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ABSTRACT

Welfare Effects of Employment Protection*

Employment protection is often related to costs incurred by firms when they fire a worker. The stability of the employment relationship, enhanced by employment protection, is also favourable to the productivity of the job. We analyse employment protection focusing on this trade-off between adjustment costs and productivity. We show that from a welfare point of view there is an optimal degree of employment protection.

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Keywords: employment protection, hold-up, human capital, reforms and welfare

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1 Introduction

When Europe with its on average high unemployment is compared with the United States where unemployment is substantially lower European rigidity and American flexibility are often emphasized. One of the institutions that is potentially incompatible with labor market flexibility is employment protection. There is a difference in employment protection between the US and Europe but also within Europe there is a big variety across countries. From an OECD (1999) overview it appears that southern European countries stand out for having relatively strict employment regulation, along with France and Germany. At the other extreme, regulation is least restrictive in the United States, the United Kingdom, New Zealand and Canada. Differences in employment protection across countries are not very much related to differences in unemployment rates. However, as far as employment protection is concerned it is not only unemployment that matters but also economic growth. Employment protection may have an effect on labor productivity through the slowing down of the reallocation from old and declining sectors to new and dynamic sectors. Still, as Nickell and Layard (1999) indicate this effect will most likely be limited because quits already allow for a substantial downward adjustment of the workforce of a firm without any costs. They emphasize that instead of having a negative effect on labor productivity, 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. Therefore, employment protection stimulates growth because it increases job tenure and thus provides an incentive for job training.[1] To illustrate this 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.

Employment protection involves costs for employers that want to adjust

[1]Employment protection may be provided through labor laws but also through the private market, collective bargaining agreements and court decisions.

their workforce. Employment protection is also a commitment device of the employer, which stimulates workers to make productivity enhancing investments in firm specific human capital. This trade-off between adjustment costs and productivity growth is the focal point of our study. If employers would not offer employment protection, workers can be fired on the spot. Without employment protection workers severely underinvest in relationship-specific capital due to a hold-up problem. Employment protection reduces the probability that workers are dismissed after they have made an effort. Hence, employment protection might be desirable both from the point of view of the worker (job stability and wage gains) and of the firm (productivity gains). No contract is ever-lasting in the sense that employers offer workers contracts that ensure the workers of a job until they retire. On the arrival of negative productivity shocks employers may decide to fire a worker despite of the costs involved. Even if employers would offer all workers ex ante the same contract, i.e. a contract with the same firing costs there may be differences in job tenure related to the productivity of the worker. Low productivity workers are more vulnerable to negative external shocks. Conditional on a particular shock high productivity workers may keep their job while low productivity workers are made redundant.

The paper is set up as follows. In Section 2 we provide an overview of stylized facts on employment protection. There are substantial differences across countries. Many countries have substantially changed their employment protection regulation towards more flexibility. From the empirical studies it appears that employment protection does not affect unemployment much but may have effects on labor market dynamics and economic growth. Theoretical studies analyze employment protection from different angles. Most of the theoretical studies consider employment protection as a cost incurred by the firm. Productivity is present in some of them but is treated exogenously. The trade-off between costs and productivity gains from employment protection constituted the originality of our paper. In Section 4 we present our theoretical matching model, where initially employment regulation is introduced with one type of contract. We assume that productivity is uncertain while there is some information about the potential suitability of the worker for the job at the time firm and worker meet. On the basis of this potential suitability employers decide whether or not to offer a contract and conditional on the offered contract workers decide whether or not they will make a productivity enhancing investment. Employment protection enhances the incentives of the workers to invest in human capital in order to reduce the probability of being fired. Hence, when the firm offers a contract with high separation costs, it commits itself to a stable employment relationship, i.e. it offers a guarantee to the worker that she won't be easily fired. Before production starts the productivity of the match is fully revealed. Then, either the firm and the worker find it efficient to separate or production starts. We show that for a given productivity there is an optimal degree of employment protection. If there is a productivity distribution it is welfare improving if different types of contracts, i.e. contracts with different firing costs, are offered. In Section 5 we present simulations to illustrate the main characteristics of our model. We show that the optimal employment protection depends on the productivity of the workers. Section 6 concludes.

2 Employment protection - stylized facts

Employment protection refers both to regulations concerning hiring and firing. It may concern rules favoring disadvantaged groups, 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 increase adjustment costs and thus job tenures.

When considering the potential welfare effect of employment protection we are especially interested in differences between countries in terms of the strictness of employment protection and the range of contracts offered in terms of temporary or more or less permanent nature.[2] Keeping in mind that the definitions and regulations governing temporary and long-term employment differ across countries and changed over time, we present some basic trends in the development of employment protection regulation of "permanent" and temporary contracts.

OECD (1999) gives a nice overview of the major changes in the two main components of employment protection: traditional open-end contracts and temporary employment. We present the indicators of the strictness of employment protection regulation in Table 1. We rank the countries according to the strictness of the regulation protecting regular contracts. As shown in the first column of Table 1 English speaking countries are the most flexible. Then come the countries from continental Europe, Northern Europe and finally, Southern Europe. By and large, the overall strictness with respect to the regulation of temporary employment, shown in the second column of Table 1 has the same pattern. The last two decades have been marked by significant liberalizations in the use of fixed-term contracts in countries that sometimes had very stringent regulations. Among them, Belgium, Finland, France, Germany, the Netherlands and Spain eased, for some of them considerably, the legal restrictions on recourse to various forms of temporary employment. An important step in these reforms was the allowance of the use of temporary contracts for non-temporary activities. Reforms in the employment protection system have sometimes been accompanied by reforms of the social security system. For example, in order to promote the use of fixed-term contracts, the Italian government established fiscal incentives for

[2] 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)). We ignore temporary work agencies because these focus on the relationship between two firms. See Delsen (1995) for an overview of the various definitions of temporary employment across OECD countries.

the employer in the form of social security tax relief (Adam and Canziani (1998)).

There are several reasons for the existence of temporary contracts. First, temporary employment is often considered as a way of providing flexibility to the firms, i.e. allowing them to adjust employment with relatively low costs to the variations in demand (Bentolila and Dolado, 1994). The most traditional and broadly accepted reason for using temporary contracts remains linked to the type of activity (seasonal or limited in duration). 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).[3] The growth of temporary employment may also have been stimulated by changes in the labor supply. The increased participation of women in the labor force is often considered as an important factor in the growth of temporary employment (OECD (1999)). Finally, there are studies focusing on the role of other institutional characteristics, e.g. Golden and Appelbaum (1992) who suggest that a reduction in the union bargaining power has enhanced the growth of temporary contracts. Their argument is that when labor's bargaining strength is high, firms are hindered to add temporary rather than permanent employees.

The incidence of temporary employment is shown in the third column of Table 1. This incidence is relatively small in most of the OECD countries, with the exception of Australia and Spain. Furthermore, the evolution of the share of temporary employment has been quite stable in the majority of countries. Nevertheless, it increased significantly in Australia, France, the Netherlands and Spain and decreased in Belgium, Greece, Luxembourg and Portugal. The variation in temporary employment may have to do with its

[3] The majority of temporary employed 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 we consider the status of temporary employed one year later, it appears that 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%).

attractiveness relative to permanent contracts. Bentolila and Dolado note that the share of temporary employment in total employment is the highest in countries where traditional arrangements are very rigid.

Finally, temporary employment is unequally spread among the population and sectors of activities. Bentolila and Dolado argue that temporary employment is prevalent among people with an unstable attachment to the labor force. 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. Temporary matches would therefore be less productive. One of the explanations suggested by Bentolila and Dolado is that fixed-term contracts would be associated with low investments in human capital and less effort from the workers. We argue in this paper that the relationship between productivity and temporary employment goes also the other way around: It would be optimal to offer short duration contracts to low productive matches.

3 Employment protection - previous studies

3.1 Empirical studies

The relationship between employment protection and unemployment has been studied frequently in the context of an international comparison of labor market institutions. Nickell (1998) for example concludes on the basis of a comparison of 20 OECD countries that employment protection has no effect on the unemployment rate. Scarpetta (1996) finds that employment protection increases unemployment and extends the period of employment adjustment. Bertola (1992) finds no relationship between employment adjustment costs and the level of unemployment. Elmeskov et al. (1998) find that employment protection increases unemployment in countries with an intermediary level of corporatism. Belot and Van Ours (2001) find that employment protection has a negative effect on unemployment when bargaining is at the firm level. Nickell and Layard (1999) scrutinize empirical evidence on the relationship between labor market institutions and economic performance. As far as unemployment is concerned they advocate a focus on unions and social security systems. The negative effect of unions can be reduced by encouraging product market competition. Social security systems can be improved by linking benefits to active labor market programs that move people from welfare to work. Nickell and Layard conclude that time spent worrying about strict labor market regulations, employment protection and minimum wages is probably time largely wasted. The OECD (1999) also concludes that employment protection has little or no effect on overall unemployment. Employment protection regulation does seem to influence the dynamics of the labor market and in particular unemployment flows (Bentolila and Bertola (1990)). The rates of job creation and job destruction on the other hand seem to be less sensitive to employment protection. They do not differ strongly between North-America and European countries, suggesting that the role of employment protection regulation is small.

As indicated in the introduction Nickell and Layard (1999) conclude from a cross-country comparison of the effects of labor market institutions on economic growth that only employment protection matters. This is in line with a cross-country analysis in OECD (1999), which shows that workers on temporary contracts are less likely to be trained.

3.2 Theoretical studies

The relationship between employment protection and labor market performance has been studied from different angles.[4] Bentolila and Dolado (1994) for example suggest an extension of the insider-outsider model to analyze the

[4]In this overview, we restrict ourselves to the direct effects of employment protection. There are some studies that consider the interactions of employment protection with other labor market institutions. Coe and Snower (1997) analyze systematically all kind of theoretical interactions between various labor market institutions. Bertola and Rogerson (1997) suggest that the effects of employment protection depend on the wage institutions.

case of Spain. The basic idea is that unionized permanent workers, dominating the wage bargaining of all workers, see their bargaining power increasing with the share of temporary employment. Indeed, the presence of a buffer of flexible employees lowers the likelihood that insiders will lose their jobs and thereby increases their bargaining power. The consequence is a widespread increase in wages damaging labor market performance.

Other studies analyze the effect of employment protection in the context of labor market flows. Boeri (1999) attempts to reconcile the empirical evidence of relatively high destruction rates and low unemployment inflows in Europe with the theoretical implications of the equilibrium labor market flows literature. He argues that employment protection actually increases the proportion of job-to-job shifts, i.e. a large number of workers move directly to another job, without experiencing unemployment. Holmlund and Linden (1993) consider a similar model where employed have a chance to avoid unemployment at the end of a long-term employment relationship, by ending up in a temporary public job. From this job they search for another job and compete with unemployed.

Wasmer (1999) argues that the share of temporary contracts relative to the share of long-term contracts depends on the productivity growth rate. High growth rates make long-term contracts attractive to firms. Downturns are associated with a shift towards temporary contracts. The co-existence of two types of contracts is guaranteed by a decreasing matching efficiency of the vacancies of one type when the number of vacancies of this type is rising. There is a threshold for the growth rate, above what the productivity of the match is so high there are only long-term vacancies posted. Employment protection makes sense here because it enables firms to protect high productive matches. Productivity determines therefore the optimal contract the firms should offer. But it enters the model exogenously. Employment protection enables the firms to keep high productive matches but does not have a direct effect on productivity itself. We find this effect also in our model, but we argue that the relationship also goes the other way around: The protection of contracts stimulate the productivity of the corresponding matches.

Hogan and Ragan (1997) also model employment protection in a matching framework. The provision of job security is defined as the proportion of firms offering a secure contract rather than a risky contract, where risky contracts are characterized by a higher layoff rate. They use a matching function with increasing returns-to-scale which generates multiple equilibria. On the one hand, when the proportion of firms offering job security is small, flows into and out of unemployment are large and so is the arrival rate of an unemployed to a vacancy. This reinforces the attractiveness of risky contracts. On the other hand, a lot of employment protection generates a relatively small arrival rate, which makes it more attractive for firms to offer secure contracts.

Estevez-Abe et al. (2001) focus on the relationship between employment protection and skills. Employment protection gives workers incentives to invest in firm-specific skills, while the absence of employment protection would stimulate investments in general, portable skills.

All in all, we conclude that most of the theoretical studies consider employment protection as a cost incurred by the firm[5]. The gains for the worker associated with employment protection concerns the stability of the employment relationship and the increased wage (insider effect). As we will describe in more detail in the next subsection, we add to this the productivity enhancing effect. Productivity is present in other studies on employment protection but is then not directly influenced by the type of employment protection. It can be an aspect determining the contract choice (as in Wasmer (1999)) but basically once the firm and the worker have met, the future of their relationship depends on exogenous events. Our model combines the cost-aspect of employment protection with its influence on the behavior of the partners (in particular of the workers) within the employment relationship. This introduces a trade-off between productivity gains and costs that is not present in other studies.

[5] Welfare effects of severance payments and notices of termination are investigated in Pissarides (2001) and Lazear (1990).

4 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. To make this point most forcefully, we assume that firing costs are a pure waste (e.g. paper work involved in firing an employee). In subsection 4.5 we consider firing costs as a transfer (either to employee or government). The exact form of the firing cost affects the nature of the contractual incompleteness we need to assume in order to get the positive welfare effect of firing costs. Hence we postpone the discussion on contracts to section 4.5 as well.

We use 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). This simplification allows us to introduce an additional decision margin (effort choice of a worker) while we can still derive analytical results. The model consists of four stages of which the timing is as follows.

At $t = 0$, firms post vacancies v at a cost c per vacancy and workers supply inelastically one unit of search intensity.[6] We model workers 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 $\theta = \frac{v}{u}$, we find that $\theta = v$ and we write the matching function as $m(\theta) = m(1, \theta)$. We make the usual assumptions that $m(0) = 0, m'(\theta) > 0, m''(\theta) < 0$ and $\frac{m(\theta)}{\theta}$ is decreasing in θ. Once the worker and the firm are matched the suitability of the worker for the job, x, is revealed. In this section the suitability x is the same for everyone. Below

[6] 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. Hence the welfare enhancing effect of firing costs is strengthened by endogenizing workers' search effort.

we explore what happens if x differs between workers ex post.

Because here everyone has the same suitability x, every worker who is matched with a firm gets a contract and the contract stipulates a firing cost c_f.[7] 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 his productivity in this match. Because this is a one-shot model, this effort e is firm specific. We assume that e cannot be contracted and that the cost is borne by the worker. One can think here of effort invested by the worker to get to know the firm, the procedures used, effort to help colleagues or effort invested in a formal training program. As noted above, we come back to the contractual problems surrounding e in section 4.5.

After this effort e has been sunk, the industry conditions ε are revealed at $t = 2$. The industry shock $\varepsilon \in \Re$ is randomly distributed with density function $g(.)$ and distribution function $G(.)$. We assume the following simple relation between the suitability for the job, x, the effort choice, e, the industry shock, ε, and total output of the match y:

$$y = x + e + \varepsilon \tag{1}$$

After ε has been revealed, it may be the case that the worker and firm decide to split up if ε is rather low. 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 their fellow workers that did not match with a firm at $t = 0$).

The worker and firm combinations that do not separate produce output y at $t = 3$. Further, the firm and the worker bargain about the wage rate. We use final output as numeraire and assume there are no other production costs than labor costs.

[7] 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 vancancies are posted at $t = 0$. We ignore this irrelevant case and assume that x is big enough.

In the following subsections, we solve the model using backward induction. First, we solve for the wage rate and profits, then for workers' effort choice e and finally for the number of vacancies posted by the firms.

4.1 Wages and profits

We assume that the surplus y is divided by the worker and the firm using Nash bargaining. Thus, the wage is determined by the following maximization problem

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

where β $(1-\beta)$ is the worker's (firm's) bargaining power, b is the unemployment benefit level and thus the worker's fall back position, t and T denote components of the wage tax levied by the government and c_f is the firing cost. That is, $-c_f$ 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 the firm has to pay the firing cost c_f. It follows from this that the worker's wage w and the firm's profit π equal

$$w = \frac{\beta}{1+t} (y - T + c_f) + (1-\beta)\, b \tag{2}$$

$$\pi = (1-\beta)\,(y - T - (1+t)\, b) - \beta c_f \tag{3}$$

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

$$\begin{aligned} taxes &= y - w - \pi \\ &= tw + T \end{aligned}$$

The worker and firm will separate after ε 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:

$$\begin{aligned} \pi &\leq -c_f \\ w &\leq b \end{aligned}$$

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). It is routine to verify that this can be reformulated as follows.

Lemma 1 *The firm and the worker separate after ε has been revealed if and only if*

$$y \leq \underline{y}$$

where

$$\underline{y} \equiv (1+t)\,b + T - c_f \tag{4}$$

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

$$\Pr\left(x + e + \varepsilon \leq \underline{y}\right) = G\left((1+t)\,b + T - c_f - e - x\right) \tag{5}$$

Hence, the worker and firm continue after the industry shock 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.

4.2 Effort choice

In this section we derive the effect of the firing cost on worker's effort investment. To do this, we write the wage rate in (2) explicitly as a function of effort e and industry shock ε.

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

What is important here is 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. One would expect the worker and firm to look for opportunities to remove this hold up problem. In section 4.5 we discuss what type of contractual incompleteness we need to assume so that the worker and firm cannot solve the hold up problem themselves.

The worker choosing e solves the following maximization problem.

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

where we assume that the effort costs satisfy $\gamma(0) = 0$ and $\gamma'(.), \gamma''(.) > 0$. In words, 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 for this maximization problem implies that marginal costs are equal to marginal benefits:

$$\gamma'(e) = \left[1 - G\left(\underline{y} - e - x\right)\right] \frac{\beta}{1+t} \tag{6}$$

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

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

$$\frac{\partial e}{\partial c_f} > 0$$
$$\frac{\partial e}{\partial x} > 0$$

The intuition for these results is as follows. As c_f goes up, it becomes less likely that the worker is fired. Hence it becomes more likely that the effort e will yield a revenue in terms of a higher wage. Similarly, as x goes up, it becomes less likely that the worker is fired and hence he is more willing to invest effort e.

4.3 Vacancies

In this section we determine the number of vacancies that are created in the economy at $t = 0$. We write profits explicitly as a function of e and ε.

$$\pi(e, \varepsilon) = (1 - \beta)(x + e + \varepsilon - T - (1 + t) b) - \beta c_f$$

Then the expected value of being matched with a worker equals

$$\begin{aligned} E(J) &= -G(\underline{y} - e - x) c_f + \int_{\underline{y}-e-x}^{+\infty} \pi(e, \varepsilon) g(\varepsilon) d\varepsilon & (7) \\ &= [1 - G(\underline{y} - e - x)](1 - \beta)(x + e + c_f - T - (1 + t) b) - c_f + \\ &\quad + (1 - \beta) \int_{\underline{y}-e-x}^{+\infty} \varepsilon g(\varepsilon) d\varepsilon & (8) \end{aligned}$$

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

$$c = \frac{m(\theta)}{\theta} E(J) \tag{9}$$

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

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

$$\frac{\partial E(J)}{\partial c_f} = -1 + [1 - G(\underline{y} - e - x)](1 - \beta)\left(1 + \frac{\partial e}{\partial c_f}\right) \tag{10}$$

A rise in firing costs reduces a firm's expected profits for two reasons. First, it increases the direct cost at separation and second, the wage goes up since the firing costs 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, $\gamma(.)$ sufficiently linear), the last effect dominates and the firm gains as firing costs go up.

Lemma 3 *If* $G\left(\underline{y}-e-x\right)$*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 ($G\left(\underline{y}-e-x\right)$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 $\gamma(.)$ 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.

4.4 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. 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 (7) above. The analogous equation for expected value for a worker of being matched with a firm is

$$E\left(V_e\right)=-\gamma(e)+G\left(\underline{y}-e-x\right)b+\int_{\underline{y}-e-x}^{+\infty}w(e,\varepsilon)\,g(\varepsilon)\,d\varepsilon$$

Welfare W can be written as

$$W = (1 - m(\theta))\, b + m(\theta)\, E(V_e) + m(\theta)\, E(J) - c\theta$$

Using the government budget constraint

$$taxes = g + \left[1 - m(\theta) + m(\theta)\, G\left(\underline{y} - e - x\right)\right] b$$

we can write welfare as

$$W = -g + m(\theta)\left[-\gamma(e) - G\left(\underline{y} - e - x\right) c_f + \int_{\underline{y}-e-x}^{+\infty} (x + e + \varepsilon)\, g(\varepsilon)\, d\varepsilon\right] - c\theta$$

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

$$\gamma'(e) = g\left(\underline{y} - e - x\right)((1+t)\, b + T) + \left[1 - G\left(\underline{y} - e - x\right)\right] \tag{11}$$

Simple comparison of this equation with (6) 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 ($\frac{\beta}{1+t} < 1$): the worker bears all the cost of the effort e but gets only a fraction of the gains. In particular, part of the additional output of the worker's effort is shared with the firm and the government. 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 as $y > 0$. By raising e such matches with strictly positive social value are saved.

Next we compare the socially optimal number of vacancies (or tightness) with the private outcome. Maximizing welfare with respect to θ yields

$$m'(\theta)\left[-\gamma(e) - G\left(\underline{y} - e - x\right) c_f + \left[1 - G\left(\underline{y} - e - x\right)\right](x + e) + \int_{\underline{y}-e-x}^{+\infty} \varepsilon\, g(\varepsilon)\, d\varepsilon\right] = c$$

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

$$\frac{c\theta}{m(\theta)} = \eta \left[-\gamma(e) - G\left(\underline{y} - e - x\right) c_f + \left[1 - G\left(\underline{y} - e - x\right)\right](x+e) + \int_{\underline{y}-e-x}^{+\infty} \varepsilon g(\varepsilon)\, d\varepsilon \right] \tag{12}$$

Comparing this equation with the market outcome in equation (9) we get the following result.

Lemma 5 *Sufficient conditions for the socially optimal tightness θ to exceed tightness in the private outcome (see (9)) are*

$$\eta \geq 1 - \beta$$

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

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 θ). If the elasticity of the matching function η 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 $(1-\beta \leq \eta)$ firms are not overinvesting in vacancies either. 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 6 *There exist effort functions* $\gamma(.)$ *such that*

$$\frac{dW}{dc_f} > 0$$

for $c_f \in [0, \bar{c}_f\rangle$ *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 $e > 1$.[8] 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 is c_f to get the positive welfare effect of c_f.

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

4.5 The nature of firing cost and contractual incompleteness

So far we have assumed that firing costs are a pure waste, say paper work needed to fire an employee. Alternatively, we 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 we discuss here what

[8] That is, $\gamma(.)$ is of the form: $\gamma(e) = \begin{cases} 0 & \text{if} \quad e \in [0,1] \\ +\infty & \text{otherwise} \end{cases}$.

the welfare effects are of a rise in the firing cost and what sort of contractual incompleteness we need to assume to defend government intervention in these cases.

In all three of these cases we need to assume that the effort e of the worker is not contractible. This seems reasonable in many circumstances. Such effort costs are hard to observe and are usually not verifiable in court. Think here of a worker's effort to cooperate with colleagues, to behave towards customers etc. If this effort level were contractible, the hold up problem would disappear and there would be no case for firing costs.

Further, we need to assume that the firm cannot commit to leaving the gains from effort to the worker. For instance, the following contract would solve the hold up problem. The firm sells itself to the employee at $t = 1$ for a price equal to its expected profits, thereby leaving all gains from effort to the worker. This contract is infeasible if we assume that the worker has a liquidity constraint. Again this is a reasonable assumption in most cases.

To defend government intervention in the case where the firing cost is a pure waste (created by the government), we need to answer the question 'if this firing cost creates additional 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 likes an easy life and job security, the other is willing to work hard and does not mind a bit of risk. By offering (unilaterally) a contract with high c_f, a firm attracts disproportionately the wrong type of worker. This makes the selection of workers very expensive. 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. So in this case we need fewer assumptions on the contractual incompleteness to make the story work. In this case, we only need to assume that effort is not contractible, so that there is a hold up problem. The firing tax is then 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. On the question why the government needs to stipulate such contracts, similar arguments as above can be used (adverse selection problem; worker has liquidity constraint). 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 cost we need to assume that the worker's effort is not contractible. In order to make a case for the government to stipulate contracts with firing cost we need to assume that either 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 problems with different types of employees.

5 Simulations

In this section we illustrate the functioning of our model by means of simulations. We assume that no unemployment benefits are paid and there are no other government expenditures. Therefore, there are no taxes[9]. Furthermore, we assume that $g(\epsilon) \sim N(0,4)$. Furthermore, the other parameters are specified as follows: $\eta = \beta = 0.5$, $A = 0.9$, $c = 2$, $\phi = 0.1, \gamma(e) = \frac{1}{2}\varphi e^2$. This combination of parameter values ensures plausible values of unemployment rates over a wide range of values for x. We start with $x = 1.5$. The first column of Table 1 shows the simulation results with respect to a number of relevant parameters in case firing costs, $c_f = 0$. The effort $e = 4.7$. This induces the employers to open up many vacancies such that the matching probability is equal to 1. Every unemployed worker meets a vacancy. However, 6.1% of the matches split up immediately after the industry conditions 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. The decline in unemployment is caused by two opposite effects. First, because firing costs increase, profits decline and therefore less vacancies are created. This reduces the matching probability and has a positive effect on unemployment. Second, because firing costs increase, workers have an incentive to generate effort, which reduces the number of matches that split-up. This has a negative effect on unemployment. Initially, at low firing costs the second effect dominates the first effect. However, as firing costs keep increasing there is situation where almost all matches sustain. Then, the second effect is obsolete and only the first effect remains. Therefore, a further increase in firing costs will increase unemployment. Figure 1 shows that under the set of parameter values chosen the optimal value of the firing costs is $c_f^* = 0.70$. At this level of firing costs unemployment is at its lowest point and welfare is

[9]This approach is stylized and does not modify fundamentally the basic results.

maximized. The second column of Table 1 shows the full simulation results in this optimum. Effort is now higher and less vacancies are opened. The matching probability is still 100%. Since productivity is higher less matches are destroyed in the optimum and the unemployment rate now equals 2.9%. Profits are lower but because there is more employment and productivity has increased welfare has also increased.

It is interesting to investigate whether it makes sense for employers to offer two types of contracts with different firing costs. The contract with the high firing costs resembles a permanent position (high expected duration) while the contract with the low firing cost represents a temporary position (low expected job duration). To get both types of contracts to be offered by firms in equilibrium we let x vary over job matches. All workers are the same ex ante, but ex post their suitability for a job x may differ. Some workers are matched with a job for which they are very suitable (high x) some with a job for which they are not suitable (low x).

We illustrate what happens if a worker is less suitable in the third and fourth column of Table 2, where we present simulation results in case $x = 1$. The third column of Table 2 presents the results in the case of no firing costs. The suitability for the firm is lower but the matching probability is still equal to 1. After the industry conditions are revealed more matches split-up than in the previous situation. Both effects result in an unemployment rate of 8.1%. The fourth column of Table 2 shows the situation of optimal firing costs. The optimal firing costs are lower than before, $c_f^* = 1.2$. Because of the introduction of firing costs workers generate more effort than before. But not every match sustains. And, the low suitability induces employers to generate less vacancies. Because of the low matching probability overall unemployment is higher than in the case of more suitable workers. Note that unemployment is higher with optimal firing costs than it is without firing costs.[10] Overall welfare is higher because even though less workers are productive, the productivity per worker is substantially higher.

[10]Unemployment is lowest (4.8%) if the firing costs are equal to 0.9.

The results that less suitable workers are offered less employment protection is intuitively clear. Note that due to the lower level of employment protection unemployment is higher for less suitable workers. The main reason for this is that for less suitable workers employers find it less worthwhile to open up a lot of vacancies. We conclude that for high productivity workers the welfare maximizing contract specifies a high firing cost. There may be a limit to this positive relationship. If the effort produced without employment protection is already high offering a lot of employment protection will not increase effort sufficiently if the effort function is very steep. Then, the costs of providing extra effort may be too high. So, it may be that for high levels of x there is a negative relationship between x and c_f^*.[11]

This conclusion is interesting since it corresponds to the observed facts: Low productive workers are over-represented in temporary employment (with low firing cost) relatively to long-term employment (with high firing cost).

6 Conclusions

We propose in this paper a theoretical analysis of the welfare effects of employment protection. In our framework, the duration of the employment contract is endogenous. Firing costs associated with an employment contract serve as a commitment device for the firm and give incentives to workers to invest in productivity enhancing human capital. We analyze employment protection focusing on the trade-off between flexibility and commitment. We start with a situation where all workers have the same productivity. We show that for a given productivity there is an optimal degree of employment protection. If there is a productivity distribution it is welfare improving if different types of contracts, i.e. contracts with different firing costs, are offered.

[11] In the current parameter setting of Table 1 there is no negative relationship at higher levels of x. In order to generate such a relationship a different effort function would have to be used.

The optimal degree of employment protection is country-specific, i.e. depends on some parameter values that are specific to the countries. Over the last decade, many countries have substantially changed their employment protection legislation, towards more flexibility essentially. It could therefore be that they are now closer to their optimum. The important conclusion of our paper is that the optimal firing cost is in most cases larger than 0.

Finally, we show that there is a nonlinear relationship between the firing cost and unemployment which may be one of the reasons why some empirical studies find that the employment protection legislation does not affect the unemployment rate.

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7 Appendix

Proof of lemma 2

Differentiating equation (6) with respect to e and c_f, we get

$$\left[\gamma''(e) - \frac{\beta}{1+t} g\left(\underline{y} - x - e\right)\right] \frac{\partial e}{\partial c_f} = g\left(\underline{y} - x - e\right) \frac{\beta}{1+t} \tag{13}$$

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

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

Substituting the expression for $\frac{\partial e}{\partial c_f}$ in (13) into equation (10) we get

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

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 ζ between e and $\hat{e}$. Changing the concavity of the function $\gamma(.)$ 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, we can verify ϕ without changing $\hat{e}$. It is routine to verify that as ϕ comes close to $\frac{\beta}{1+t} g\left(\underline{y} - \hat{e} - x\right)$, 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 θ (by assumption), the socially optimal number of vacancies exceeds the private number of vacancies if and only if

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

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

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

which can be written as

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

Q.E.D.

Proof of Proposition 6

As shown in lemma 3, if $\gamma(.)$ 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. Further, Nash bargaining implies that $w(e, \varepsilon) \geq b$ 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 $\frac{\partial[(1-m(\theta))b + m(\theta)E(V_e)]}{\partial \theta} > 0$. Further, by choosing $\gamma(.)$ such that in the market equilibrium (determined by $\gamma'(e)$) it is the case that

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

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

Table 1 Employment protection in OECD countries

	Strictness of protection against dismissals		Strictness of regulation of temporary empl.		Incidence temporary employment	
	Late 80s	Late 90s	Late 80s	Late90s	1989	1999
Anglo-Saxon countries						
United States	0.2	0.2	0.3	0.3	0.8	-
United Kingdom	0.8	0.8	0.3	0.3	5.4	6.8
Canada	0.9	0.9	0.3	0.3	-	-
Australia	1.0	1.0	0.9	0.9	19.9	-
Ireland	1.6	1.6	0.3	0.3	8.6	-
New Zealand	-	1.7	-	0.4	-	-
Continental Europe						
Switzerland	1.2	1.2	0.9	0.9	-	-
Belgium	1.5	1.5	4.6	2.8	5.1	10.3
France	2.3	2.3	3.1	3.6	8.5	14
Austria	2.6	2.6	1.8	1.8	-	7.5
Germany	2.7	2.8	3.8	2.3	11	13.3
Netherlands	3.1	3.1	2.4	1.2	8.5	12
Northern Europe						
Denmark	1.6	1.6	2.6	0.9	10	10.2
Finland	2.7	2.1	1.9	1.9	11.9	18.2
Norway	2.4	2.4	3.5	2.8	-	-
Sweden	2.8	2.8	4.1	1.6	-	13.9
Southern Europe						
Greece	2.5	2.4	4.8	1.8	17.2	13
Italy	2.8	2.8	5.4	3.8	6.3	9.8
Spain	3.9	2.6	3.5	3.5	26.6	32.7
Portugal	4.8	4.8	3.4	3.0	18.7	18.6

Source: OECD, 1999

Table 2 Simulation results$^{a)}$

	$x = 1.5$		$x = 1.0$	
	$c_f = 0.0$	$c_f^* = 1.4$	$c_f = 0.0$	$c_f^* = 1.2$
e	4.70	4.87	4.60	4.80
$Prob(match)$	1	1	1	0.94
$G(\epsilon)$	0.061	0.029	0.081	0.040
$u(\%)$	6.1	2.9	8.1	9.3
$profits$	3.15	2.46	2.87	2.33
$Welfare$	2.729	2.754	2.217	2.248

$^{a)}$ $\eta = \beta = 0.5$, $A = 0.9$, $c = 2$, $\phi = 0.1$, $g(\epsilon) \sim N(0, 4), \mu = 0, \gamma(e) = \frac{1}{2}\phi e^2$; c_f^* is the value of the firing cost that maximizes welfare under the set of parameter values chosen.

Figure 1: Firing costs, unemployment and welfare