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Unemployment and employment protection in a unionized economy with search frictions

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Abstract:
In theoretical literature, the effects of employment protection on unemployment are ambiguous. Higher employment protection decreases job creation as well as job destruction. However, in most models, wages are bargained individually between workers and firms. Using a conventional matching model in which a monopoly union sets wages, I show that employment protection can unambiguously increase unemployment. Interestingly, I find that tightening the restrictions on redundancies and dismissals may even increase the probability of dismissal.

Keywords: employment protection, search and matching models, unemployment, unions.
JEL-Classification: J41, J64, J65, J68.

Non-technical summary

Recently, employment protection has again become subject of intense political debate in Europe as the need for more flexible labor markets to reduce unemployment is discussed. For example, at the beginning of 2006, the French government passed the Contrat Première Embauche (CPE), implying that young workers could be fired without any prior notification or justification, which was not adopted in the face of massive public opposition. In Germany and other European countries, too, there has been an ongoing debate on the role that employment protection plays in reducing unemployment.

In the economic literature, a clear link between employment protection and unemployment has not yet been established. From a theoretical point of view, stricter employment protection indeed reduces the incentive for job creation. However, it produces fewer dismissals, too. Hence, the effects on unemployment are ambiguous. Reviewing conventional theoretical findings, it becomes obvious that the results have been achieved using models in which wages are either exogenously given or individually bargained between firms and workers. This may be problematic as European labor markets are characterized by a high degree of collective bargaining.

This paper develops a theoretical model that is able to account for this institutional factor. The basic idea in this context is that a monopoly union sets a perfectly egalitarian wage for each worker. The union maximizes the gain from employment compared with unemployment. An increase in restrictions on redundancies and dismissals improves the union's bargaining position. This causes the union to increase its wage claim. It can be shown that the additional labor costs may outweigh the additional dismissal costs and, hence, result in an increased probability of dismissal. As stricter employment protection still lowers the incentive for job creation, unemployment unambiguously rises.

Nicht-technische Zusammenfassung

In neuerer Zeit wird die Diskussion über Kündigungsschutz innerhalb Europas im Rahmen der Notwendigkeit flexiblerer Arbeitsmärkte wieder verstärkt geführt. Anfang des Jahres 2006 hat beispielsweise Frankreichs Regierung zunächst den *Contrat Première Embauche* (CPE) beschlossen, wodurch jüngere Arbeitnehmer ohne Fristen und Angaben von Gründen entlassen werden können, der aber aufgrund starker öffentlicher Opposition nicht eingeführt worden ist. Auch in Deutschland, wie in anderen europäischen Ländern, wird die Rolle des Kündigungsschutzes im Zusammenhang mit dem Abbau der Arbeitslosigkeit immer wieder diskutiert.

In der ökonomischen Literatur hat man bisher keinen klaren Zusammenhang zwischen Kündigungsschutz und Arbeitslosigkeit gefunden. Aus theoretischer Sicht senkt Kündigungsschutz tatsächlich den Anreiz zur Schaffung neuer Stellen. Andererseits führt er auch zu weniger Entlassungen. Die zusammengefassten Auswirkungen auf die Arbeitslosigkeit sind demnach unklar. Bei näherer Betrachtung der theoretischen Modelle, in denen diese Ergebnisse erzielt wurden, wird jedoch ersichtlich, dass dort entweder von exogen gegebenen Löhnen oder individuellen Lohnverhandlungen zwischen Arbeitgeber und Arbeitnehmer ausgegangen wird. Dies ist problematisch, da viele europäische Arbeitsmärkte durch einen hohen Grad an kollektiven Lohnverhandlungen gekennzeichnet sind.

In diesem Papier wird ein theoretisches Modell entwickelt, dass dieser institutionellen Gegebenheit besser Rechnung trägt. Die Grundidee in diesem Modellrahmen ist, dass es eine Monopolgewerkschaft gibt, die für alle gültige Löhne setzt. Die Gewerkschaft maximiert den Nutzengewinn von Beschäftigung im Vergleich zu Arbeitslosigkeit. In diesem Modellrahmen kann gezeigt werden, dass sich durch einen erhöhten Kündigungsschutz die Verhandlungsposition der Gewerkschaft verbessert. Dadurch setzt sie höhere Löhne durch. Diese durch grosszügigeren Kündigungsschutz induzierte Arbeitskostensteigerung kann die zusätzlich erwarteten Kündigungskosten kompensieren, so dass die gesamtwirtschaftliche Entlassungswahrscheinlichkeit trotz erhöhtem Kündigungsschutz steigt. Da zusätzlich der Anreiz zur Schaffung neuer Stellen sinkt, hat dann eine Ausweitung des Kündigungsschutzes einen Anstieg der Arbeitslosigkeit zur Folge.

Contents

List of Figures

Unemployment and Employment Protection in a Unionized Economy with Search Frictions[1]

1 Introduction

Recently, employment protection has again become subject of intense political debate in Europe as the need for more flexible labor markets to reduce unemployment is discussed. For example, at the beginning of 2006, the French government has presented the *Contrat Première Embauche* (CPE), implying that young workers (below the age of 26) could be fired without any prior notification or justification (in firms employing more than 20 workers). The CPE was not adopted in the face of massive social opposition. In Germany and other (at least central) European countries, too, there has been a steady steady call to relax employment protection to encourage employers to hire more workers on the grounds that employers consider the cost of a future dismissal when deciding whether to hire a new worker (German Council of Economic Experts, 2003 and 2006). Government officials claim that the high level of employment protection is at the root of Europe's relatively high unemployment rates and insist that the desired relaxation would reduce unemployment.

In economic literature, a clear link between employment protection and unemployment has not yet been established. From a theoretical point of view, higher employment protection reduces the incentive for job creation and for job destruction as dismissals become more expensive, leading to ambiguous effects on unemployment (see, for example, Bertola, 1990, Garibaldi, 1998, or Mortensen and Pissarides, 1999). Thus, theoretically, it is arguable that less employment protection would indeed decrease unemployment. Reviewing conventional theoretical findings, it becomes obvious that the results have been achieved using models in which wages are either exogenously given or indi-

[1]Author: Nikolai Stähler, Deutsche Bundesbank, Department of Economics, Wilhelm-Epstein-Str. 14, 60431 Framkfurt am Main, e-mail: nikolai.staehler@bundesbank.de. I would like to thank Florian Baumann, Laszlo Goerke, Rolf Helmes, Johannes Hoffmann, Marcus Jansen, Martin Kolmar and Beate Schirwitz for discussions on the topic. I am grateful for comments received from participants of the 2006 Annual Meeting of the Public Choice Society and the 2006 Congress of the International Institute for Public Finance. The idea for this paper was born while I was working as part of the research group *Heterogeneous Labor: Positive and Normative Aspects of the Skill Structure of Labor* founded by the German Research Association (DFG). Financial support is gratefully acknowledged. The opinions expressed in this paper do not necessarily reflect the opinions of the Deutsche Bundesbank or of its staff. Any errors are mine alone.

vidually bargained between firms and workers. However, (continental) European labor markets are characterized by a high degree of collective bargaining power through unionization (OECD, 2004). I therefore present a matching model basically in line with that of Mortensen and Pissarides (1994, 1999), with unionized wage bargaining. It is shown that employment protection may indeed be responsible for high unemployment in the presence of collective bargaining. Under certain circumstances, an increase in employment protection even increases dismissals in this model. This counterintuitive result is barely mentioned in literature. As will be shown, it is the consequence of the trade union's wage setting behavior to maximize the gain from employment.[2]

The combination of employment protection and unionized wage bargaining has barely entered the theoretical economic arena due to problems made clear in the model by Booth (1995a). In traditional literature, it has basically been assumed that firms employ a certain stock of workers and have to dismiss some these workers in the event of an economic shock. It seems logical that, when introducing firing costs (making any dismissal costly), the initial stock of workers employed as well as the number of workers dismissed decrease. Booth (1995a) and Belot and van Ours (2004) show that overall employment decreases. A more sophisticated analysis is presented by Modesto and Thomas (2001) who integrate a infinite horizon, or by Modesto (2004) who uses an overlapping generation model. Mortensen and Pissarides (1999) have shown a way to combine the matching framework of Mortensen and Pissarides (1994) with unionized wage bargaining. The basic idea is that the union is organized as a democracy that sets a perfectly egalitarian wage for each member. Outsiders and unemployed workers are excluded from membership. Insider workers are heterogenous in their idiosyncratic productivity and may have different preferences concerning the wage set by the union. The union therefore chooses the wage for all matches by majority voting. In the event that the job value turns negative (as a result of to the chosen wage), firms are free to destroy the job. This set-up corresponds to the classical monopoly union approach, in which unions impose their preferred wage level on the firm which then determines

[2]To my knowledge, the only analysis that finds a positive relation between employment protection and dismissals is by Cavalcanti (2004). He presents a model in which employment protection increases with job tenure. Then, a rise in employment protection may result in more dismissals as firms wish to compensate for the continuously increasing costs by 'early' dismissals. The effects in the present analysis are different, however, and totally driven by the wage setting behavior.

employment (see McDonald and Solow, 1981). Garibaldi and Violante (2005) enhance this setting by allowing for a utilitarian union that takes into account the fact that higher wages impose higher insider reservation productivity and, thus, job destruction (which reflects the fact that the union also - at least to a certain extent - considers the level of employment of insiders). Garibaldi and Violante (2005) analyze the effects of severance payments in such a framework. They confirm the famous employment neutrality result of severance payments by Lazear (1990) provided that outsiders remain unconstrained by their individual-level bargaining because then the change in severance payments is fully absorbed by a corresponding change in wages. However, they show that when insiders and outsiders are constrained by the wage set by the union, severance payments unambiguously decrease overall employment. Garibaldi and Violante (2005) assume, in line with Saint-Paul (2002), that the utility of unemployment is given from the union's point of view.

In this paper, I present a model in the manner of Garibaldi and Violante (2005); in contrast to their model, the utility of unemployment is directly considered by the union. The union maximizes the gain from employment (i.e. the utility difference between being employed and being unemployed). It sets the optimal wage by equalizing the marginal gain from a wage increase with the marginal loss due to higher job reallocation (resulting from higher dismissal probability and lower re-employment chances given higher labor costs). An increase in dismissal restrictions *ceteris paribus* reduces job reallocation and increases the marginal effects of wage changes on the corresponding change in job reallocation. This *ceteris paribus* decreases the union's utility which is anticipated by the union and causes the wage claim to increase with augmented employment protection in order to compensate for the loss. It can be shown that, for a uniform productivity distribution, the additional labor costs outweigh the additional dismissal costs and, hence, result in an increased dismissal probability. (Note that for a more general distribution function, this effect is still present, but may be offset by opposing wage effects then existent.) As higher employment protection still lowers the incentive for job creation, unemployment unambiguously increases.

The rest of the paper is organized as follows. Section 2 presents the model and derives the equilibrium conditions with unionized wage bargaining. Section 3 contains the comparative static analysis. Conclusions are presented in section 4. A mathematical appendix has been included.

2 The Model

The model presented here builds on that of Garibaldi and Violante (2005). The matching framework therefore differs slightly from the classical matching model in the manner of Mortensen and Pissarides (1994) while, nevertheless, retaining the same features. This issue has been widely discussed by Garibaldi and Violante (2005, pp. 807-808) and will therefore not be repeated here.

I consider an economy in continuous time, where the population is normalized to one and there is a 'large' supply of potential firms (or jobs, respectively). Agents discount at rate r. The labor market is characterized by search frictions. There is a fixed measure v of matching licences that can be rented by firms each period at costs q. Potential firms compete for the matching licences, while free market entry ensures that the steady state value of a vacancy will be zero. Vacant jobs and unemployed workers, u, meet randomly, where $\alpha > 0$ is the fixed contact rate for an unemployed worker. There is no on-the-job search. This implies that the contact rate for a vacant job can be expressed as $(\alpha u)/v$. Upon meeting, the initial productivity level of the job, x, is drawn from a cumulative distribution function $G(x)$, where $g(x)$ denotes the corresponding density function. For simplicity and without loss of generality, I assume that $x \in [0, 1]$. Only after the parties meet is the realization of the idiosyncratic productivity component x revealed. This implies that a contact might not necessarily yield job creation. Only if the idiosyncratic productivity component exceeds some endogenously determined threshold value, R_o, is a job created. After a successful match, firms move on to production and release the costly matching licence, which is immediately rented out to another vacant firm.

After the successful match, the worker starts production with productivity x initially drawn upon meeting. However, there are idiosyncratic productivity shocks that hit a firm-worker pair at a Poisson rate $\lambda > 0$. In the event of a shock, a new idiosyncratic productivity is drawn from the distribution function $G(x)$. When productivity falls below an endogenously determined threshold value, R_i, the job is destroyed and firms have to pay a dismissal tax, T. This occurs with probability $\lambda G(R_i)$. Note that R_o is the threshold value for newly created jobs (outsider reservation productivity), whereas R_i denotes the one for existing jobs (insider reservation productivity). Outsider reservation productivity determines job creation in steady state and can be interpreted as being equivalent to market tightness found in matching models in the manner of Mortensen and Pissarides (1994). The larger the outsider reservation productivity is, the lower job creation is as a newly created job needs a rather high productivity (which corresponds to a low market tightness in the 'classical' matching setup).

A monopoly union sets a wage, ω, which is binding for all workers in the economy. In literature, several different union utility functions have been discussed. Trade unions can be utilitarian, maximizing the sum of their members' utility (either employed or unemployed). Or the union is considered to be insider-dominated, i.e. it maximizes the gain of its members from employment over unemployment (or any other alternative income). The extent to which unions pursue which objectives remains an open empirical question (see Goerke et al., 2007, Booth, 1995b, Pencavel, 1991, and Oswald 1982, 1993). I assume, partly following Goerke et al. (2007), that the union maximizes the gain from employment over unemployment, i.e. the difference between the utility of employment and unemployment. It therefore takes into account the effects of its wage setting on both these utilities.[3]

The value of a vacant firm, V, can be expressed by the following well-known Bellman equation

$$rV = -q + \frac{\alpha u}{v}\left(\int_{R_o}^{1} J(x)dG(x) - [1 - G(R_o)]V\right), \tag{1}$$

where $J(x)$ captures the value of a (newly) created job which can be stated as

$$(r+\lambda)J(x) = x - \omega + \lambda\int_{R_i}^{1} J_i(x)dG(x) - \lambda G(R_i)T. \tag{2}$$

Analogously, the utility flow of an employed worker can be expressed by the Bellman equation

$$(r+\lambda)W(\omega) = \omega + \lambda\int_{R_i}^{1} W dG(x) + \lambda G(R_i)U, \tag{3}$$

[3]It should be noted that assuming this kind of utility function allows us to obtain fairly clear analytical results, whereas a utilitarian utility function, for example, does not. This problem is common in literature incorporating unions. A common way to avoid this problem is to assume that the utility of unemployment is constant (see, for example, Garibaldi and Violante, 2005 or Saint-Paul, 2002). As it is reasonable to assume that the union's wage setting behavior does indeed affect the utility of unemployment, we chose the union utility function described above. It should be borne in mind, however, that the unambiguous results derived below might not hold for alternative utility functions.

where the utility of an unemployed worker, U, can be written as

$$rU = \alpha \left(\int_{R_o}^{1} W dG(x) - [1 - G(R_o)]U \right). \quad (4)$$

For simplicity, we exclude any leisure or unemployment income. Hence, the unemployed worker only receives utility from the probability of finding a new job multiplied by the corresponding utility difference of being employed and staying unemployed.

To calculate the firm's job creation and job destruction conditions, we have to consider that a firm will dismiss a worker if the value of an existing job falls short of the negative dismissal tax, i.e. $J(R_i) = -T$. For job creation, the value of a newly created job must at least be equal to zero, $J(R_o) = 0$. The latter holds true as free market entry guarantees $V = 0$ due to the price alignment for matching licences. Assuming these conditions and following Garibaldi and Violante (2005), we obtain

$$R_i + \frac{\lambda}{r + \lambda} \int_{R_i}^{1} (x - R_i) dG(x) = \omega - rT, \quad (5)$$

as the firm-level job destruction and

$$R_o + \frac{\lambda}{r + \lambda} \int_{R_i}^{1} (x - R_i) dG(x) = \omega + \lambda T, \quad (6)$$

as the firm-level job creation conditions for any given wage ω. These two equations endogenously determine the equilibrium values for insider reservation productivity, R_i, and outsider reservation productivity, R_o.

The union's utility function can be expressed as

$$\Omega(\omega) = W(\omega) - U = \frac{\omega - rU}{r + \lambda G(R_i)} = \frac{\omega}{r + \lambda G(R_i) + \alpha[1 - G(R_o)]}, \quad (7)$$

which can be achieved by substituting equation (4) into equation (3) and some rearranging. Maximizing equation (7) with respect to the wage, ω, subject to equations (5) and (6), - the firms' reaction to a change in wages, as the union considers the effect of their wage setting on job creation and job destruction -, yields

$$\frac{1}{[r + \lambda G(R_i) + \alpha[1 - G(R_o)]]} = \frac{\omega}{[r + \lambda G(R_i) + \alpha[1 - G(R_o)]]^2} \left[\lambda g(R_i) \frac{dR_i}{d\omega} - \alpha g(R_o) \frac{dR_o}{d\omega} \right], \quad (8)$$

where the lhs represent the marginal gain due to an increase in the wage, ω, whereas the rhs is the corresponding utility loss. The latter is represented by the change in the job reallocation rate (hereinafter JR) owing to a higher wage claim, $\lambda g(R_i)\frac{dR_i}{d\omega} - \alpha g(R_o)\frac{dR_o}{d\omega}$ (i.e. an increased dismissal probability and a decreased re-employment probability),[4] multiplied by the corresponding discounted utility, $\frac{\omega}{[r+\lambda G(R_i)+\alpha[1-G(R_o)]]^2} = \frac{\Omega(\omega)}{[r+\lambda G(R_i)+\alpha[1-G(R_o)]]}$. The optimal wage is chosen so that the marginal utility gain equals the marginal utility loss. Rearranging allows us to restate this equation as

$$[r + \lambda G(R_i) + \alpha[1 - G(R_o)]] = \omega \cdot \underbrace{\left[\lambda g(R_i)\frac{dR_i}{d\omega} - \alpha g(R_o)\frac{dR_o}{d\omega}\right]}_{=dJR/d\omega}. \tag{9}$$

Bearing in mind that $\frac{dR_i}{d\omega} = \frac{dR_o}{d\omega} = \frac{r+\lambda}{r+\lambda G(R_i)} > 0$ (obtained from equations (5) and (6)), it is straightforward to show that

$$\omega = \frac{[r + \lambda G(R_i)][r + \lambda G(R_i) + \alpha[1 - G(R_o)]]}{(r + \lambda)[\lambda g(R_i) - \alpha g(R_o)]}. \tag{10}$$

Equation (10) states that each worker obtains the reservation wage per period (which is zero in our model as there is no leisure or unemployment income) plus an extra remuneration for working, equal to ω. For tractability and analytical convenience, we assume a uniform productivity distribution for $x \in [0, 1]$. This yields $G(x) = x$, $g(x) = 1$ and $\int_{R_k}^{1}(x - R_k)dG(x) = \frac{1}{2}(1 - R_k)^2$, with $k = i, o$. Equation (10) can be re-written as

$$\omega^* = \frac{[r + \lambda R_i][r + \lambda R_i + \alpha(1 - R_o)]}{(r + \lambda)(\lambda - \alpha)}. \tag{11}$$

Further implications of the uniform distribution function are discussed in Appendix B. Equation (11) shows that for $\lambda > \alpha$ (which will be discussed in more detail below but is assumed to hold henceforth) the wage *ceteris paribus* increases with increasing dismissal probability, pictured by an increase in R_i, to compensate for the risk of losing the job, while it *ceteris paribus* decreases with decreasing re-employment chances, described by an increase in R_o, as the chances of finding another job become less likely when unemployed.

Substituting the wage, equation (11), into the firm-level job destruction and job creation conditions, equations (5) and (6), and taking into account

[4] Note that dismissal probability is given by $\lambda G(R_i)$, whereas (re-)employment chances are given by $\alpha[1-G(R_o)]$ in equilibrium. Hence, the JR is given by $\lambda G(R_i)+\alpha[1-G(R_o)]$, i.e. rate of employed workers becoming unemployed plus the rate of unemployed workers finding employment. Changing the wage claim, ω, changes the dismissal and (re-)employment probability and, hence, the JR.

the uniform distribution function, the market equilibrium conditions for job destruction and job creation become

$$R_i + \frac{1}{2}\frac{\lambda}{r+\lambda}(1-R_i)^2 = \frac{[r+\lambda R_i][r+\lambda R_i+\alpha(1-R_o)]}{(r+\lambda)(\lambda-\alpha)} - rT, \tag{12}$$

as equilibrium job destruction (hereinafter JD), and

$$R_o + \frac{1}{2}\frac{\lambda}{r+\lambda}(1-R_i)^2 = \frac{[r+\lambda R_i][r+\lambda R_i+\alpha(1-R_o)]}{(r+\lambda)(\lambda-\alpha)} + \lambda T, \tag{13}$$

as equilibrium job creation (hereinafter JC). Simultaneously solving equations (12) and (13) for insider and outsider reservation productivity, R_i and R_o, respectively, determines equilibrium.

Note that the possibility of an unstable equilibrium exists. While the JC has a positive slope in the (R_i/R_o)-space, the JD is also positively sloped as shown in figure 1.[5] The interpretation of the JC is simple. For a pair (R_i, R_o) on the JC curve, where $J(R_o) = 0$, a marginal increase in insider reservation productivity, R_i, reduces the expected gains from a new realization of the idiosyncratic shock which occurs at rate λ and makes the outsider job value negative. To remain on the curve it is necessary to increase outsider reservation productivity, R_o, in order to compensate for this expected loss. The rise in R_o has a direct impact on the marginal (newly created) job's productivity as well as an indirect impact through a reduction in the wage via a decline in the worker's outside option rU.

The positive slope of the JD is due to the positive feedback between the wage, ω, and insider reservation productivity, R_i. For a pair (R_i, R_o) on the JD curve, where $J(R_i) = -T$, a decrease in R_o (yielding better re-employment chances) increases the wage through its positive effect on the worker's outside option rU and reduces the value of the marginal job. To restore the JD, it is necessary to augment the value of the job for the firm, which *ceteris paribus* is done by increasing R_i. This, however, generates a rise in the union wage (equation (11)) which overcompensates for the increase in the value of the job for the firm. Thus, due to the unionized wage setting, R_i must be decreased in order to restore the JD which explains the positive slope.

Proposition 1. *There exists a stable equilibrium for $\lambda > \alpha$.*

Proof. Concerning stability, we know that if the Jacobi-matrix of the system of equations (12) and (13) is negative the resulting equilibrium is stable. The

[5]Figure 1 represents equations (12) and (13) for $r = 0.05$, $\lambda = 0.6$, $\alpha = 0.2$ and $T = 0$.

Jacobi-matrix can be derived as (see Appendix A)

$$D = \frac{-\lambda(r + \lambda R_i) - \lambda\alpha(1 - R_o)}{(r + \lambda)(\lambda - \alpha)}, \tag{14}$$

equivalent to equation (18). We see that $D < 0$ for $\lambda > \alpha$. □

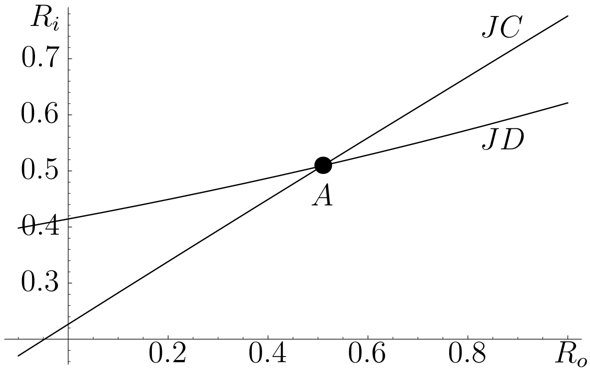

Figure 1: Equilibrium with Unionized Wage Bargaining

We further concentrate on the unique and stable equilibrium and, thus, assume $\lambda > \alpha$ to hold henceforth. This guarantees that the JC's slope exceeds the JD's. For $\lambda < \alpha$, an equilibrium may exist, but then, the JD's slope is steeper than the JC's. It is straightforward to show that such an equilibrium is explosive as there will be no adjustment to the equilibrium point A in figure 1 after an exogenous shock. Furthermore, for $\lambda < \alpha$, the union wage and union's utility would be negative.

Unemployment is determined by inflows into unemployment, $[(1 - u)\lambda G(R_i)]$, and outflows out of unemployment, $[u[1 - G(R_o)]\alpha]$, according to job destruction and job creation conditions (and, hence, the corresponding reservation productivity) in equilibrium. In steady state, the changes in unemployment are zero and the rate is thus given by

$$u = \frac{\lambda G(R_i)}{\lambda G(R_i) + \alpha[1 - G(R_o)]} = \frac{\lambda R_i}{\lambda R_i + \alpha[1 - R_o]}. \tag{15}$$

3 Comparative Statics

In what follows, we further develop the effects that occur when employment protection is increased. We restrict our attention to the steady state. Totally differentiating equations (12) and (13) and some rearranging yields (see Appendix A)

$$\frac{dR_i}{dT} = -\frac{\lambda}{D}\left\{\frac{r + \alpha R_i}{(\lambda - \alpha)}\right\} > 0, \tag{16}$$

and

$$\frac{dR_o}{dT} = -\frac{\lambda}{D}\left\{\frac{2r + \alpha(1 - R_o) + (\lambda + \alpha)R_i}{(\lambda - \alpha)}\right\} > 0, \tag{17}$$

where

$$D = \frac{-\lambda(r + \lambda R_i) - \lambda\alpha(1 - R_o)}{(r + \lambda)(\lambda - \alpha)} < 0, \tag{18}$$

for $\lambda > \alpha$. Equations (16) and (17) state that both insider and outsider reservation productivity increase with increasing dismissal costs. This implies more job destruction and less job creation in equilibrium, unambiguously increasing unemployment (see equation (15)). This certainly needs some further explanation, as the rise in dismissals - even though they become costlier - is certainly surprising at first glance. We will, however, start by analyzing the intuitive effect (the decline in job creation) and then turn to the counterintuitive effect.

From differentiating the JC, equation (13), we obtain

$$\begin{aligned} &-\frac{\lambda[(\lambda - \alpha) + 2r + (\lambda + \alpha)R_i + \alpha(1 - R_o)]}{(r + \lambda)(\lambda - \alpha)}dR_i \\ &+\left[1 + \frac{\alpha(r + \lambda R_i)}{(r + \lambda)(\lambda - \alpha)}\right]dR_o = \lambda dT. \end{aligned} \tag{19}$$

Equation (19) states that *ceteris paribus* job creation decreases (which implies an increase in outsider reservation productivity, R_o) with increasing firing costs, T, and insider reservation productivity, R_i. The reasoning is straightforward and, therefore, quickly explained. Higher dismissal costs increase expected total labor costs and, thus, make job creation less attractive. The same holds for higher insider reservation productivity due to the wage effect. Additionally, the probability of a job closure increases and, hence, the expected duration and value of a newly created job decrease (see also Mortensen and Pissarides, 1999).

Differentiating the JD, equation (12), yields

$$-\frac{(\lambda + \alpha)(r + \lambda R_i) + \lambda\alpha(1 - R_o)}{(r + \lambda)(\lambda - \alpha)}dR_i + \frac{\alpha(r + \lambda R_i)}{(r + \lambda)(\lambda - \alpha)}dR_o = -rdT. \tag{20}$$

According to equation (20), job destruction (insider reservation productivity, R_i) increases with decreasing job creation (a rise in outsider reservation productivity, R_o). The explanation can be retraced in the equilibrium description in section 2. However, the interesting fact is that *ceteris paribus* job destruction increases when firing costs, T, are augmented. This is quite surprising and contradicts the findings of most convectional models. Higher dismissal costs (accompanied by the resulting higher outsider reservation productivity) reduce the value of the job. To restore the job destruction condition, $J(R_i) = -T$, the firm must reduce the marginal job value. Disregarding the wage effect for the moment (and relating our model to conventional findings), we see in equation (5) that this can be done by reducing insider reservation productivity and, thus, dismissals decrease according to $\frac{(r+\lambda R_i)}{r+\lambda} > 0$. Nevertheless, the wage effect is present in our setup. The reduction of R_i implies a wage reduction which overcompensates for the reduction in the value of the job as $\frac{d\omega}{dR_i} = \frac{2(r+\lambda R_i)+\alpha(1-R_o)}{(r+\lambda)(\lambda-\alpha)} > \frac{(r+\lambda R_i)}{r+\lambda} > 0$ (see equations (5) and (11)). In total, this implies an increase in the value of a job, not complying with the JD. Hence, insider reservation productivity must be increased in order to restore the job destruction condition.

Combining these effects (an increase in insider and outsider reservation productivity) explains equations (16) and (17). Graphically, this is represented by an upward shift of the JD curve and a downward shift of the JC curve in figure 1.

To get a better understanding of the effects at work, reconsider the structure of our model and the union's behavior. We know that dismissal costs are exogenously given by some third party (the government) not explicitly modelled. Given the wage, ω, firms determine job creation and job destruction (or speaking in terms of the model, R_o and R_i) according to equations (5) and (6). However, the wage is set by the union before insider and outsider reservation productivity are chosen by the firm. Choosing the optimal wage, the union takes into consideration the firms' choice of R_i and R_o (given the dismissal taxes, T) and the firms' reaction to the wage claim. The union is therefore able to implicitly determine dismissal probability and (re-)employment probability (equations (12) and (13)). It does so by maximizing the difference between the utilities of being employed and being unemployed (equation (7)).

Disregarding the wage effect for the moment (i.e. assuming that the union did not set the wage before firms determine employment), *ceteris paribus* an increase of dismissal costs, T, decreases dismissal probability and re-employment chances. This becomes quite apparent by totally differentiating equations (5) and (6) and following the calculations in Appendix A, which yields $\frac{dR_i}{dT} = -\frac{r(r+\lambda)}{r+\lambda R_i} < 0$ and $\frac{dR_o}{dT} = \frac{(r+\lambda)\lambda R_i}{r+\lambda R_i} > 0$. This decreases the JR and, thus, increases the rise of the JR resulting from an increased wage claim, $(\lambda-\alpha)\frac{r+\lambda}{r+\lambda R_i}$ (see also the brief description in footnote 4), which *ceteris paribus* reduces the union's wage claim according to equation (11) as a consequence of reduced marginal utility gain and increased marginal utility loss due to a wage increase (see equation (9)). Thus, the union's utility falls.[6] The loss of utility is, however, anticipated by the union. In order to compensate for the utility loss, the union's wage claim increases (over-)proportionably when dismissal costs are raised by forcing the firms to increase dismissal probability according to the JD (see equation (20)). Note, however, that this relatively strong wage effect unambiguously holds true for a uniform distribution function. Due to additional effects resulting from a more general distribution function, the wage effect and, hence, employment effects may become ambiguous (see also Appendix B).

4 Conclusion

In this paper, I have presented a matching model in the manner of Mortensen and Pissarides (1994) with unionized wage bargaining following an enhanced approach by Garibaldi and Violante (2005). I have shown that, for a uniform distribution function, an increase in employment protection unambiguously increases unemployment due to less job creation and, in contrast to most conventional findings, results in even higher job destruction.

As higher employment protection increases expected dismissal costs, it is quite intuitive (and in line with conventional findings) that job creation decreases. The potential rise in dismissal probability needs some further explanation, however. I have assumed an insider-dominated monopoly union that maximizes the gain from employment over unemployment. It takes into account the effects which its wage claim, binding for all firms, has on job creation and destruction and, thus, on job reallocation. Disregarding the wage effect, higher employment protection decreases dismissal probability and (re-) employment chances and, thus, job reallocation as presented in conventional literature. But higher employment protection also implies that the marginal increase in the job reallocation rate due to a rise in wages is increased which would result in a utility loss for the union. As this is anticipated by the union, it raises its wage claim in order to compensate for this effect. Uncouthly spo-

[6]Note that substituting the optimally chosen wage, equation (11), into the union's utility function, $\Omega(\omega)$, yields $\Omega(\omega^*) = \frac{r+\lambda R_i}{(r+\lambda)(\lambda-\alpha)} = \frac{1}{\lambda(dR_i/d\omega)-\alpha(dR_o/d\omega)} = \frac{1}{dJR/d\omega}$ which states that union's utility equals the reciprocal of the change in the JR due to an increase in the wage claim. Hence, the lower the change in the JR due to a change in the wage claim (which indeed decreases with increasing employment protection), the higher the union's utility.

ken, we could say that an increase of employment protection improves the union's bargaining position. The additional labor costs (due to higher wages) overcompensate for the additional dismissal costs and, thus, increase dismissal probability. More dismissals and less job creation increase unemployment.

This unambiguously holds true for a uniform productivity distribution. For a more general distribution function, the wage effect is ambiguous. However, the effect described is still present and, thus, tends to increase unemployment when employment protection is generous. Only when this effect is compensated by the opposing effects resulting from a more general distribution function do the results of conventional findings also apply to unionized wage bargaining. This is an empirical question which undoubtedly warrants further attention.

Mathematical Appendix

A Calculating the Jacobi-matrix and the Comparative Statics

Totally differentiating equations (12) and (13) yields equations (20) and (19). Writing these equations as a matrix yields

$$\underbrace{\begin{pmatrix} -\frac{(\lambda+\alpha)(r+\lambda R_i)+\lambda\alpha(1-R_o)}{(r+\lambda)(\lambda-\alpha)} & \frac{\alpha(r+\lambda R_i)}{(r+\lambda)(\lambda-\alpha)} \\ -\frac{\lambda[(\lambda-\alpha)+2r+(\lambda+\alpha)R_i+\alpha(1-R_o)]}{(r+\lambda)(\lambda-\alpha)} & \left[1+\frac{\alpha(r+\lambda R_i)}{(r+\lambda)(\lambda-\alpha)}\right] \end{pmatrix}}_{=B} \begin{pmatrix} dR_i \\ dR_o \end{pmatrix} = \begin{pmatrix} -r \\ \lambda \end{pmatrix} dT. \tag{21}$$

With $D = det(B)$, which gives the Jacobi-matrix, equation (18), rearranging of equation (21) yields

$$\begin{pmatrix} dR_i \\ dR_o \end{pmatrix} = \frac{1}{D} \begin{pmatrix} \left[1+\frac{\alpha(r+\lambda R_i)}{(r+\lambda)(\lambda-\alpha)}\right] & -\frac{\alpha(r+\lambda R_i)}{(r+\lambda)(\lambda-\alpha)} \\ \frac{\lambda[(\lambda-\alpha)+2r+(\lambda+\alpha)R_i+\alpha(1-R_o)]}{(r+\lambda)(\lambda-\alpha)} & -\frac{(\lambda+\alpha)(r+\lambda R_i)+\lambda\alpha(1-R_o)}{(r+\lambda)(\lambda-\alpha)} \end{pmatrix} \times \times \begin{pmatrix} -r \\ \lambda \end{pmatrix} dT. \tag{22}$$

After some rearranging, equation (22) produces equations (16) and (17).

B The Effects with More General Distribution Functions

As already mentioned, some of the results achieved in the paper are based on the assumption of a uniform productivity distribution and, hence, the corresponding large wage effect. With a more general distribution function, the wage effect is different. Differentiating equation (10) with respect to insider and outsider reservation productivity, respectively, yields

$$\begin{aligned}\frac{d\omega}{dR_i} &= \lambda g(R_i)\frac{2[r+\lambda G(R_i)]+\alpha[1-G(R_o)]}{(r+\lambda)[\lambda g(R_i)-\alpha g(R_o)]} \\ &- \lambda g'(R_i)\frac{[r+\lambda G(R_i)][r+\lambda G(R_i)+\alpha[1-G(R_o)]]}{[(r+\lambda)[\lambda g(R_i)-\alpha g(R_o)]]^2} \qquad (23)\end{aligned}$$

and

$$\begin{aligned}\frac{d\omega}{dR_o} &= -\alpha g(R_o)\frac{[r+\lambda G(R_i)]}{(r+\lambda)[\lambda g(R_i)-\alpha g(R_o)]} \\ &+ \alpha g'(R_o)\frac{[r+\lambda G(R_i)][r+\lambda G(R_i)+\alpha[1-G(R_o)]]}{[(r+\lambda)[\lambda g(R_i)-\alpha g(R_o)]]^2}. \qquad (24)\end{aligned}$$

It is easy to see that the first terms on the rhs of equations (23) and (24) correspond to the changes with a uniform distribution function calculated in the main text and, thus, yield the same implications. However, there is an additional wage effect with a more general distribution function. This is captured by the second terms on the rhs of equations (23) and (24). Whether these terms are negative or positive depends to a great extent on the properties of the density function at reservation productivity R_i and R_o, respectively. If $g'(R_k) < 0$, the results presented in the main text are amplified. For a normally distributed productivity, for example, this is the case if $R_k > \mu$, where μ is the expected value of productivity. If $g'(R_k) > 0$, however, the wage increase (decrease, respectively) reached in the main text is lessened by the second terms on the rhs of equations (23) and (24). If this second effect dominates the first effect, wages decrease with increasing dismissal probability and increase with increasing job creation. Then, it is a straightforward matter to show that an increase in dismissal costs leads to the results found in conventional literature, i.e. a decrease in job destruction and job creation and, hence, ambiguous effects on unemployment. If the first effect dominates (as is unambiguously the case with a uniform distribution), the results in the main text can be qualitatively reached even with a more general distribution function.

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