Experience Rated Unemployment Insurance: Was Europe Right not to Choose It?

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February 1, 2007

Abstract

Theoretical economic literature dealing with the financing of the unemployment insurance finds that experience rating (partly) solves the externality caused by individual efficient but socially inefficient dismissals and, hence, reduces unemployment. This is, however, found in models where workers and firms bargain over wages individually. Introducing unionized wage bargaining - a major characteristic of at least continental European economies - generally gives highly ambiguous results; for an uniform productivity distribution even opposite results can be obtained showing that the introduction of experience rating increases unemployment.

Keywords: experience rating, search and matching models, unemployment, unemployment insurance, unions

JEL-Code: J 30, J 64, J 65, J 68

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†I would like to thank Florian Baumann, Johannes Clemens and Laszlo Goerke for discussions on the topic. The opinions expressed in this paper do not necessarily reflect the opinions of the Deutsche Bundesbank or of its staff. Remaining errors are mine.

1 Introduction

Many economists have concluded that an experience rated unemployment insurance decreases unemployment (see beneath a description of the literature). As continental Europe faces relatively high and persistent unemployment rates (OECD, 2004), it seems surprising that hardly any European country has adopted experience rating, even though policy advisors have demanded for such a system (European Commission, 2004 or German Council of Economic Experts, 2003). France has already introduced experience rating - at least in parts - through the *Delalande tax*, where firms firing workers that are above the age of 50 have to pay part of the unemployment benefits (Behaghel et al., 2005 give a more detailed analysis concerning this form of experience rating). Since 2005 (after the introduction of the so-called *Hartz IV-laws*), in Germany, employers laying off a standing worker above the age of 55 must pay his unemployment benefits (*Arbeitslosengeld I* which is basically restricted to one year) and can be forced to pay other social security costs as pension or health insurance contributions up to 32 months according to § 147a of the *Sozialgesetzbuch* (social statute book). In the Nordic countries, an alternative experience rated unemployment insurance connected to union membership - though heavily subsidized by the government - has been introduced through the so called *Gent model* (for a detailed description about these insurance systems see Björklund and Holmund, 1991 for Sweden, Sinko, 2001 for Finland and Parson et al., 2003 for Denmark). Experience rating exists in the USA and indeed, the introduction seems to have raised employment (Anderson and Meyer, 2000). Still it does, with the exceptions mentioned, hardly exist in Europe (see also Fath and Fuest, 2005 and L'Haridon and Malherbet, 2002). This allows to ask the question if policy makers interested in reducing unemployment might have been right not to introduce experience rating.

To not keep the reader on tenterhooks, the answer to this question is yes, maybe.[1] The basic story behind the negative effect of experience rating on unemployment found in theoretical literature is that each individually efficient dismissal from a firm-worker pair's perspective generates social costs if the unemployment insurance is (solely) financed through employment taxes. This is the case, because the newly unemployed worker creates additional financial needs for the insurance while the insurance lacks his contributions. Dismissal taxes force firms to (partly) take into account those social costs when laying off a worker. They can, therefore, be interpreted as some sort of Pigouvian tax that internalize the externalities and can, under certain circumstances, reduce the total tax burden that firms have to bear. This issue has recently been discussed in Blanchard and Tirole (2004), Cahuc and Malherbet (2004), Cahuc and Zylberberg (2005) and Baumann and Stähler (2006). Earlier contributions are, e.g. Feldstein (1976), Burdett and Wright (1989), and Marceau (1993). Blanchard and Tirole (2004) show that dismissal taxes should be part of an optimal design of unemployment insurance to make firms internalize the costs of benefits provided. Similarly, Cahuc and

[1]Note that the focus of the analysis is positive. I will deal with the effects experience rating has on unemployment, while considerations about the optimal level of unemployment from an efficiency perspective are not addressed. This issue should, nevertheless, certainly be subject of further research.

Zylbergerg (2005) present a model of optimal taxation and find that dismissal taxes to finance unemployment insurance could significantly increase employment and GDP. The two studies just mentioned, however, do not consider a dynamic process of job creation and, hence, exclude an important part of the analysis. The lack of being able to analyze the job creation process has been overcome by Cahuc and Malherbet (2004). They find that while the positive effect on employment remains, job creation decreases when introducing dismissal taxes. The model they use is a matching model with endogenous job creation and destruction. The unemployment insurance is financed by dismissal and employment taxes, while its total expenditure is fixed. The increase of dismissal taxes results in fewer dismissals on the one hand. On the other hand, job creation is reduced. The latter effect is dominated by the first effect which overall yields a positive effect on employment. Baumann and Stähler (2006) show in a related model where unemployment benefits are fixed (but the total expenditures of the unemployment insurance varies with the unemployment rate) that an experience rated unemployment insurance can indeed increase job creation. This will be the case if the unemployment insurance system is located on the upward sloping part of the Laffer-curve regarding employment taxes and as long as the insurance is not yet fully financed through dismissal taxes.

The models just mentioned basically consider individual wage bargaining between workers and firms. However, continental European economies are characterized by a high degree of unionization (OECD, 2004). In the following, I present a matching model in the manner of Mortensen and Pissarides (1994) perfectly in line with Baumann and Stähler (2006) enhanced by unionized wage bargaining. To do this, I follow the approach of Garibaldi and Violante (2005). The matching process slightly differs from the conventional one in the manner of Mortensen and Pissarides (1994) but allows to differentiate between insider and outsider workers more easily while it contains the same features. The different matching framework is, therefore, not important for the results achieved. (To prove this, the analysis of Baumann and Stähler (2006) is integrated into the model framework presented here.) The unionized wage setting, however, indeed makes a difference. I assume an insider-dominated monopoly union that maximizes the gain from employment over unemployment. The government maintains a mandatory unemployment insurance that is financed by employment and dismissal taxes. When switching the financing scheme of the unemployment insurance towards a system of experience rating, i.e. introducing or augmenting dismissal taxes to substitute for employment taxes, the effects in the setting with unionized wage bargaining can be described in three steps.

First, the introduction or augmentation of dismissal taxes makes dismissals more costly. Neglecting the wage effects and budget effects of the unemployment insurance, this *ceteris paribus* reduces the incentive for job creation and destruction and, hence, decreases labor reallocation.

Second, still neglecting the budget effect, the union's wage claim increases. This is due to the fact that lower initial labor reallocation implies a rise of the union's marginal utility loss due to a wage increase, while the corresponding marginal utility gain falls. As the union anticipates this, it increases its wage claim disproportionably high in order to compensate for the marginal utility loss. For a uniform productivity distribution, it can be shown that in this situation, the rise in labor costs overcompensates the augmented dismissal costs *ceteris paribus* yielding a reduction of job creation whereas job destruction increases, unambiguously augmenting unemployment (see Stähler, 2007).

Third, higher dismissal taxes *ceteris paribus* decrease employment taxes needed to have a balanced budget which reduces direct labor costs. However, this decrease in direct labor costs is diminished as the union's wage claim additionally increases with decreasing employment taxes (again due to the fact that lower employment taxes *ceteris paribus* decrease labor reallocation). The effect on direct labor costs, i.e. wages plus employment taxes, is ambiguous from a theoretical point of view. However, the change of direct labor costs plus increased dismissal taxes unambiguously reduces the incentive for job creation as total expected labor costs (including firing costs) increase on the one hand. On the other hand, it is ambiguous what happens to the dismissal decision as firing a worker becomes more costly whereas it is not clear what happens to direct labor costs. It can be shown that if the reciprocal of the marginal change in labor reallocation due to a wage increase (which determines how large the change of the union's wage claim will be) exceeds the marginal increase of employment taxes due to less job creation, direct labor costs increase (over-)compensating the additional dismissal costs. This implies an increase in dismissal probability, unambiguously augmenting unemployment. Otherwise, layoff probability decreases, yielding ambiguous employment effects. Nevertheless, it can be shown for a uniform productivity distribution that the introduction of experience rating (i.e. the introduction of dismissal taxes in a situation where the unemployment insurance has initially solely been financed by employment taxes) unambiguously increases unemployment as the reduction of job creation will always overcompensate the job destruction effect (i.e. even if the introduction of dismissal taxes yields fewer dismissals). To my knowledge, this is the only theoretical paper showing that experience rating can indeed increase unemployment.[2]

I will proceed as follows. In section 2, I describe the basic structure of the model, introduce unionized wage bargaining and derive the resulting equilibrium. Section 3 deals with the effects of the introduction of an experience rated unemployment insurance under unionized wage bargaining. In section 4, the main findings are summarized. A general mathematical appendix is added. Further, Appendices C and D prove that the different matching framework still produces the same effects present in Baumann and Stähler (2006) for individual wage bargaining.

[2]Note that Cahuc and Malherbet (2004) find that experience rating yields fewer dismissals and less job creation. In their setting, the reduced dismissal probability overcompensates the job creation effect yielding positive employment effects. In the setting presented here, the opposite relation holds due to the unionized wage setting.

2 The Basic Model

The economy is continuous in time, where population is normalized to one. There is a large supply of potential firms. Agents discount at rate r. The labor market is characterized by search frictions. This is captured by 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 guarantees that the steady state value of a vacancy will be zero (due to an according price alignment of q). 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, the realization of the idiosyncratic productivity component x is 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, a job is created. After a successful match, firms move to production and release the costly matching licence which is immediately rented out to another vacant firm. This matching framework differs from the conventional matching in line with Mortensen and Pissarides (1994). It has, nevertheless, the same features as is widely discussed in Garibaldi and Violante (2005, pp. 807-808).

After the match, the worker starts production with productivity x drawn upon the meeting. However, there are idiosyncratic productivity shocks that hit a firm-worker pair at a Poisson rate $\lambda > 0$. In the case of a shock, a new idiosyncratic productivity is drawn from the distribution function $G(x)$. In the case productivity falls below an endogenously determined threshold value, R_i, the job is destroyed and firms have to pay a dismissal tax, T. Note that R_o is the threshold value for newly created jobs (outsider's reservation productivity), whereas R_i denotes the one for existing jobs (insider's reservation productivity). The subscripts o and i stand for outsiders and insiders, respectively. Outsider's reservation productivity determines job creation in steady state and can be interpreted in equivalence to market tightness in the matching models in the manner of Mortensen and Pissarides (1994). The larger is outsider's reservation productivity, the lower is job creation as a newly created job then needs a rather high productivity.

The government maintains a mandatory unemployment insurance that is financed by lump-sum employment taxes, t, per employed worker and dismissal taxes, T, per layoff. Unemployment benefits are exogenously fixed at b per period and paid to each unemployed worker.

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

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

where $J_o(x)$ captures the value of a newly created job. The value for jobs can be stated as

$$(r+\lambda)J_k(x) = x - w_k(x) - t + \lambda \int_{R_i}^{1} J_i(x)dG(x) - \lambda G(R_i)T, \tag{2}$$

where $k = o, i$ indicates if the firm employs an insider or an outsider, respectively. Analogously, the utility flow of an employed worker can be expressed by the Bellman equation

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

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

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

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 the job destruction and job creation conditions (and, hence, the corresponding reservation productivities) which are endogenously derived beneath. In steady state, the change of unemployment is zero and the rate is thus given by

$$u = \frac{\lambda G(R_i)}{\lambda G(R_i) + \alpha[1 - G(R_o)]}. \tag{5}$$

As the government finances unemployment benefits, b, per unemployed worker, u, through dismissal taxes, T, in the case of a layoff (which occurs to employed workers, $(1-u)$, with probability $\lambda G(R_i)$) and a lump-sum tax, t, per employed worker, the budget constraint reads

$$bu = (1-u)t + (1-u)\lambda G(R_i)T. \tag{6}$$

Given the equations just described, the equilibrium of the economy is formally defined according to

Definition 1 *The steady state equilibrium with given policy parameters b and T is a set of value functions $\{V, J_o(x), J_i(x), U, W_o(x), W_i(x)\}$, a pair of reservation productivities $\{R_i, R_o\}$, a union wage ω or a pair of wage rules $\{w_i(x), w_o(x)\}$, a rental price for matching licences, q, an unemployment rate, u, and an employment tax, t, that satisfy the following conditions:*

1. *there is free market entry in the matching market and, thus, from $V = 0$, and equation (1) $q = (\alpha u/v) \int_{R_i}^{1} J_o(x)dG(x)$;*
2. *the optimal reservation productivity for job creation is given by $J_o(R_o) = 0$;*
3. *the optimal reservation productivity for job destruction is given by $J_i(R_i) = -T$;*

4. *wages are determined by equation (12) when set by the union and equations (31) and (32) when bargained individually (see Appendix C), respectively;*
5. *the value functions* (J_o, J_i, W_o, W_i, U) *are determined by equations (2) to (4);*
6. *the equilibrium unemployment rate is determined by equation (5);*
7. *the government's budget is balanced, i.e.* t *is endogenously chosen such that equation (6) holds.*

To integrate unionized wage bargaining into the matching model, I assume that a monopoly union sets a wage, ω, 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. It remains an open empirical question which objective is pursued (see Goerke et al., 2007, Booth, 1995, Pencavel, 1991, and Oswald 1982, 1993). I assume, partly following Goerke et al. (2007), that the union solely maximizes the gain from employment over unemployment, i.e. the difference between the utility of employment and unemployment.[3] Using equations (3) and (4), the union's utility can be expressed as

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

The union maximizes its utility, equation (7), with respect to ω subject to

$$R_i - t + \frac{\lambda}{r + \lambda} \int_{R_i}^{1} (x - R_i) dG(x) = \omega - rT, \tag{8}$$

and

$$R_o - t + \frac{\lambda}{r + \lambda} \int_{R_i}^{1} (x - R_i) dG(x) = \omega + \lambda T, \tag{9}$$

which are the firm-level job destruction and creation conditions for any given wage, ω, derived by the the equilibrium definition 1 which states that jobs are destroyed as soon as $J_i(R_i) = -T$ and jobs are created if $J_o(R_o) = 0$, respectively. It is straightforward to show by totally differentiating equations (8) and (9) that both, insider's and outsider's reservation

[3]Note that the assumption of such a utility function does indeed partly drive the results derived below. However, with a more general utility function, as e.g. a utilitarian utility function, no clear analytical results can be achieved. A usual way to avoid this problem is to (probably also unrealistically) assume that the utility of unemployment is constant (see e.g. Garibaldi and Violante, 2005 or Saint-Paul, 2002). See also Stähler (2007) and the literature therein for a discussion about the problems of introducing unions.

productivity increase with a rising wage, ω,[4]

$$\frac{dR_i}{d\omega} = \frac{dR_o}{d\omega} = \frac{r+\lambda}{r+\lambda G(R_i)} > 0. \tag{10}$$

The first order condition of the maximization problem given in equation (7) reads

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

where the lhs represent the marginal gain due to an increase of the wage, ω, whereas the rhs is the corresponding utility loss. The latter is represented by the change in the job reallocation rate (further JR) due 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),[5] times the corresponding discounted utility, $\frac{\omega-b}{[r+\lambda G(R_i)+\alpha[1-G(R_o)]]^2} = \frac{\Omega(\omega)}{[r+\lambda G(R_i)+\alpha[1-G(R_o)]]}$. The optimal wage is chosen such that the marginal utility gain equals the marginal utility loss. Rearranging allows us to restate this equation as

$$[r+\lambda G(R_i)+\alpha[1-G(R_o)]] = [\omega - b]\cdot \underbrace{\left[\lambda g(R_i)\frac{dR_i}{d\omega} - \alpha g(R_o)\frac{dR_o}{d\omega}\right]}_{=dJR/d\omega}. \tag{11}$$

Substitution of equation (10) and solving for ω gives

$$\omega = b + \frac{[r+\lambda G(R_i)][r+\lambda G(R_i)+\alpha[1-G(R_o)]]}{(r+\lambda)[\lambda g(R_i)-\alpha g(R_o)]} \tag{12}$$

as the optimal wage chosen by the union. Equation (12) states that each worker must obtain the reservation utility of unemployment (unemployment benefits per period, b) plus some extra charge of working, $\frac{[r+\lambda G(R_i)][r+\lambda G(R_i)+\alpha[1-G(R_o)]]}{(r+\lambda)[\lambda g(R_i)-\alpha g(R_o)]}$.

For tractability and analytical convenience, I assume a uniform productivity distribution for $x \in [0,1]$, which yields $G(x) = x$, $g(x) = 1$, $g'(x) = 0$ (eliminating the indirect wage effect resulting from a more general distribution as gets obvious in equation (12) and is further described in Appendix B). Equation (12) can be re-written as

$$\omega = b + \frac{[r+\lambda R_i][r+\lambda R_i+\alpha(1-R_o)]}{(r+\lambda)(\lambda-\alpha)}. \tag{13}$$

[4]A higher wage increases labor costs and results in the need of a more productive worker (either insider or outsider) in order to generate a large enough job value. Hence, increasing the wage level *ceteris paribus* yields more job destruction and less job creation.

[5]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 dismissal and (re-)employment probability and, hence, the JR.

This shows that the wage increases with increasing dismissal probability, pictured by an increase in R_i, to compensate for the risk of loosing the job, while it decreases with decreasing re-employment chances, describable by an increase in R_o, as it becomes less likely to get another job when being unemployed.

Substituting the union wage, equation (13), into the firm-level job destruction and job creation conditions, equations (8) and (9), and taking into account the uniform distribution function, $\int_{R_k}^{1}(x - R_k)dG(x) = \frac{1}{2}(1 - R_k)^2$, with $k = i, o$, the market equilibrium conditions for job destruction (further JD) and job creation (further JC) can be stated as

$$R_i - t + \frac{1}{2}\frac{\lambda}{r + \lambda}(1 - R_i)^2 = b + \frac{[r + \lambda R_i][r + \lambda R_i + \alpha(1 - R_o)]}{(r + \lambda)(\lambda - \alpha)} - rT, \qquad (14)$$

and

$$R_o - t + \frac{1}{2}\frac{\lambda}{r + \lambda}(1 - R_i)^2 = b + \frac{[r + \lambda R_i][r + \lambda R_i + \alpha(1 - R_o)]}{(r + \lambda)(\lambda - \alpha)} + \lambda T, \qquad (15)$$

respectively. From equations (14) and (15), we see that both, the JD and the JC are positively sloped in a (R_i/R_o)-space, which could cause some stability problems.

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's 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's reservation productivity, R_o, in order to compensate this expected loss. The rise in R_o has a direct impact on the marginal (newly created) job's productivity and 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's 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 is *ceteris paribus* done by increasing R_i. This, however, generates a rise in the union wage (equation (13)) which overcompensates increase of 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 *Stability exists for for $\lambda > \alpha$.*

Proof. Concerning stability, we know that if the Jacobi-matrix of the system of equations (14) and (15) is negative, the resulting equilibrium (for any given level of T and t) is stable. The Jacobi-matrix can be derived as

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

We see that $D < 0$ for $\lambda > \alpha$. ■

We further assume that $\lambda > \alpha$ in order to rule out any explosive equilibrium. Following definition 1, simultaneously solving equations (14) and (15), which represent the firm-level job destruction and creation conditions, and equations (5) and (6), which are the equilibrium unemployment rate and the balanced budget rule, determine the equilibrium values for insider's and outsider's reservation productivity, R_i and R_o, as well as the equilibrium unemployment rate and the necessary employment tax, t, for a given level of dismissal taxes, T.

From equations (14) and (15), another important observation is that if the unemployment insurance is solely financed through employment taxes, t (which implies $T = 0$), insider's and outsider's reservation productivity are equal, $R_i = R_o$. According to the equilibrium conditions, definition 1, the JC and the JD are equal for $T = 0$, $J_i(R_i) = J_o(R_o) = 0$ and, hence, imply the same reservation productivity, no matter if the job is newly created or already exists as no dismissal costs apply.

3 Employment Effects with Unionized Wage Bargaining and Experience Rating

The following section deals with the question of what happens if dismissal taxes become more important in financing the unemployment insurance in the presence of unionized wage bargaining. The analysis more or less follows Baumann and Stähler (2006). Differentiating the JD and the JC, equations (14) and (15), yields

$$-\frac{(\lambda+\alpha)(r+\lambda R_i)+\lambda\alpha(1-R_o)}{(r+\lambda)(\lambda-\alpha)}dR_i + \frac{\alpha(r+\lambda R_i)}{(r+\lambda)(\lambda-\alpha)}dR_o = -rdT + dt, \tag{16}$$

and

$$-\frac{\lambda[(\lambda-\alpha)+2r+(\lambda+\alpha)R_i+\alpha(1-R_o)]}{(r+\lambda)(\lambda-\alpha)}dR_i + \left[1+\frac{\alpha(r+\lambda R_i)}{(r+\lambda)(\lambda-\alpha)}\right]dR_o = \lambda dT + dt. \tag{17}$$

We see in equation (16) that insider's reservation productivity, i.e. dismissal probability *ceteris paribus* rises with increasing dismissal taxes, T, and increasing outsider's reservation productivity, R_o, whereas it decreases with falling employment taxes, t. Outsider's reservation productivity *ceteris paribus* increases with rising dismissal taxes, T, insider's reservation productivity, R_i, and employment taxes, t, as equation (17) shows.

The effects on outsider's reservation productivity are easily explained. Higher dismissal taxes as well as higher employment taxes increase (expected) labor costs (due to higher direct taxation or indirect taxation connected to a layoff) and, hence, decrease the value of a job. Analogously, higher insider's reservation probability shortens the average duration of a job. This implies that the incentive for job creation decreases.

The effects on insider's reservation productivity are a bit odd at first sight. Neglecting the wage effect for a moment, we see that an increase of dismissal taxes, T, decreases dismissal probability, whereas an increase of employment taxes, t, raises dismissal probability.[6] This is quite intuitive as a rise in dismissal taxes makes layoffs more expensive, whereas a rise in employment taxes increases labor costs. Taking into account the wage effect, we see that due to the reduced insider's reservation productivity, the union's wage claim falls by $\frac{2(r+\lambda R_i)+\alpha(1-R_o)}{(r+\lambda)(\lambda-\alpha)}$ (see equation (13)). This wage reduction overcompensates the decrease of the value of the job, $\frac{r+\lambda R_i}{r+\lambda}$ (see equation (8)). In total, this implies an increase of the value of a job, not complying with the JD. Hence, insider's reservation productivity must rise with higher dismissal taxes in order to restore the job destruction condition (see also Stähler, 2007). An analogous argument can be made for the effects resulting from an increase of employment taxes, t. The positive relation between insider's and outsider's reservation productivity on the JD has already been explained in section 2.

In order to analyze the total economic effects of an increase of dismissal taxes, T, one must take into account that the government adapts employment taxes, t, in order to achieve a balanced budget. Differentiating the budget constraint, equation (6), and using the uniform distribution function, we get

$$dt = \frac{b}{(1-u)^2}du - \lambda R_i dT - \lambda T dR_i. \tag{18}$$

This shows that *ceteris paribus* an increase of the unemployment rate, u, and an increase of the dismissal probability, indicated by an increase of the insider's reservation productivity, R_i, increases the required employment tax, t, while an increase of the dismissal taxes, T, decreases the employment tax for a balanced budget.

Differentiating equation (5) yields

$$du = \frac{\lambda\alpha[1-R_o]}{[\lambda R_i + \alpha[1-R_o]]^2}dR_i + \frac{\alpha\lambda R_i}{[\lambda R_i + \alpha[1-R_o]]^2}dR_o. \tag{19}$$

By substituting the decomposed unemployment effect, equation (19), and $\frac{\alpha^2[1-R_o]^2}{[\lambda R_i+\alpha[1-R_o]]^2} = (1-u)^2$ (see equation (5)) into equation (18), we get

$$dt = \left\{\frac{b}{\alpha[1-R_o]} - T\right\}\lambda dR_i + \frac{\lambda R_i \alpha}{[\lambda R_i + \alpha[1-R_o]]^2}dR_o - \lambda R_i dT. \tag{20}$$

This shows that employment tax, t, decrease with an increase of dismissal taxes, T, (through the direct financing effect) and decreases with increasing job creation (decreasing outsider's reservation productivity, R_o). An increase of dismissal probability has two opposite effects. On the one hand, employment taxes have to increase, as an increase in insider's reservation productivity *ceteris paribus* increases unemployment (captured by the term $\frac{b}{\alpha[1-R_o]}$

[6] To see this, we totally differentiate equation (8) which yields $\frac{r+\lambda R_i}{r+\lambda} = d\omega + dt - rdT$.

which represents the average costs per unemployed worker).[7] On the other hand, increasing dismissal probability (increase in insider's reservation productivity) may decrease the employment tax as the tax base for the dismissal taxes, T, (the average number of dismissals) changes. We can, however, conclude that as long as the unemployment insurance is not yet fully financed through dismissal taxes, i.e. the average costs of an unemployed worker exceed the dismissal taxes ($\frac{b}{\alpha[1-GR_o]} > T$), employment taxes, t, increase with increasing job destruction probability (see also Baumann and Stähler, 2006).

Substituting equation (20) into equations (16) and (17) and some rearranging (see Appendix A) yields

$$\frac{dR_i}{dT} = -\frac{(r+\lambda)}{\widetilde{D}} \left\{ \frac{\lambda(r+\lambda R_i)}{(\lambda-\alpha)(r+\lambda)} - \underbrace{\frac{\alpha\lambda R_i}{[\lambda R_i + \alpha(1-R_o)]^2}}_{=dt/dR_o} \right\}, \tag{21}$$

$$\frac{dR_o}{dT} = -\frac{(r+\lambda)}{\widetilde{D}} \left\{ \left[\frac{b}{\alpha(1-R_o)} - T \right] + \frac{\lambda[2(r+\lambda R_i)+\alpha(1-R_o)]}{(r+\lambda)(\lambda-\alpha)} \right\} > 0, \tag{22}$$

where

$$\widetilde{D} = -\frac{\lambda[(r+\lambda R_i)+\alpha(1-R_o)]}{(r+\lambda)(\lambda-\alpha)} - \frac{\alpha\lambda R_i}{[\lambda R_i+\alpha(1-R_o)]^2} - \lambda\left[\frac{b}{\alpha(1-R_o)} - T\right] < 0. \tag{23}$$

Equation (23) shows that $\widetilde{D} < 0$ for $\lambda > \alpha$ and as long as the unemployment insurance is not yet fully financed by dismissal taxes, $\frac{b}{\alpha(1-R_o)} > T$. This implies that outsider's reservation productivity, R_o, increases with increasing dismissal taxes, i.e. job creation decreases, according to equation (22). From equation (21) we see that the effect on insider's reservation productivity, i.e. dismissal probability, is ambiguous.

Again, we start off by describing the incentives for job creation as they are easier to assess. Due to the increase of dismissal taxes, T, the expected labor costs increase, which reduces the incentive for job creation. This incentive may be diminished by the *potential* decrease of insider's reservation productivity (see equation (21)) and/or the *potential* decrease of employment taxes (see equation (20)). As gets obvious in equation (22), this does not compensate the negative effects on the incentive for job creation which unambiguously decreases due to a rise of dismissal taxes (i.e. outsider's reservation productivity increases).

The effect of an increase of dismissal taxes, T, on insider's reservation productivity can be explained as follows. Augmenting T *ceteris paribus* reduces dismissal probability and job creation as firing a worker gets more expensive. This reduces labor reallocation but augments the increase of job reallocation due to a rise in wages, $dJR/d\omega = \lambda(dR_i/d\omega) - \alpha(dR_o/d\omega)$,

[7] Note that b are the unemployment benefits that have to be paid each period and $\frac{1}{\alpha[1-R_o]}$ is the average duration of unemployment in steady state.

see equation (10), which would result in a lower union's utility.[8] As this is anticipated by the union, it increases its wage claim disproportionably high in order to compensate for this effect. The resulting wage increase overcompensates the the rise in dismissal taxes and generates the incentive to increase dismissal probability which is captured by the term $\frac{\lambda(r+\lambda R_i)}{(\lambda-\alpha)(r+\lambda)}$ in equation (21). Contrary to this effect we see in equation (21) that the increase of employment taxes due to the increase of outsider's reservation productivity, dt/dR_o (which *ceteris paribus* increases unemployment and therefore generates additional financial needs for the unemployment insurance, see also equation (20)), generates the incentive to decrease dismissal probability as described in equation (16).

It remains an empirical question which of the effects dominates. If insider's reservation productivity increases, unemployment unambiguously increases with a rise in dismissal taxes due to more layoffs and less job creation. If it decreases, the effects on the unemployment rate are ambiguous as there are fewer dismissals and less job creation (see equation (19)). The latter holds for $T > 0$ which implies that experience rating already exists in the economy and the importance of dismissal taxes for the financing of the unemployment insurance is enforced.

Part of the question asked in this paper is, however, if the introduction of an experience rating unemployment insurance in the presence of unionized wage bargaining may result in an increase of unemployment. When experience rating does not exist, we know that the unemployment insurance must be fully financed by employment taxes and, thus, $T = 0$ initially. This implies $R_i = R_o = R$ as we know from equations (14) and (15). Still, equations (21) and (22) hold and, hence, the effects on insider's reservation productivity are ambiguous. Nevertheless, by substituting equations (21) and (22) into equation (19) for $R_i = R_o = R$ and some rearranging, we get

$$\begin{aligned}\frac{du}{dT} &= -\frac{(r+\lambda)\alpha\lambda}{[\lambda R_i + \alpha(1-R_i)]^2\widetilde{D}}\left\{\frac{\alpha\lambda R^2(\lambda-\alpha)[(\lambda-\alpha)(1-R)R + 2\alpha(1-R) + (r+\lambda)]}{(r+\lambda)(\lambda-\alpha)[(\lambda-\alpha)R+\alpha]^2}\right.\\ &\quad + \frac{\lambda\alpha^3 R(1-R) + 2\alpha\lambda R(r+\lambda R^2) + \alpha\lambda R(1-R)[(\lambda-\alpha)R+\alpha]^2}{(r+\lambda)(\lambda-\alpha)[(\lambda-\alpha)R+\alpha]^2}\\ &\quad \left. + R\left[\frac{b}{\alpha(1-R)} - T\right]\right\} > 0. \qquad (24)\end{aligned}$$

This shows that the introduction of an experience rated unemployment insurance unambiguously increases unemployment, no matter what happens with insider's reservation productivity. Even if dismissal probability decreases due to an augmentation of dismissal taxes, this reduction is overcompensated by the resulting decrease of job creation.

[8] By totally differentiating equations (8) and (9) and following Appendix A, it is straightforward to show that neglecting the wage effect, $\frac{dR_i}{dT} = -\frac{r(r+\lambda)}{r+\lambda R_i} < 0$ and $\frac{dR_o}{dT} = \frac{(r+\lambda)^2}{r+\lambda R_i} > 0$. Substituting the optimal wage, equation (13), into the union's utility function, equation (7), it is easy to see that it decreases with decreasing changes in job reallocation resulting from wage increases.

4 Conclusion

In this paper, I have shown that policy makers interested in reducing the unemployment rate in Europe might have been right not to introduce an experience rated unemployment insurance system (i.e. increase dismissal taxes in order to reduce employment taxes). This contradicts many theoretical findings in labor market analysis which suggest that experience rating indeed decreases unemployment.

The reason is that those findings basically assume individual wage bargaining between workers and firms. European labor markets are, however, characterized by a high degree of unionization. To integrate unions, I have assumed an insider-dominated monopoly union that maximizes the gain from employment over unemployment and sets a wage binding for all firms.

Raising dismissal taxes *ceteris paribus* reduces job destruction and creation, reducing job reallocation but also augmenting the marginal increase of job reallocation due to higher wages. This decreases the union's marginal utility gain from a rise the wage claim and increases the corresponding utility loss. Hence, in order to compensate for this effect, the union claims disproportionably higher wages when dismissal taxes are increased. This unambiguously yields less job creation as higher wages plus additional firing costs cannot be compensated by a potential decrease in employment taxes.

Higher dismissal taxes create ambiguous effects on job destruction. On the one hand, dismissals get more expensive (reducing dismissal probability). On the other hand, wages increase whereas employment taxes potentially decrease (which is itself ambiguous). If the wage effect is strong enough, dismissal probability may increase as well. This implies a rise in unemployment. Otherwise, job destruction decreases, yielding ambiguous employment effects due to less job creation and fewer dismissals. In principle, it remains an empirical question which effect dominates.

It can be shown, however, that when introducing an experience rating unemployment insurance (i.e. introducing dismissal taxes to an insurance that is solely financed by employment taxes initially), the reduction of job creation always dominates the potential decrease of dismissal probability and unemployment unambiguously rises.

I should address some limitations of the above analysis. First, the results just described unambiguously hold for a uniform productivity distribution which guarantees the wage effect to be strong enough to compensate the opposite effects that result from a reduction of employment taxes. For a more general distribution function, the results tend to be highly ambiguous as there are additional effects that may reduce the wage increase. Second, the union's utility function chosen does indeed partly drive the results. A different and more common utility function as, e.g. the utilitarian one, does again produce wage effects in the opposite direction which may possibly compensate the effects described here. It then remains an empirical question which effect dominates as a clear analytical solution of the problem gets impossible. These shortcoming should be addressed in further research. Nevertheless, to my knowledge, this paper is the only one showing that experience rating can indeed increase unemployment from a theoretical point of view.

Appendix

A Calculating the Overall Effect in Presence of Unionized Wage Bargaining

Totally differentiating equations (14) and (15) yields equations (16) and (17). Substituting equation (20) and writing these equations as a matrix yields

$$\underbrace{\begin{pmatrix} -\frac{(\lambda+\alpha)(r+\lambda R_i)+\lambda\alpha(1-R_o)}{(r+\lambda)(\lambda-\alpha)} - \left[\frac{b}{\alpha(1-R_o)} - T\right] & \frac{\alpha(r+\lambda R_i)}{(r+\lambda)(\lambda-\alpha)} - \frac{\alpha\lambda R_i}{[\lambda R_i+\alpha(1-R_o)]^2} \\ -\frac{\lambda[(\lambda-\alpha)+2r+(\lambda+\alpha)R_i+\alpha(1-R_o)]}{(r+\lambda)(\lambda-\alpha)} - \left[\frac{b}{\alpha(1-R_o)} - T\right] & \left[1 + \frac{\alpha(r+\lambda R_i)}{(r+\lambda)(\lambda-\alpha)} - \frac{\alpha\lambda R_i}{[\lambda R_i+\alpha(1-R_o)]^2}\right] \end{pmatrix}}_{=B} \times$$

$$\times \begin{pmatrix} dR_i \\ dR_o \end{pmatrix} = \begin{pmatrix} -(r+\lambda R_i) \\ \lambda(1-R_i) \end{pmatrix} dT. \tag{25}$$

With $\widetilde{D} = det(B)$, which gives the Jacobi-matrix, equation (23), rearranging of equation (25) yields

$$\begin{pmatrix} dR_i \\ dR_o \end{pmatrix} = \frac{1}{\widetilde{D}} \cdot$$

$$\cdot \begin{pmatrix} \left[1 + \frac{\alpha(r+\lambda R_i)}{(r+\lambda)(\lambda-\alpha)} - \frac{\alpha\lambda R_i}{[\lambda R_i+\alpha(1-R_o)]^2}\right] & -\frac{\alpha(r+\lambda R_i)}{(r+\lambda)(\lambda-\alpha)} + \frac{\alpha\lambda R_i}{[\lambda R_i+\alpha(1-R_o)]^2} \\ \frac{\lambda[(\lambda-\alpha)+2r+(\lambda+\alpha)R_i+\alpha(1-R_o)]}{(r+\lambda)(\lambda-\alpha)} + \left[\frac{b}{\alpha(1-R_o)} - T\right] & -\frac{(\lambda+\alpha)(r+\lambda R_i)+\lambda\alpha(1-R_o)}{(r+\lambda)(\lambda-\alpha)} - \left[\frac{b}{\alpha(1-R_o)} - T\right] \end{pmatrix} \times$$

$$\times \begin{pmatrix} -(r+\lambda R_i) \\ \lambda(1-R_i) \end{pmatrix} dT. \tag{26}$$

After some rearranging, equation (26) gives equations (21) and (22).

B The Effects with More General Distribution Functions

As already mentioned, parts of the results derived within the paper are driven by the assumption of a uniform productivity distribution and, hence, the corresponding large wage effect. With a more general distribution function, the wage effect differs. Differentiating equation (12) with respect to insider's and outsider's reservation productivity, respectively, yields

$$\frac{d\omega}{dR_i} = \lambda g(R_i) \frac{2[r + \lambda G(R_i)] + \alpha[1 - G(R_o)]}{\lambda(r + \lambda)[g(R_i) - \alpha g(R_o)]} - g'(R_i) \frac{[r + \lambda G(R_i)][r + \lambda G(R_i) + \alpha[1 - G(R_o)]]}{[\lambda(r + \lambda)[g(R_i) - \alpha g(R_o)]]^2} \tag{27}$$

and

$$\frac{d\omega}{dR_o} = -\alpha g(R_o) \frac{[r + \lambda G(R_i)]}{\lambda(r + \lambda)[g(R_i) - \alpha g(R_o)]} + \alpha g'(R_o) \frac{[r + \lambda G(R_i)][r + \lambda G(R_i) + \alpha[1 - G(R_o)]]}{[\lambda(r + \lambda)[g(R_i) - \alpha g(R_o)]]^2}. \tag{28}$$

It is easy to see that the first terms on the rhs of equations (27) and (28) 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 (27) and (28). If these terms are negative or positive highly depends 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) derived in the main text is lessened by the second terms on the rhs of equations (27) and (28). If this second effect dominates the first effect, wages decrease with increasing dismissal probability and increase with increasing job creation. Then, it is straightforward to show that an increase in firing costs generates the results of 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 of the main text can qualitatively be derived even with a more general distribution function.

To be continued...

C The Model of Baumann and Stähler (2006)

In this section, wages are bargained individually between workers and firms. The bargaining power of workers is $0 < \beta < 1$. I assume that wages are renegotiated in the case of a shock. When bargaining over wages in existing jobs, $w_i(x)$, the fall back position of the firm is given by the (negative) dismissal tax T that has to be paid in the case of a layoff, whereas the worker's fall back position is given by the utility of unemployment, U. If workers and firms bargain over initial wages, $w_o(x)$, the firms' fall back position is zero (which is the steady state value of a vacancy). Hence, we get the two-tier wage contract solving

$$w_i(x) = \arg\max \left(W_i(x) - U\right)^{\beta} \left(J_i(x) + T\right)^{1-\beta}, \tag{29}$$

$$w_o(x) = \arg\max \left(W_o(x) - U\right)^{\beta} J_o(x)^{1-\beta}. \tag{30}$$

The maximization problems given by the two last equations yields the sharing rules $(1-\beta)[W_i(x)-U] = \beta[J_i(x)+T]$ and $(1-\beta)[W_o(x)-U] = \beta J_o(x)$, respectively. Substituting equations (2) to (4) into those sharing rules, the wages turn out to be[9]

$$w_i(x) = \beta\left(x - t + rT + \frac{\alpha}{r+\lambda}\int_{R_o}^{1}(x-R_o)dG(x)\right) + (1-\beta)b, \tag{31}$$

$$\begin{aligned} w_o(x) &= \beta\left(x - t - \lambda T + \frac{\alpha}{r+\lambda}\int_{R_o}^{1}(x-R_o)dG(x)\right) + (1-\beta)b \\ &= w_i(x) - \beta(r+\lambda)T. \end{aligned} \tag{32}$$

For given policy parameters, the market equilibrium is determined by the reservation productivity for outsiders, R_o (as a measure for job creation) and the reservation productivity for insiders, R_i (as a measure for job destruction). The latter is determined by the job destruction condition that the worker will be dismissed, if the value of the firm falls below the negative dismissal tax as point 3 of definition 1. Using equations (2) and (31) and following Pissarides (2000), we can derive

$$R_i - t + \frac{\lambda}{r+\lambda}\int_{R_i}^{1}(x-R_i)dG(x) = b + \frac{\beta}{(1-\beta)}\frac{\alpha}{r+\lambda}\int_{R_o}^{1}(x-R_o)dG(x) - rT \tag{33}$$

as the job destruction condition (further JD). Analogously, we can derive

$$R_o - t + \frac{\lambda}{r+\lambda}\int_{R_i}^{1}(x-R_i)dG(x) = b + \frac{\beta}{(1-\beta)}\frac{\alpha}{r+\lambda}\int_{R_o}^{1}(x-R_o)dG(x) + \lambda T \tag{34}$$

as the job creation condition (further JC) when using equations (2) and (32) and point 2 of definition 1. Hence, the equilibrium is determined by equations (33), (34), (5) and (6).

To derive the effects of an experience rated unemployment insurance, i.e. an increase of dismissal taxes, T, I follow Baumann and Stähler (2006). Totally differentiating equation (6) yields

$$dt = \frac{b}{(1-u)^2}du - \lambda G(R_i)dT - \lambda g(R_i)TdR_i. \tag{35}$$

This shows that *ceteris paribus* an increase of the unemployment rate, u, and an increase of the dismissal probability, indicated by an increase of the insiders' reservation productivity,

[9] Wages turn out to be $w_i(x) = \beta[x-t+rT]+(1-\beta)rU$ and $w_o(x) = \beta[x-t-\lambda T]+(1-\beta)rU$, respectively. To eliminate U, I make use of $(1-\beta)[W_o(x)-U] = \beta J_o(x)$ and $(r+\lambda)[J_o(x)-J_o(R_o)] = (1-\beta)(x-R_o)$, with $J_o(R_o)=0$. Substituting this into equation (4) yields $rU = b + \frac{\alpha\beta}{(1-\beta)(r+\lambda)}\int_{R_o}^{1}(x-R_o)dG(x)$. Substituting rU into the just mentioned wage equations and rearranging finally leads to equations (31) and (32). Note that these wages are perfectly equivalent to those derived in Baumann and Stähler (2006), where the term $\frac{\alpha}{r+\lambda}\int_{R_o}^{1}(x-R_o)dG(x)$ is equivalent to the market tightness term. Hence, a detailed discussion about the two-tier wage contract is found there or in Mortensen and Pissarides (2003) and will be skipped here.

R_i, increases the required employment tax, t, while an increase of the dismissal taxes, T, decreases the employment tax for a balanced budget.

Differentiating equation (5) yields

$$du = \frac{\lambda g(R_i)\alpha[1-G(R_o)]}{[\lambda G(R_i)+\alpha[1-G(R_o)]]^2}dR_i + \frac{\alpha g(R_o)\lambda G(R_i)}{[\lambda G(R_i)+\alpha[1-G(R_o)]]^2}dR_o. \tag{36}$$

By substituting the decomposed unemployment effect, equation (36), and $\frac{\alpha^2[1-G(R_o)]^2}{[\lambda G(R_i)+\alpha[1-G(R_o)]]^2} = (1-u)^2$ (see equation (5)) into equation (35), we get

$$dt = \left\{\frac{b}{\alpha[1-G(R_o)]} - T\right\}\lambda g(R_i)dR_i + \frac{\lambda G(R_i)\alpha g(R_o)}{[\lambda G(R_i)+\alpha[1-G(R_o)]]^2}dR_o - \lambda G(R_i)dT. \tag{37}$$

This shows that employment tax, t, decrease with an increase of dismissal taxes, T, (through the direct financing effect) and decreases with increasing job creation (decreasing outsider's reservation productivity, R_o) as there is *ceteris paribus* less unemployment. An increase of dismissal probability has two opposite effects. On the one hand, employment taxes have to increase, as an increase in insider's reservation productivity *ceteris paribus* increases unemployment (captured by the term $\frac{b}{\alpha[1-G(R_o)]}$ which represents the average costs per unemployed worker). On the other hand, increasing dismissal probability (increase in insider's reservation productivity) may decrease the employment tax as the tax base for the dismissal taxes, T, (the average number of dismissals) increases. We can, however, conclude that as long as the unemployment insurance is not yet fully financed through dismissal taxes, i.e. the average costs of an unemployed worker exceed the dismissal taxes ($\frac{b}{\alpha[1-G(R_o)]} > T$), employment taxes, t, increase with increasing job destruction probability (see also Baumann and Stähler, 2006).

To analyze the reaction of job destruction and job creation and, hence, unemployment to an increase of dismissal taxes, T, we totally differentiate equations (33) and (34) and substitute equation (37) for dt. This yields[10]

$$\begin{aligned} &- \left\{\frac{r+\lambda G(R_i)}{r+\lambda} - \left[\frac{b}{\alpha[1-G(R_o)]} - T\right]\lambda g(R_i)\right\}dR_i \\ &- \left\{\frac{\beta}{1-\beta}\frac{\alpha}{r+\lambda}[1-G(R_o)] - \frac{\lambda G(R_i)\alpha g(R_o)}{[\lambda G(R_i)+\alpha[1-G(R_o)]]^2}\right\}dR_o = \{r+\lambda G(R_i)\}dT \end{aligned} \tag{38}$$

[10]Totally differentiating equation (33) yields $-\frac{r+\lambda G(R_i)}{r+\lambda}dR_i - \frac{\beta}{(1-\beta)}\frac{\alpha}{r+\lambda}[1-G(R_o)]dR_o = rdT - dt$. From differentiating equations (34), we get $-\frac{\lambda}{r+\lambda}[1-G(R_i)]dR_i + \left\{1 + \frac{\beta}{(1-\beta)}\frac{\alpha}{r+\lambda}[1-G(R_o)]\right\}dR_o = \lambda dT + dt$, which then gives a downward sloping JD- and an upward sloping JC-curve in the (R_i/R_o)-space. Substituting equation (37) to eliminate dt and rearranging yields equations (38) and (39).

and

$$\left\{-\frac{\lambda}{r+\lambda}[1-G(R_i)]-\left[\frac{b}{\alpha[1-G(R_o)]}-T\right]\lambda g(R_i)\right\}dR_i$$
$$+\left\{1+\frac{\beta}{1-\beta}\frac{\alpha}{r+\lambda}[1-G(R_o)]-\frac{\lambda G(R_i)\alpha g(R_o)}{[\lambda G(R_i)+\alpha[1-G(R_o)]]^2}\right\}dR_o=\lambda[1-G(R_i)]dT. \tag{39}$$

Using equations (38) and (39) we can then further derive

$$\frac{dR_i}{dT}=\frac{(r+\lambda)}{Q}\left\{\underbrace{\frac{r+\lambda G(R_i)}{r+\lambda}+\frac{\beta}{1-\beta}\frac{\alpha}{(r+\lambda)}[1-G(R_o)]}_{=-D}-\frac{\lambda G(R_i)\alpha g(R_o)}{[\lambda G(R_i)+\alpha[1-G(R_o)]]^2}\right\}, \tag{40}$$

$$\frac{dR_o}{dT}=\frac{1}{Q}\left\{\left[\frac{b}{\alpha[1-G(R_o)]}-T\right](r+\lambda)\lambda g(R_i)\right\}, \tag{41}$$

where

$$Q=D+\left[\frac{b}{\alpha[1-G(R_o)]}-T\right]\lambda g(R_i)+\frac{\lambda G(R_i)\alpha g(R_o)}{[\lambda G(R_i)+\alpha[1-G(R_o)]]^2}, \tag{42}$$

with $D=-\frac{r+\lambda G(R_i)}{r+\lambda}-\frac{\beta}{(1-\beta)}\frac{\alpha}{(r+\alpha)}[1-G(R_o)]<0$. From equation (41) it is obvious that outsider's reservation productivity, R_o, decreases (i.e. job creation increases) with an increase in dismissal taxes, T, as long as $Q<0$ and the unemployment insurance is not yet fully financed through dismissal taxes, $\frac{b}{\alpha[1-G(R-o)]}>T$. $Q<0$ if the unemployment insurance is located on the upward sloping part of the Laffer-curve regarding employment taxes, t, (see Appendix D) as in Baumann and Stähler (2006). It is straightforward to see that the term in brackets of equation (40) is greater than zero as long as $Q<0$. Hence, insider's reservation productivity decreases with increasing dismissal taxes and, thus, yields fewer dismissals. Equation (5) shows that unemployment unambiguously decreases due to fewer dismissals and higher job creation.

Briefly sketching the mechanism at work, the effect can be decomposed into three components. An increase of dismissal taxes, T, leads to a direct financing effect substituting those taxes with employment taxes, t. But employment taxes, t, and dismissal taxes, T, cannot be fully substituted as higher dismissal taxes yield fewer dismissals and generate the tax base effect described in equation (37). Hence, employment taxes need to stay higher than would be implied by a full substitution. However, also obvious in equation (37), higher dismissal taxes decrease the the financial requirement of the unemployment insurance due to fewer dismissals so that employment taxes can be reduced by more than implied by a full substitution. The latter effect dominates the tax base effect as long as the conditions just derived - $Q<0$ and $\frac{b}{\alpha[1-G(R-o)]}>T$ - hold. This results in a decrease of the firms' total tax burden and, hence, reduces labor costs and unemployment. For a more detailed description, see Baumann and Stähler (2006). As the results are perfectly the same, it has been shown that the different matching process does not matter. Nevertheless, as we will see in the following analysis, unionized wage bargaining does. It can even reverse the mechanism just described.

D Sign of Q

To proof that $Q < 0$ as long as the unemployment insurance is located on the upward sloping part of the Laffer-curve, we follow Baumann and Stähler (2006, Appendix C). In case of a balanced budget, equation (6), can be redefined as

$$A = (1-u)[t + \lambda G(R_i)T] - bu = 0. \tag{43}$$

Totally differentiating A with respect to t and using equation (43) to simplify yields

$$\begin{aligned} \frac{dA}{dt} &= (1-u) - [t + \lambda G(R_i)T + b]\frac{du}{d} + (1-u)\lambda g(R_i)\frac{dR_i}{dt} \\ &= (1-u) - \frac{A+b}{(1-u)}\frac{du}{dt} + (1-u)\lambda g(R_i)\frac{dR_i}{dt} \\ &= (1-u)\left\{1 - \frac{b}{(1-u)^2}\frac{du}{dt} + \lambda g(R_i)\frac{dR_i}{dt}\right\} - \underbrace{\frac{A}{(1-u)}}_{=0}. \end{aligned} \tag{44}$$

From equation (43), we know that due to the initially balanced budget, $A = 0$. Substituting equation (36), for du/dt, we can derive

$$\frac{dA}{dt} = (1-u)\left\{1 - \left[\frac{b}{\alpha[1-G(R_o)]} - T\right]\lambda g(R_i)\frac{dR_i}{dt} - \frac{\lambda G(R_i)\alpha g(R_o)}{[\lambda G(R_i) + \alpha[1-G(R_o)]]^2}\frac{dR_o}{dt}\right\}. \tag{45}$$

From the totally differentiated job destruction and job creation condition as presented in footnote 10, we know that

$$\frac{dR_i}{dt} = \frac{dR_o}{dt} = -\frac{1}{D} > 0,$$

where $D = -\frac{r+\lambda G(R_i)}{r+\lambda} - \frac{\beta}{(1-\beta)}\frac{\alpha}{(r+\lambda)}[1-G(R_o)] < 0$. Substituting this into equation (45) yields

$$\begin{aligned} \frac{dA}{dt} &= \frac{(1-u)}{D}\left\{D + \left[\frac{b}{\alpha[1-G(R-o)]} - T\right]\lambda g(R_i) + \frac{\lambda G(R_i)\alpha g(R_o)}{[\lambda G(R_i) + \alpha[1-G(R_o)]]^2}\right\} \\ &= \frac{(1-u)}{D}Q. \end{aligned} \tag{46}$$

So, if an increase of employment taxes, t, increases the surplus of the unemployment insurance (it is located on the upward sloping part of the Laffer-curve with respect to employment taxes), $dA/dt > 0$, Q must be negative, as $D < 0$.

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