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Working Papers

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CESifo Working Paper No. 663 (4)

February 2002

Category 4: Labour Markets

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ISSN 1617-9595

CESifo *Working Paper No. 663*
February 2002

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Abstract

This paper explores how the introduction of an experience rated system of unemployment insurance affects employment and welfare in a model where implicit contracts between firms and workers give rise to wage rigidities and unemployment. In the literature, it has been argued that experience rated systems of unemployment insurance may reduce long term employment as firms anticipate the higher costs of layoffs implied by experience rating. Our analysis shows that, despite the higher costs of layoffs, the introduction of experience rating may increase long term employment. Moreover, it unambiguously increases welfare.

JEL Classification: H20, J63, J65.

Keywords: unemployment insurance, labour markets, implicit contracts.

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Introduction

It is a striking difference between US and European systems of unemployment insurance that US unemployment insurance systems usually imply some degree of experience rating. Experience rating means that unemployment insurance contribution rates of an individual firm increase with layoffs or with the amount of unemployment benefits paid to workers whom the firm has laid off. The main argument in favour of introducing experience rating is that a system of unemployment insurance without experience rating distorts the employment decisions of firms.[1] As Feldstein (1978, p.844) puts it, a system with little or no experience rating "imposes an efficiency loss by distorting the behavior of firms to lay off too many workers when demand falls rather than cutting prices or building inventories." Feldstein concludes that an increase in experience rating will reduce unemployment and increase the efficiency of the labour market.

The view that experience rating will reduce incentives for firms to lay off workers temporarily is plausible. But does this necessarily imply that experience rating is a desirable element of unemployment insurance systems? Burdett and Wright (1989) claim that Feldstein´s argument in favour of experience rating only holds if the overall number of workers hired by a firm is fixed. However, given that firms anticipate the costs of future layoffs when they make their hiring decisions, the question arises whether the introduction of experience rating will have an adverse effect on long term employment. Burdett and Wright (1989) analyse this question in a standard model of implicit contracts with unemployment. It turns out that the introduction of experience rating does reduce temporary layoffs, but it also reduces long term employment. This result suggests that Feldstein´s argument in favour of experience rating might actually be misleading because it neglects the negative impact of increased layoff costs on long term hiring decisions.

The present paper reconsiders the employment and welfare effects of experience rating in a standard implicit contract model which is similar the one used by Burdett and Wright (1989), henceforth denoted BW. The key difference is that we explicitly take into account the budget constraint of the unemployment insurance system. This difference complicates the analysis somewhat but leads to results which are exactly opposed to those in BW. Most importantly, we show that the introduction of experience rating unambiguously increases welfare. It may

[1] For a very useful survey of theoretical and empirical work on unemployment insurance systems see Holmlund (1998).

also increase long term employment. Our findings differ from those in BW because their analysis neglects that the introduction of a tax on layoffs allows to reduce the average contribution rate of the unemployment insurance system. They do not explicitly analyse the budget constraint of the unemployment insurance system but assume that budget balance may be achieved through lump sum taxes.

This paper is also related to the broader literature which deals with the impact of changes in layoff costs on labour market performance and economic efficiency (see e.g. Bentolila and Bertola (1990), Burda (1992) or Mortensen and Pissarides (1999)).[2] Concerning the employment effects of layoff costs, these contributions lead to mixed results.[3] The main difference to the present paper is that these contributions use search and matching models of the labour market whereas this paper uses an implicit contract framework. Moreover, our analysis focuses on layoff costs implied by the structure of the unemployment insurance system whereas the papers mentioned above are concerned with different types layoff costs such as, for instance, severance payments.

The following analysis is set up as follows. The next section introduces the model. Section three analyses the effect of introducing experience rating on welfare and employment. Section four concludes.

2. The model

Consider a firm which produces a good y using labour (n) as the only factor of production. The firm´s production function is $f(n)$, with $f'(n) > 0, f''(n) < 0$. The firm faces uncertainty concerning the price of its good in the output market. There are two possible states of the world. We refer to these two states as state 1 (the "good state") occurring with probability p and state 2 (the "bad state") occurring with probability 1-p. In the good state, the output price is assumed to be equal to unity. In the bad state, the price is $0 \leq \phi < 1$.[4]

The firm maximizes expected profits and offers state contingent contracts to m risk averse workers. Following BW, we call these workers *attached* and we assume that, once these

[2] For recent surveys see Ljungqvist (2001) or Addison and Teixeira (2001).
[3] The factors explaining these differences are studied in Ljungqvist (2001).
[4] The price shock can also be interpreted as a productivity shock. The restriction to two states is not critical for our results but facilitates the presentation.

workers are attached to the firm, they have no other employment opportunities in the period under consideration. Accordingly, the firm can only employ workers attached to it, i.e. it is impossible to hire more than m workers after the state of the world is revealed. In the following, we also interpret m as the level of long term employment per firm. The contract C specifies wages for the two states w_1 and w_2 and the number of workers to be employed in the two states, i.e. $C = (w_1, w_2, n_1, n_2)$. Workers may either be employed and work one unit of time in the firm they are attached to or be unemployed, i.e. we exclude work sharing arrangements.[5] If the number of employed workers n_j in some state j is lower than the number of attached workers m, the firm dismisses $m-n_j$ workers. We refer to these layoffs as *temporary layoffs*. This has the purpose to distinguish between workers who are hired by a firm and laid off later as opposed to workers who never are hired in the first place. Workers are laid off at random, so that each worker faces the same probability $(m-n_j)/m$ of being laid off in state j. Workers who are laid off receive unemployment insurance benefits b. Workers and the firm take b as given.

The utility of each worker is given by the utility function $U(c,h)$, with $U_c(c,h) > 0$, $U_h(c,h) < 0$, $U_{cc}(c,h) < 0$, where c is the worker´s consumption, h denotes hours of work and subscripts are partial derivatives. Workers will only accept contracts with the firm under consideration if the expected utility from being attached to the firm is at least as high as the reservation level $\overline{U}$. This implies that all contracts have to satisfy the constraint

$$U^e = p\left(\frac{n_1}{m}U(w_1,1) + \left(1-\frac{n_1}{m}\right)U(b,0)\right) + (1-p)\left(\frac{n_2}{m}U(w_2,1) + \left(1-\frac{n_2}{m}\right)U(b,0)\right) \geq \overline{U}. \quad (1)$$

When choosing the optimal contract C, the firm takes the reservation utility $\overline{U}$ as given. The expected profit of the firm is

$$\pi^e = p\big(f(n_1) - w_1 n_1(1+t) - \beta(m-n_1)\big) + (1-p)\big(\phi f(n_2) - w_2 n_2(1+t) - \beta(m-n_2)\big) \quad (2)$$

where t and β are parameters of the unemployment insurance system; t is a payroll tax and β is a parameter reflecting the degree of experience rating. With t>0 and β=0, we have the European type system of unemployment insurance, where contributions are typically simply

[5] On work sharing in implicit contract models see Burdett and Wright (1989b).

payroll taxes and there is no experience rating. With t>0 and β>0, we have a US-type system with experience rating.

The firm maximizes expected profits π subject to the participation constraint (1) and subject to $n_j \le m$, j=1,2. The Lagrangean is

$$L(w_1, w_2, n_1, n_2, m, \eta, \delta_1, \delta_2) = \pi^e + \eta(U^e - \overline{U}) + \delta_1(m - n_1) + \delta_2(m - n_2) \tag{3}$$

The first order conditions for w_1 and w_2 are

$$\frac{\partial L}{\partial w_1} = pn_1\left(-(1+t) + \eta\frac{1}{m}U_c(w_1,1)\right) = 0 \tag{4}$$

$$\frac{\partial L}{\partial w_2} = (1-p)n_2\left(-(1+t) + \eta\frac{1}{m}U_c(w_2,1)\right) = 0 \tag{5}$$

For n_j>0, j=1,2, (4) and (5) lead to the standard result that the wage rate is state independent, i.e. w_1=w_2. In the following analysis, we denote the optimal wage rate by w. The first order conditions for m, n_1 and n_2 can be written as

$$\frac{\partial L}{\partial m} = -\beta - \frac{\eta}{m^2}\left(pn_1 + (1-p)n_2\right)\left(U(w,1) - U(b,0)\right) + \delta_1 + \delta_2 = 0 \tag{6}$$

$$\frac{\partial L}{\partial n_1} = p(f'(n_1) - w(1+t) + \beta) + \frac{\eta p}{m}\left(U(w,1) - U(b,0)\right) - \delta_1 = 0 \tag{7}$$

$$\frac{\partial L}{\partial n_2} = (1-p)(\phi f'(n_2) - w(1+t) + \beta) + \frac{\eta(1-p)}{m}\left(U(w,1) - U(b,0)\right) - \delta_2 = 0 \tag{8}$$

(6) implies that one of the two employment contraints $n_j \le m$, j=1,2, must be binding. We assume that the employment constraint is binding in the good state, i.e. $n_1 = m$. We assume

further that some workers are dismissed in the bad state, i.e. $n_2 < m$ and $\delta_2 = 0$.[6] Substituting (5) into (8) yields

$$\phi f'(n_2) - (1+t)\left(w - \frac{U(w,l) - U(b,0)}{U_c(w,l)} \right) + \beta = 0 . \qquad (9)$$

Using (7) and (8) to eliminate the Lagrangean multipliers in (6) and making some rearrangements leads to

$$pm(f'(m) - w(1+t)) + (1-p)n_2(\phi f'(n_2) - w(1+t)) - (1-p)(m-n_2)\beta = 0 \qquad (10)$$

Using $w_1=w_2=w$ and $n_1=m$ in (1) yields

$$U(b,0) + \left(p + (1-p)\frac{n_2}{m} \right)\big(U(w,l) - U(b,0)\big) = \overline{U} \qquad (11)$$

Equations (9)-(11) determine the equilibrium values of m, n_2 and w for a given reservation utility of workers $\overline{U}$.

3. Effects of Introducing Experience Rating on Employment and Welfare

It is the objective of the analysis to explore the effect of introducing experience rating on employment and welfare in our model. In the preceding section, we have only discussed the behaviour of an individual firm, which takes the reservation utility of workers $\overline{U}$ as given. In order to analyse the effects of policy changes for the economy as a whole, though, the model must be closed, i.e. some assumption must be made on how $\overline{U}$ is determined.[7] There are two simple ways of doing this. Firstly, one may assume that the economy consists of a given, large number of identical firms of the type described above, and that all workers seek employment in one of these firms. This would imply that $\overline{U}$ adjusts such that all workers will be attached to some firm in equilibrium. As a consequence, if the number of firms is denoted by Q and the

[6] It is straightforward to show that the existence of unemployment benefits (b>0) is a necessary condition for unemployment to occur in this model. This point is discussed extensively in Akerlof and Miyazaki (1980).
[7] We also assume that there is no uncertainty in the aggregate and that firm owners are perfectly diversified (or risk neutral).

overall number of workers is normalized to unity, we always have m=1/Q. It is clear that, in such a model, the question of whether or not experience rating may have a negative impact on hiring decisions is trivial because m is given.

The second possibility is to assume that workers have an alternative to working in the type of firm described above. For instance, one may assume that workers may have the option to be voluntarily long term unemployed or to work in an informal sector. The utility when choosing this alternative is constant, such that $\overline{U}$ is fixed. In the following, we concentrate on this case.[8] A second important issue for the analysis of policy changes is the question of whether or not the budget constraint of the unemployment insurance system is taken into account. In the following, we proceed in two steps. In the first step, we neglect the budget constraint of the unemployment insurance system by assuming that changes in revenue induced by changes in policy instruments are neutralized by lump sum transfers or taxes. This is also done in BW. Not suprisingly, as will be shown below, our results confirm the findings in BW. As a second step, we assume that reforms in the unemployment insurance system must be revenue neutral, i.e. the budget constraint of the unemployment insurance system must hold. This assumption complicates the analysis but it turns out that the results are different.

Consider first the case where the budget constraint of the unemployment insurance system is neglected. The effects of changes in t and β on m, n_2 and w can be derived by totally differentiating (9)-(11) and setting $d\overline{U} = 0$. Since we are interested in the effects of introducing experience rating, we assume that the reform departs from an equilibrium with β=0, t>0. Since the algebra is tedious but straightforward, we relegate the formal analysis to the appendix and state the results as

Proposition 1:
Departing from an equilibrium with t>0, β=0,
i) an inrease in t reduces m and n_2 and
ii) an increase in β reduces the number of temporary layoffs ($m-n_2$) and reduces the number of attached workers per firm (m). The effect on n_2 is ambiguous.

It is not surprising that an increase in the payroll tax t reduces both the number of attached workers (m) and the level of employment in the bad state (n_2). Our key interest is in the effect

[8] The analysis in BW also focuses on this case.

of a change in β. Firstly, it turns out that an increase in the tax parameter β does reduce the number of temporary layoffs. This is the effect emphasized by Feldstein (1978), as mentioned in the introduction. However, an increase in β also increases the ex ante expected labour cost per worker hired. As a consequence, the number of attached workers (m) declines. So it turns out that our results in proposition 1 confirm the point made by BW: If the introduction of experience rating is conceived as the introduction of an *additional* tax on layoffs, it may have detrimental effects on hiring deicisions and, hence, reduce the level of long term employment.

However, while it is clear that the effects of experience rating on long term hiring decisions of firms is important, it also has to be taken into account that an increase in β does not necessarily imply an increase in the ex ante expected cost of labour because it makes more revenue available for the unemployment insurance system. This revenue may be used to reduce the "non experience rated component" of the unemployment insurance system, i.e. an increase in β allows to reduce t, given the level of unemployment benefits b. The budget of the unemployment insurance system can be written as

$$wt(pm + (1-p)n_2) + (1-p)(m-n_2)\beta = (1-p)(m-n_2)b\,. \qquad (12)$$

In the following, we consider the introduction of experience rating, i.e. an increase in β, assuming that t is adjusted such that the budget constraint in (12) continues to hold. We derive the effects of this reform on the endogenous variables by differentiating and solving equations (9)-(12). The result is

Proposition 2:

Departing from an equilibrium with t>0, β=0, a revenue neutral increase in β increases n_2 and may increase or reduce m. The number of temporary layoffs $(1-p)(m-n_2)$ may increase or decrease.

Proposition 2 shows that it is important to take into account the budget constraint of the public sector. Most importantly, it turns out that experience rating does not necessarily reduce the number of attached workers (m). For instance, it can be shown that the introduction of experience rating increases m if the productivity difference between the good state and the bad state is large enough, i.e. ϕ is small. The reason is simply that the increase in β generates

revenue which allows to reduce t, which c.p. reduces the expected cost of labour. Given that m may increase, it is not surprising that the number of temporary layoffs may rise or fall. So the main insight provided by the results in proposition 2 is that experience rating neither necessarily reduces the level of long term employment, nor does it necessarily reduce the number of temporary layoffs. The number of temporary layoffs may increase simply because more workers may be hired ex ante. Of course, the crucial question is whether experience rating makes employment and layoff decisions more efficient. We may state

Proposition 3:

Departing from an equilibrium with $t>0$, $\beta=0$, a revenue neutral increase in β leads to a Pareto improvement.

Proof. See the appendix.

The introduction of experience rating gives rise to a Pareto improvement for the following reason. In this model, the (expected) utility of workers is fixed and given by $\overline{U}$. So in order to evaluate the efficiency effects of the reform under consideration, we can restrict our attention to the effect on profits. When making its layoff decisions, each individual firm takes its contribution rate to the unemployment insurance system as given. It thus does not take into account that more temporary layoffs must lead to higher contributions, given the level of b. Temporary layoffs thus give rise to what may be called a negative fiscal externality on other firms. This implies that, for the economy as a whole, temporary layoffs are inefficiently high. Experience rating corrects for this externality and therefore improves overall efficiency.

4. Conlusions

This paper explores the effects of experience rating on employment and layoff decisions in a simple implicit contract model. It turns out that, in our model, the introduction of experience rating may increase or reduce long term employment but unambiguously raises welfare. Our results thus suggest that experience rating is a desirable feature of unemployment insurance systems. The fact that firms anticipate the higher layoff costs implied by experience rating is an important factor in the evaluation of this system, but it does not imply that experience rating is not desirable. Our analysis thus qualifies the views expressed in BW. Moreover, our

results suggest that the introduction of experience rating should be considered in particular as an option for European labour markets, where unemployment benefits are typically relatively generous. Of course, the results derived in this paper have to be evaluated in the light of the model underlying our analysis. The importance of implicit contracts as a factor contributing to wage rigidities in existing labour markets is the subject of an ongoing debate. Moreover, our analysis does not tackle the question of what the optimal degree of experience rating is. One of the problems associated with experience rating is that it places an additional burden on firms which have to lay off workers permanently. Given this, it may accelerate the decline of shrinking firms or sectors. Whether or not this is desirable is an issue for future research.

Appendix

Proof of Proposition 1:

For notational simplicity we define $p^*=pm+(1-p)n_2$ and

$$U^* = \frac{U(w,l) - U(b,0)}{U_c(w,l)}$$

Differentiating equations (9)-(11) yields

$$\Sigma \begin{pmatrix} dn_2 \\ dw \\ dm \end{pmatrix} = \begin{pmatrix} \frac{\phi f'(n_2)}{1+t} dt - d\beta \\ 0 \\ p^* w dt + (1-p)(m-n_2) d\beta \end{pmatrix} \qquad \text{(A.1)}$$

with

$$\Sigma = \begin{pmatrix} \phi f''(n_2) & -(1+t)\frac{U_{cc}(w,l)}{U_c(w,l)} U^* & 0 \\ (1-p)U^* & p^* & -(1-p)\frac{n_2}{m} U^* \\ (1-p)\phi f''(n_2) n_2 & 0 & pf''(m)m \end{pmatrix}.$$

Solving for dn_2 and dm yields

$$\frac{dm}{dt} = \frac{p^*}{\Delta}\left(pf'(m)m\frac{\phi f''(n_2)}{(1+t)} + (1-p)w(1+t)\frac{U_{cc}(w,l)}{U_c(w,l)}(U^*)^2 \right) < 0, \qquad \text{(A.2)}$$

$$\frac{dm}{d\beta} = \frac{1}{\Delta}\left((1-p)p^{*}\phi f''(n_2)m + (1-p)^2(m-n_2)(1+t)\frac{U_{cc}(w,l)}{U_c(w,l)}(U^{*})^2 \right) < 0\,, \tag{A.3}$$

$$\frac{dn_2}{dt} = \frac{p^{*}}{\Delta}\left(pmf''(m)\frac{\phi f'(n_2)}{(1+t)} + (1-p)w(1+t)\frac{n_2}{m}\frac{U_{cc}(w,l)}{U_c(w,l)}(U^{*})^2 \right) < 0\,, \tag{A.4}$$

and

$$\frac{dn_2}{d\beta} = \frac{1}{\Delta}\left(-p^{*}pmf''(m) + (1-p)^2(m-n_2)(1+t)\frac{n_2}{m}\frac{U_{cc}(w,l)}{U_c(w,l)}(U^{*})^2 \right) \begin{matrix} > \\ < \end{matrix} 0 \tag{A.5}$$

where

$$\Delta = \phi f''(n_2)f''(m)p^{*}pm + (1-p)^2(1+t)(U^{*})^2\frac{U_{cc}(w,l)}{U_c(w,l)}\left(\frac{pf''(m)m}{1-p} + \frac{n_2}{m}\phi f''(n_2)n_2 \right) > 0$$

The effect of the change in β on temporary layoffs per firm in the bad state ($m-n_2$) is

$$\frac{d(m-n_2)}{d\beta} = \frac{(1-p)m}{\Delta}\left(p^{*}\left(\phi f''(n_2) + \frac{pf''(m)}{(1-p)} \right) + (1-p)(1+t)\frac{U_{cc}(w,l)}{U_c(w,l)}(U^{*})^2\left(1-\frac{n_2}{m} \right)^2 \right) < 0\,. \tag{A.6}$$

Q.E.D.

Proof of Proposition 2:

Differentiating (9)-(11) and (12) yields

$$\Psi \begin{pmatrix} dn_2 \\ dw \\ dm \\ dt \end{pmatrix} = \begin{pmatrix} -1 \\ 0 \\ (1-p)(m-n_2) \\ -(1-p)(m-n_2) \end{pmatrix} d\beta \tag{A.7}$$

where

$$\Psi = \begin{pmatrix} \phi f''(n_2) & -(1+t)\dfrac{U_{cc}(w,l)}{U_c(w,l)}U^* & 0 & -\dfrac{\phi f'(n_2)}{(1+t)} \\ (1-p)U^* & p^* & -(1-p)\dfrac{n_2}{m}U^* & 0 \\ (1-p)\phi f''(n_2)n_2 & 0 & pmf''(m) & -p^*w \\ (1-p)(wt+b) & p^*t & -(1-p)\dfrac{n_2}{m}(wt+b) & p^*w \end{pmatrix}.$$

The sign of the determinant of Ψ can be determined as follows. Denote the revenue of the unemployment insurance system minus benefits paid to the unemployed by R. R can be defined as a function

$$R(t,\beta,n_2,w,m) = wt(pm+(1-p)n_2)+(1-p)(m-n_2)\beta-(1-p)(m-n_2)b \qquad (A.8)$$

Assume that a marginal increase in t, holding constant β and b, but taking into account the induced changes in n_2, w and m, raises R, i.e. the slope of the Laffer curve is positive. This implies

$$\frac{\partial R}{\partial t}+\frac{\partial R}{\partial n_2}\frac{dn_2}{dt}+\frac{\partial R}{\partial w}\frac{dw}{dt}+\frac{\partial R}{\partial m}\frac{dm}{dt}>0$$

Denote the determinant of Ψ by Γ. This determinant can be written as

$$\Gamma = \Delta\left(\frac{\partial R}{\partial t}+\frac{\partial R}{\partial n_2}\frac{dn_2}{dt}+\frac{\partial R}{\partial w}\frac{dw}{dt}+\frac{\partial R}{\partial m}\frac{dm}{dt}\right).$$

Since $\Delta>0$, we also have $\Gamma>0$, given that the Laffer curve assumption mentioned above holds, which we assume to be the case. We can now solve (A.7) for dm and dn_2, which yields

$$\frac{dn_2}{d\beta}_{|dR=0} = \frac{p^*}{\Gamma}\gamma\left(-pmf''(m)+(1-p)\frac{n_2}{m}\left(b+\frac{\phi f'(n_2)}{(1+t)}t\right)\right)>0 \qquad (A.9)$$

and

$$\frac{dm}{d\beta}_{|dR=0} = \frac{p^*}{\Gamma}(1-p)\gamma\left(b + \phi f'(n_2)\frac{t}{(1+t)} + \phi f''(n_2)n_2\right) \gtrless 0 \qquad \text{(A.10)}$$

where

$$\gamma = p^* w + (1-p)(m-n_2)\frac{\phi f'(n_2)}{(1+t)} > 0$$

Q.E.D.

In the text, we argue that it is easy to find examples where m increases. To see this, note that the change in m is unambiguously positive if ϕ approaches zero.

Proof of Proposition 3:

As mentioned in the text, the reform under consideration yields a Pareto improvement if it raises aggregate profits. Aggregate profits increase if expected profits per firm (π^e) increase. Differentiating equation (2), using the first order conditions of the firm´s profit maximization problem and using the budget constraint of the unemployment insurance system yields

$$d\pi^e = (1-p)\left(b + \phi f'(n_2)\frac{t}{(1+t)}\right)\left(dn_2 - \frac{n}{m}dm\right) \qquad \text{(A.11)}$$

Using the results of the proof of proposition 2 yields

$$\frac{d\pi^e}{d\beta}_{|dR=0} = -\frac{(1-p)p^*\gamma}{\Gamma}\left(b + \phi f'(n_2)\frac{t}{(1+t)}\right)\left(pmf''(m) + (1-p)\frac{n_2}{m}\phi f''(n_2)n_2\right) > 0\,. \qquad \text{(A.12)}$$

Q.E.D.

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