worker has a liquidity constraint which prevents him from bribing the firm into a contract with firing costs or that firms face an adverse selection problem with different types of employees.

## 4 A numerical example

This section uses simulations to illustrate the following two points. First, we give an example of an effort function  $\gamma(e)$  (as in proposition 1) which leads to strictly positive optimal firing costs. Second, we show how the model here can account for the stylized fact discussed above that more educated workers get more employment protection. From this follows that more educated workers have higher retention rates (as in Table 2).

For simplicity, we assume that there are no unemployment benefits and no government expenditures and therefore there are no taxes:  $b = g = t = T = 0$ . Next suppose that industry shocks are normally distributed, in particular  $\iota \sim N(0, 4)$ . The matching function has the following form:  $m(u, v) = au^\alpha v^{1-\alpha}$ , with  $a = 0.9$  and  $\alpha = 0.5$ . The other parameters are specified as follows:  $\beta = 0.5$ ,  $c_v = 2$ ,  $\varphi = 0.1$ ,  $\gamma(e) = \frac{1}{2}\varphi e^2$ . This combination of parameter values was chosen to ensure plausible values of unemployment rates over a wide range of values for  $x$ . First, consider the case where  $x = 1.5$ . The first column of Table 3 shows the simulation results for the case with no firing costs,  $c_f = 0$ . The effort chosen by workers equals  $e = 4.7$  and this induces the employers to open up so many vacancies that every worker is matched with a job at  $t = 0$ . However, 6.1% of the matches break up after the industry conditions  $\iota$  are revealed. Therefore, total unemployment equals 6.1%. Profits equal 3.15 and welfare 2.73.

If firing costs are introduced, initially there is a decline in unemployment and an increase in welfare. This is shown in Figure 1. At low values of firing cost  $c_f$ , an increase in  $c_f$  gives workers a higher incentive to invest effort. Hence match productivity goes up and a smaller number of

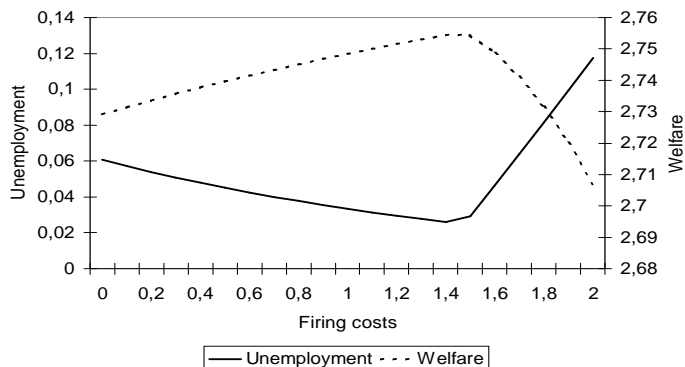


Figure 1: *Welfare and unemployment as a function of firing cost.*

matches is destroyed. For high values of  $c_f$  this effect is dominated by the negative effect of firing costs on firms' profits. In that case, a rise in  $c_f$  reduces welfare and raises unemployment. Figure 1 shows that, under the set of parameter values chosen, the optimal value of the firing costs is  $c_f^* = 1.4$ . At this level of firing costs unemployment is at its lowest point and welfare is maximized with a value of 2.75. The second column of Table 3 shows the full simulation results in this optimum. Effort is now higher, therefore productivity is higher and less matches are destroyed. The unemployment rate now equals 2.6%. Profits are lower but because there is more employment and productivity has increased welfare has also increased.

Next, we turn to the observation above that more educated workers typically enjoy higher job protection. We capture a worker's education here by his suitability for the job  $x$ . Table 3 shows that for  $x = 1.5$ , the optimal firing costs equals  $c_f^* = 1.4$ . Now consider the case of less educated workers with  $x = 1$  (and other parameters as above). Table 3 shows that in this case it is optimal to offer less employment protection as the optimal firing cost equals  $c_f^* = 1.2$ . Comparing the columns with optimal firing costs for  $x = 1.5$  and  $x = 1$  we see that the probability of separation is higher in the case of  $x = 1$  and hence retention rates are lower. Less educated workers have a higher probability of being fired because they are less productive (in terms of  $x$ ) and hence, ceteris paribus, are more likely to end up below the threshold  $\tilde{y}$  in lemma 1. This raises the probability that the firing cost has to be incurred and hence the optimal firing cost goes down as  $x$  falls. The lower firing cost raises  $\tilde{y}$  and reduces effort for less educated workers, thereby reducing retention rates further.

The theoretical positive relationship between education and optimal level of employment protection seems to correspond to what we observe in practice.

Finally, note that, in contrast to the case with  $x = 1.5$ , with  $x = 1$  we see that moving from  $c_f = 0$  to the optimal firing cost  $c_f^* = 1.2$  the unemployment rate goes up.<sup>9</sup> Hence it is not

<sup>9</sup>Unemployment is lowest (4.8%) if the firing costs are equal to 0.9.

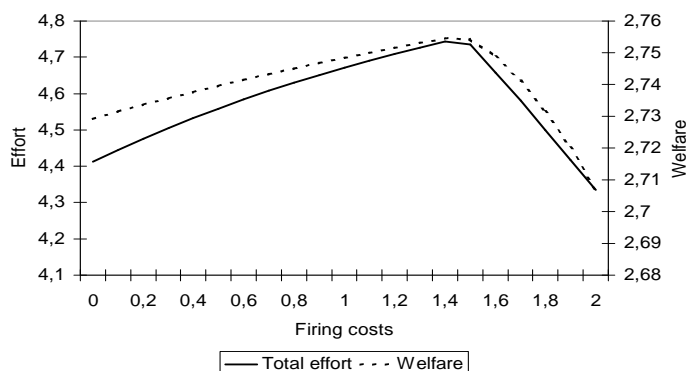


Figure 2: *Welfare and total effort as a function of the firing cost.*

always the case that maximal welfare corresponds to minimal unemployment.

## 5 Empirical analysis

As mentioned in the introduction, the relation between employment protection and unemployment levels is not as clear as is sometimes suggested. Figure 1 indicates that indeed the model here predicts a nonlinear relation between employment protection and unemployment which is not monotonically increasing. Figure 2 (based on the same simulation as Figure 1) shows the relation between firing costs and workers' effort levels. Since effort levels are not observable, we cannot test this relation directly. Yet, this section suggests that the inverse U relation between firing costs and efforts to improve efficiency is empirically relevant.

The way we test the model here is by assuming that workers' efforts which raise output (see equation (1)) can in a repeated game setting be viewed as contributing to economic growth. Hence we test whether there is an inverse U relation between employment protection and growth of GDP per capita.

This section builds on Nickell and Layard (1999) who find a significant positive effect of employment protection legislation on labor productivity growth in OECD countries (regression on first-differences over the period 1976-1992). We use five-year average data from 7 time periods (1960-94) on growth of GDP per capita and an employment protection index (Belot and Van Ours (2001), see also Table 1) to run a similar type of regression. We estimated the following model:

$$\dot{y}_{i,t} = \alpha_i + \alpha_t + \beta_1 EP_{i,t-1} + \beta_2 EP_{i,t-1}^2 + \beta_3 Z_{i,t-1} + \varepsilon_{i,t}$$

where  $i$  relates to the country and  $t$  to the time period,  $\dot{y}$  is the per capita growth of GDP,

$\alpha_i$  are the country fixed effects,  $\alpha_t$  are the time period fixed effects, EP is the employment protection index,  $Z$  is a vector of other institutional variables, and  $\varepsilon_{i,t}$  the error term.<sup>10</sup>

Table 4 shows the estimation results. The first column presents the estimate results without the quadratic term of the employment protection index and without the other institutional variables, as a benchmark. As shown the coefficient of the employment protection index is negative, but insignificantly different from zero. Including a quadratic term improves the parameter estimates substantially. Now, the linear term has a positive effect while the quadratic employment protection term has a negative effect. According to the values of both coefficients maximum growth is where the employment protection index has a value of about 0.5. The third column includes additional institutional variables that probably play a role in the economic performance of OECD countries. Whereas both coefficients of the employment protection variables are still significantly different from zero, none of the other institutional variables has a significant effect on economic growth. Therefore, the data suggest that there is an inverse U relationship between employment protection and economic growth. We interpret this as lending support to the model here which predicts an inverse U relation between firing costs and effort to raise productivity in a match.

Going back to Table 1 we see that the following picture emerges. From the point of view of per capita growth of GDP the optimal employment protection is around 0.5. Of course this is an imprecise estimate if only because as we stressed in the previous section optimal employment protection is not necessary identical for all firms and workers. Nevertheless, if we consider 0.4-0.6 to be the optimal range, the parameter estimates suggests that employment protection in the early 1990s was too low in countries like Australia, Canada, Denmark, Ireland, Switzerland, the UK and the US while employment protection is too high in countries like Finland, Italy and Sweden. Note, however, that for countries like Italy and Sweden employment protection is moving closer to the optimal range.

## 6 Conclusion

This paper analyzes the welfare effects of employment protection in an environment where workers invest in firm specific knowledge. We show that in this environment employment protection can increase the worker's training effort by raising the expected duration of the job. Thus, employment protection legislation can raise welfare, employment and average productivity. Our model also provides a rationale for the observation that more educated workers tend to have better protected jobs. From an empirical analysis of cross-country time series data it appears that employment protection legislation has a non-linear effect on economic growth. At low levels of employment protection an increase in protection stimulates growth, at high levels of employment protection an increase in protection is harmful to growth. This corresponds to our theoretical model with an inverse U relation between firing costs and effort to increase

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<sup>10</sup>The data sources used are the Groningen Growth and Development Centre (GGDC) Total Economy Database for economic growth, Belot and Van Ours (2001) for the employment protection index, union density and replacement rates, and labor tax rates. Because we use lagged explanatory variables 108 datapoints are available (6 time periods, 18 countries).



efficiency. We also find an inverse U relation between employment protection and welfare.

As our research indicates the optimal level of employment protection is not identical for all firms and workers and therefore not identical for all countries. From a policy point of view both our theoretical results and our empirical findings are interesting in the sense that they suggest that currently a lot of countries may not have an optimal employment protection. For some countries employment protection may be too low causing workers to underinvest in firm-specific skills. For other countries employment protection may be too high causing employers to underinvest in hiring workers.

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## Appendix A. Proofs of results

This appendix contains the proofs of the results in the main text.

### Proof of lemma 2

Differentiating equation (13) with respect to  $e$  and  $c_f$ , one gets

$$\left[ \gamma''(e) - \frac{\beta}{1+t} g(\tilde{y} - x - e) \right] \frac{\partial e}{\partial c_f} = g(\tilde{y} - x - e) \frac{\beta}{1+t}. \quad (\text{A.1})$$

Hence  $\frac{\partial e}{\partial c_f} > 0$  because the term in square brackets is positive due to the second order condition for  $e$ . In a similar way one can derive  $\frac{\partial e}{\partial x} > 0$ . Q.E.D.

### Proof of Lemma 3

The expression for  $E(J)$  in equation (15) can be written as

$$\begin{aligned} E(J) &= [1 - G(\tilde{y} - e - x)](1 - \beta)(x + e + c_f - T - (1 + t)b) - c_f + \\ &\quad + (1 - \beta) \int_{\tilde{y} - e - x}^{+\infty} \iota g(\iota) d\iota. \end{aligned} \quad (\text{A.2})$$

The effect of  $c_f$  on the number of vacancies follows from the effect of  $c_f$  on the expected value of a match  $E(J)$ :

$$\frac{\partial E(J)}{\partial c_f} = -1 + [1 - G(\tilde{y} - e - x)](1 - \beta) \left( 1 + \frac{\partial e}{\partial c_f} \right). \quad (\text{A.3})$$

Clearly, if  $[1 - G(\tilde{y} - e - x)] \approx 0$ , we have that  $\frac{\partial E(J)}{\partial c_f} < 0$ .

Substituting the expression for  $\frac{\partial e}{\partial c_f}$  in (A.1) into equation (A.3) we get

$$\frac{\partial E(J)}{\partial c_f} = -1 + (1 + t) \frac{1 - \beta}{\beta} \gamma'(e) \frac{\gamma''(e)}{\gamma''(e) - \frac{\beta}{1+t} g(\tilde{y} - e - x)}.$$

Let  $\hat{e}$  denote equilibrium value. Then, using a second order Taylor expansion,  $\gamma(e)$  can be written as  $\gamma(e) = \gamma(\hat{e}) + \gamma'(\hat{e})(e - \hat{e}) + \frac{1}{2}\phi(e - \hat{e})^2$  where  $\phi = \gamma''(\zeta)$  for some  $\zeta$  between  $e$  and  $\hat{e}$ . Changing the concavity of the function  $\gamma(\cdot)$  around  $\hat{e}$  (while keeping  $\gamma'(\hat{e})$  unchanged) affects how elastic  $e$  reacts to  $c_f$ , but does not affect the equilibrium  $\hat{e}$ . In other words, one can vary  $\phi$  without changing  $\hat{e}$ . It is routine to verify that as  $\phi$  comes close to  $\frac{\beta}{1+t} g(\tilde{y} - \hat{e} - x)$ , the effect of  $c_f$  on  $e$  becomes big enough to make  $\frac{\partial E(J)}{\partial c_f} > 0$ . Q.E.D.

### Proof of Lemma 5

Since  $\frac{c\theta}{m(\theta)}$  is increasing in  $\theta$ , the socially optimal number of vacancies exceeds the private number of vacancies if and only if

$$\begin{aligned} &\alpha \left[ -\gamma(e) - G(\tilde{y} - e - x) c_f + [1 - G(\tilde{y} - e - x)](x + e) + \int_{\tilde{y} - e - x}^{+\infty} \iota g(\iota) d\iota \right] \\ &\geq (1 - \beta) \left\{ [1 - G(\tilde{y} - e - x)](x + e + c_f - T - (1 + t)b) - \frac{c_f}{1 - \beta} + \int_{\tilde{y} - e - x}^{+\infty} \iota g(\iota) d\iota \right\}. \end{aligned}$$

If  $\alpha \geq 1 - \beta$  a sufficient condition for this inequality to hold is

$$\begin{aligned} & -\gamma(e) - G(\tilde{y} - e - x) c_f + \\ & \geq [1 - G(\tilde{y} - e - x)] (c_f - T - (1 + t) b) - \frac{c_f}{1 - \beta}. \end{aligned}$$

which can be written as

$$[1 - G(\tilde{y} - e - x)] (T + (1 + t) b) + \frac{\beta}{1 - \beta} c_f \geq \gamma(e).$$

Q.E.D.

**Proof of Proposition 1**

As shown in lemma 3, if  $\gamma(\cdot)$  is sufficiently elastic then we have  $\frac{\partial E(J)}{\partial c_f} > 0$ . It is clear that  $\frac{\partial E(V_e)}{\partial c_f} > 0$  because  $c_f$  raises the wage rate. Furthermore, Nash bargaining implies that  $w(e, \iota) \geq b$  for all matches that survive. Together with  $\gamma(0) = 0$  it follows that  $E(V_e) > b$ . Hence  $\frac{\partial E(J)}{\partial c_f} > 0$  implies that  $\frac{\partial \theta}{\partial c_f} > 0$  and hence  $\frac{\partial [(1 - m(\theta))b + m(\theta)E(V_e)]}{\partial \theta} > 0$ . Furthermore, by choosing  $\gamma(\cdot)$  such that in the market equilibrium (determined by  $\gamma'(e)$ ) it is the case that

$$[1 - G(\tilde{y} - e - x)] (T + (1 + t) b) + \frac{\beta}{1 - \beta} c_f \geq \gamma(e)$$

lemma 5 implies that the rise in  $\theta$  is welfare enhancing as well. Q.E.D.

| Countries   | 1960-64 | 1975-79 | 1990-94 |
|-------------|---------|---------|---------|
| Australia   | .03     | .03     | .09     |
| Austria     | .40     | .40     | .39     |
| Belgium     | .69     | .71     | .64     |
| Canada      | .11     | .11     | .11     |
| Denmark     | .37     | .37     | .14     |
| Finland     | .57     | .71     | .71     |
| France      | .69     | .73     | .55     |
| Germany     | .76     | .79     | .62     |
| Ireland     | .08     | .10     | .12     |
| Italy       | .80     | .82     | .75     |
| Japan       | .63     | .64     | .54     |
| Netherlands | .40     | .44     | .40     |
| New Zealand | .64     | .56     | .50     |
| Norway      | .33     | .33     | .33     |
| Sweden      | 1       | .93     | .76     |
| Switzerland | .07     | .11     | .11     |
| UK          | .18     | .20     | .21     |
| USA         | 0       | 0       | .02     |

Source: Belot and van Ours (2001)

Table 1: Employment protection legislation in OECD countries

|             | Education level (%)            |            | Job type (%)    |                  |
|-------------|--------------------------------|------------|-----------------|------------------|
|             | Primary/<br>lower<br>secondary | University | Blue-<br>collar | White-<br>Collar |
| Australia   | 49.4                           | 54.6       | 35.6            | 44.8             |
| Canada      | 42.3                           | 65.6       | 48.9            | 48.4             |
| France      | 46.2                           | -          | 44.5            | 53.0             |
| Germany     | 54.4                           | 78.6       | 51.6            | 66.0             |
| Japan       | 62.2                           | 77.5       | 63.7            | 73.4             |
| Spain       | 40.7                           | 71.0       | 39.9            | 33.1             |
| Switzerland | 53.4                           | -          | 54.0            | 55.7             |
| USA         | 42.7                           | 61.1       | 46.8            | 49.3             |

Table 2: Retention rates in OECD countries by education and occupation 1990-1995

|                                    | $x = 1.5$   |               | $x = 1.0$   |               |
|------------------------------------|-------------|---------------|-------------|---------------|
|                                    | $c_f = 0.0$ | $c_f^* = 1.4$ | $c_f = 0.0$ | $c_f^* = 1.2$ |
| Effort $e$                         | 4.70        | 4.87          | 4.60        | 4.80          |
| $Prob(match) m(\theta)$            | 1           | 1             | 1           | 0.94          |
| $Prob(separation) G(-c_f - e - x)$ | 0.061       | 0.026         | 0.081       | 0.040         |
| Unemployment(%)                    | 6.1         | 2.6           | 8.1         | 9.3           |
| Profits                            | 3.15        | 2.50          | 2.87        | 2.33          |
| Welfare                            | 2.73        | 2.75          | 2.21        | 2.25          |

Table 3: Simulation results

|                        | (1)         | (2)            | (3)           |
|------------------------|-------------|----------------|---------------|
| EP                     | -0.06 (0.7) | 0.84 (1.9) *   | 0.93 (2.0)**  |
| EP <sup>2</sup>        | —           | -0.80 (2.0) ** | -0.86 (2.0)** |
| Union density (%)      | —           | —              | -0.00 (0.0)   |
| Replacement rate (%)   | —           | —              | 0.04 (0.5)    |
| Labour Tax rate (%)    | —           | —              | -0.06 (0.3)   |
| $\overline{R}^2$       | 0.633       | 0.645          | 0.646         |
| Number of observations | 108         | 108            | 102           |

$t$ -values based on robust standard errors in parentheses; \* Significant at 10% level, \*\* Significant at % level

Table 4: Estimation results