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REDUNDANCY PAY AND COLLECTIVE DISMISSALS

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Abstract

Redundancy payments for collective dismissals are incorporated into a Shapiro-Stiglitz model of efficiency wages. It is shown that a fixed payment will lower wages, leave employment and welfare unaffected if there are no wage-dependent taxes, no additional firing costs and if unemployment benefits are not altered by redundancy payments. If payroll taxes exceed firing costs and unemployment benefits are independent of redundancy pay, employment and welfare will rise with redundancy payments. If these payments are also a function of previous wages, positive employment effects will be mitigated. A substitution of wage-dependent for lump-sum redundancy payments can lower employment, allowing for a continuous variation of effort.

JEL Classification: J41, J65.

Keywords: collective dismissal, efficiency wages, employment, redundancy pay, welfare

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1. Introduction

Payments for dismissed workers are widely observed. About 50% of OECD member states had legal entitlements to severance pay for individual dismissals in the early 1990s (Lazear 1990, OECD 1993). Moreover, private or collective agreements can constitute the basis for such transfers (cf. Pencavel 1991, 63f, Pita 1997, or Booth and McCulloch 1999). Despite this prevalence of severance pay, the economic analysis has so far focused only on some of their characteristics. The main features for the purpose of this paper may be summarised as:

1. Payments are often discussed in conjunction with other firing costs and subsumed under the heading of employment protection measures. Thus, their transfer character becomes intertwined with the tax nature of other firing costs (Garibaldi and Violante 1999, OECD 1999).
2. In the absence of market imperfections - and sometimes also in their presence - severance payments have no employment effects (Lazear 1990, Burda 1992, Booth 1997).
3. In general, no distinction is made between awards for individual dismissals - here referred to as severance payments (SPs) - and compensations for collective dismissals - labelled redundancy payments (RPs) -, although they can differ substantially (Emerson 1988, OECD 1999).

In this paper, the wage, employment, and welfare effects of payments in the case of collective dismissals, that is of RPs, are investigated in a dynamic shirking model of efficiency wages. Lump-sum RPs will leave employment and welfare unaffected if there are no additional wage-dependent labour or firing costs and if unemployment benefits not altered by dismissal compensation. The intuition for the absence of any employment effect is the following: in a situation in which a worker can either shirk or bring forward the required amount of effort, s/he will deliver this level of effort if the utility from doing so is higher than from shirking. The utility from providing effort includes the utility from becoming unemployed for reasons which are independent of the effort performance. Since RPs raise the expected utility of a worker who is dismissed for such exogenous reasons, providing effort becomes more attractive. This allows firms to reduce the efficiency wage, which will adjust fully to the change in labour costs owing to RPs if there are no additional wage-related labour costs, such as payroll taxes. In the absence of additional firing costs, employment remains constant. If there are payroll taxes but no additional firing costs, while unemployment benefits are unaffected by RPs, employment and welfare will increase with these payments. The positive employment effect arises as an increase in RPs and a fall in wages which retains the worker's utility level reduces labour costs owing to the amplifying effect of the tax. Reducing unemployment benefits for the recipients of RPs can reverse the employment and welfare consequences of their change since the wage reduction is mitigated. If RPs are a function of previous wages and the effort function is continuous, a substitution of wage-related for lump-sum RPs can reduce employment.

Severance payments have implicitly been analysed in an efficiency wage setting by Shapiro and Stiglitz (1984), since in their model unemployment benefits are equivalent to SPs. Thus, higher

SPs reduce employment and welfare. Fella (2000), based on Saint-Paul (1995a), assumes that SPs are never paid in the case of disciplinary dismissals. As these SPs mitigate the incentives to shirk they increase employment. In a setting with collective negotiations, bargaining about wages and RPs can result in an efficient contract, that is, bargaining about RPs can be a substitute for negotiations about employment (Booth 1995, 1997, Pita 1997). In a model of search and matching, SPs can provide a perfect insurance against income risk (Pissarides 2001). Finally, Saint-Paul (1995b, 2000) incorporates SPs into efficiency wage models to analyse the political support for their introduction. Given these previous analyses, the present paper makes three contributions: first, it is shown that SPs for individual and RPs for collective dismissals can have opposite employment effects. Second, in addition to the transfer and firing tax component, two further determinants of the employment effects of RPs are identified: labour taxes and the impact of RPs on unemployment benefits. Third, the wage-dependency of payments is shown to affect their employment consequences.

Section 2 outlines the efficiency wage model. It is based on the set-up by Shapiro and Stiglitz (1984) and includes unemployment benefits by a government agency and RPs financed by firms. Section 3 derives the employment and welfare effects of lump-sum RPs. In Section 4, payments depend on the previous wage. To explore the consequences of wage-dependent RPs, the model is extended to allow for a continuous effort function. Section 5 summarises.

2. Model

Already in 1975 the European Community enacted a directive which imposed restrictions on mass redundancies. In its wake, many countries laid down minimum requirements for SPs and RPs. For the subsequent analysis it is assumed that mass redundancies are well defined and that their occurrence creates entitlements to RPs. Although in many countries employees are covered by collective agreements which may restrict the company's behaviour if there are (collective) dismissals, negotiations about wages and RPs seldom take place simultaneously and agreements cover only a minority of workers (OECD 1997). Thus, the analysis applies to workers for whom RPs and wages are not fixed at the same time and the level of RPs is exogenous.

2.1 Workers

Workers are infinitely lived, discount future payments with the rate r, $r > 0$, cannot borrow or save and are characterised by an instantaneous utility $w - e$, where w is the wage and e their disutility level. Effort can either be high and conform to the level required by firms $\overline{e}$, $\overline{e} > 0$, or it can be at its minimum level $e = 0$. Unemployment benefits $\overline{w}$ are paid to every worker who loses the job. A job loss can occur for three distinct reasons. Workers might shirk and will be caught doing so with probability q per unit of time. There might be a 'small' exogenous shock which induces the firm to dismiss individual workers without incurring the costs of RPs. Finally, there might be a 'large' exogenous shock which requires the firm to fire a substantial fraction of its workers. The probability that a worker loses the job owing to such a mass redundancy which obliges the firm to make RPs is equal to h. The probabilities h and q are sufficiently small, implying that the time periods under consideration are very short, such that $hq \approx 0$.[1] Firms are not able to make a credible commitment with respect to dismissal payments.

Since it might be cheaper for firms to make SPs also to shirkers than to engage in costly legal disputes, and because a company will always have an incentive to claim that a worker has shirked if it could save SPs by doing so, it is assumed for simplicity, and in line with Shapiro and Stiglitz (1984), but unlike Fella (2000) and Goerke (2000), that dismissals for shirking and owing to a small exogenous shock entitle to the same financial compensation. However, a mass redundancy can clearly be distinguished from firing an individual worker and the respective payments to workers who lose their jobs can differ. Since the focus of the paper is on RPs, individually dismissed workers are assumed to obtain unemployment benefits only. Moreover, the probability of a small shock is normalised to zero without loss of generality.

The probability that a worker who has lost the job obtains a new one is denoted by a, the job acquisition rate. Since all workers provide the required amount of effort in equilibrium, the expected life time utility of an employed non-shirker ($V^{E,N}$), an employed shirker ($V^{E,S}$), and a worker who has been dismissed individually ($V^{U,D}$) are defined by:

$$V^{E,N} = \frac{w - \bar{e} + hV^{U,M}}{r + h} \tag{1}$$

$$V^{E,S} = \frac{w + qV^{U,D} + hV^{U,M}}{r + q + h} \tag{2}$$

$$V^{U,D} = \frac{\overline{w} + aV^{E,N}}{r + a} \tag{3}$$

The utility stream of an unemployed worker who has lost the job owing to a mass redundancy ($V^{U,M}$) resembles the utility of a worker who has been dismissed individually, with the exception of RPs. A worker who has lost the job owing to a mass redundancy obtains unemployment benefits $\overline{w}$ plus payments S per period. With a probability a, the worker finds a new job. Being employed again implies the termination of unemployment benefit payments. However, this is not true for RPs. Hence, obtaining a new job raises the (discounted) utility stream by $V^{E,N}$ - $V^{U,M}$ and the current value of RPs, that is S/r.[2] If the receipt of RPs allows for a reduction of

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[1] The assumption of a fixed dismissal probability implies that a change in the firm's employment level does not alter the individual's probability of a job loss. This contrasts with Fella's (2000) hypothesis that greater firm-specific employment raises this probability. One consequence of the differential assumptions is that hysteresis effects are feasible in Fella's (2000) model (cf. Saint-Paul 1995), which are of no relevance for the present analysis.

[2] To avoid the complication of having to consider intertemporal effort and consumption decisions, Shapiro and Stiglitz's (1984) presumption that workers cannot save requires the definition of RPs as payments per unit of time. Instead of including RPs into the definition of the utility stream $V^{U,M}$ from unemployment due to a mass redundancy, the payments could also be incorporated into $V^{E,N}$ and $V^{E,S}$. The modification would not alter the results as the utility differential which determines the choice of effort is unaffected by the alternative approach.

unemployment benefits by a fraction α of RPs, $0 \leq \alpha \leq \overline{w}/S$, per period of unemployment, the asset equation for a worker having experienced a mass redundancy will be:

$$rV^{U,M} = (\overline{w} - \alpha S) + S + a(V^{E,N} - V^{U,M} + S/r) \tag{4}$$

Solving for $V^{U,M}$ yields:

$$V^{U,M} = V^{U,D} + \tilde{S}, \qquad \text{where} \qquad \tilde{S} \equiv S\frac{a + (1-\alpha)r}{r(r+a)} > 0 \tag{5}$$

Using equations (1) and (5), the expected lifetime utility $V^{U,D}$ of a worker who has lost the job owing to an individual dismissal can be derived as:

$$V^{U,D} = \frac{\overline{w}(r+h) + a(w - \overline{e}) + ah\tilde{S}}{r(r+h+a)} \tag{6}$$

A worker will not shirk if the utility from doing so is not less than the utility from shirking, that is if $V^{E,N} \geq V^{E,S}$ holds. Substituting for $V^{U,D}$ and $V^{U,M}$ in accordance with (3) and (5), and assuming that the constraint binds, allows for the derivation of the efficiency wage w^e:

$$w^e - \frac{\overline{e}}{q}(r+h+a) - \overline{e} - \overline{w} + h\tilde{S} = 0 \tag{7}$$

Thus, equation (7) yields:

Proposition 1:
In a shirking economy with dichotomous effort decision, redundancy pay lowers wages. The decrease in wages will be greater if payments are not conditioned on the employment status.

The intuition for this result is that higher payments for workers who have lost their job for other reasons than shirking increase the utility from selecting the required amount of effort $\overline{e}$. Effectively, payments in the case of collective dismissals allow for a partial distinction between job losses for other reasons than shirking and owing to insufficient effort since raising S makes only those workers better off who have not been caught shirking. Hence, higher RPs lower the wage which is needed to induce the effort level $e = \overline{e}$. The wage reduction is more pronounced the higher the increase in the payoff to workers is which are affected by a mass redundancy. Since conditioning RPs on the employment status reduces this payoff, the wage reduction will be larger if not only unemployed workers obtain RPs.

2.2 Firms

The economy consists of a large number of ex-ante identical firms. Their number τ is fixed. Consistency with the specification of the workers' maximisation problem requires firms to choose an employment level which will be too high if a negative shock occurs and too low if a positive shock to productivity or demand takes place. Such situations can arise, for example, if firms can vary employment at no costs before the type of shock is revealed, while they incur firing costs subsequent to the revelation of the shock. Below a kind of reduced-form approach is pursued since the firm chooses an employment level n optimally prior to the revelation of the shock, and will employ Tn > n people if there is a positive shock and Pn < n people if a large adverse shock occurs. T and P are selected optimally. Shocks last one period and are exogenous. Accordingly, at the beginning of the next period it is again optimal to employ n people. For simplicity and because the impact of RPs is not affected by this presumption, the costless adjustment of employment before the beginning of a period takes place by reallocating workers from firms with excessive employment to those with an insufficient number of workers. Hence, the dismissal probability h and the job acquisition rate a are unaffected by these adjustments.

At the beginning of a period a firm fixes a wage which determines the level of effort. The wage is independent of the economic situation (cf. equation (7)). Then the shock occurs and the firm adjusts employment. Firms discount future payments with the common rate r. Expected profits are invariant over time and the firm's behaviour can be derived from the maximisation of its per-period expected profits. Let the probability that a firm experiences a positive shock and that the output price - or productivity - rises from unity to $\overline{T}$, $\overline{T} > 1$, and that the firm, therefore, employs Tn > n workers be given by β, 0 < β < 1. Alternatively, β can be interpreted as the fraction of firms which experiences a positive shock. The probability that employment remains constant or declines is given by (1 - β). A mass redundancy is due to an output price $\overline{P}$, $\overline{P} < 1$, takes place with probability (1 - β)p, leaves employment at Pn and entitles (1 - P)n workers to RPs. Redundancies can involve costs in addition to the transfers to former workers, such as for legal proceedings or procedural requirements (Bentolila and Bertola 1990) or, more generally, 'red tape costs' (Burda 1992). These costs are represented by a mark-up ξ on RPs, ξ ≥ 0, such that total firing costs per worker amount to S(1 + ξ)/r. The production function f is strictly concave in effective employment (f '(en) > 0, f '' < 0), while the capital stock is fixed and its costs are normalised to zero. Firms pay taxes μ, μ ≥ 0, on their payroll. These taxes include all wage-related employment costs, except wages itself. Denoting the gross efficiency wage by $\tilde{w}^e \equiv w^e(1 + \mu)$, expected profits are:

$$E(\Pi) = \beta\left[\overline{T}f(Tn\bar{e}) - \tilde{w}^e nT\right] + (1-\beta)(1-p)(f(n\bar{e}) - \tilde{w}^e n)$$

$$+ (1-\beta)\left[p(\overline{P}f(Pn\bar{e}) - P\tilde{w}^e n - (1-P)nS(1+\xi)/r)\right] \tag{8}$$

The present value S/r of RPs is unaffected by the legal rules governing the relation between RPs and unemployment benefits. This is because lower unemployment compensation only reduces government expenditure. In a steady-state, inflows into and outflows from unemployment are equal. Denoting aggregate employment by N and the fixed labour supply by L, a steady-state is given by hN = a(L - N) since no worker shirks in equilibrium. The inflows into unemployment owing to mass redundancies are given by (1 - β)τnp(1 - P) and have to equal the inflows as defined on the aggregate scale, i.e. hN = (1 - β)pτn(1 - P). Moreover, outflows due to employment expansion at the firm level have to equal their aggregate counterparts. Since N = τn holds, this entails β(T - 1) + 1 - (1 - β)[c(1 - C) + p(1 - P)] = 1 and yields:

$$E(\Pi) = \beta\overline{T}f(Tn\overline{e}) + (1-\beta)\left[(1-p)f(n\overline{e}) + p(\overline{P}f(Pn\overline{e})\right] - n\left[\tilde{w}^{e} + hS(1+\xi)/r\right] \tag{9}$$

The firm chooses employment n to maximise profits. This implies:

$$\frac{d(E(\Pi))}{dn} \equiv \pi_n = \hat{f}' - w^{e}(1+\mu) - hS(1+\xi)/r = 0, \text{ where} \tag{10}$$

$$\hat{f}' \equiv \overline{e}\left\{\beta\overline{T}f'(Tn\overline{e})T + (1-\beta)\left[(1-p)f'(n\overline{e}) + p\overline{P}(f'(Pn\overline{e})P\right]\right\} > 0$$

The second-order condition $\pi_{nn} < 0$ will be warranted if f is strictly concave as assumed above.

3. Redundancy Pay, Employment, and Welfare

Higher RPs reduce the wage which is required to obtain the level of effort $\overline{e}$. This wage reduction increases employment, ceteris paribus. However, RPs raise expected labour costs and, thus, reduce employment, for a given wage. The first objective of this section is to analyse which of the two effects dominates. Subsequently, the welfare consequences of RPs are investigated.

3.1 Employment

The impact of higher RPs on employment can be calculated by totally differentiating equations (7) and (10) for $N = \tau n$, since all firms are ex-ante identical and employ n workers at the beginning of each period, where $a = Nh/(L - N)$ has been taken into account:

$$\frac{dn}{dS} = h\frac{(\xi-\mu)(a+r) + \alpha r(1+\mu)}{\left[\hat{f}'' - \dfrac{(1+\mu)\tau L\overline{e}h}{q(L-N)^2}\right](r+a)r} \tag{11}$$

Given an endogenous job acquisition rate a, the relationship between RPs and employment may be summarised as:

Proposition 2:
In a shirking economy with dichotomous effort decision, redundancy payments S will not affect aggregate employment if S is paid unconditionally and if the payroll tax rate and the firing cost mark-up coincide. If S is paid unconditionally and the payroll tax rate exceeds the firing cost mark-up, aggregate employment will rise with S.

Redundancy pay is only obtained by workers who have not been caught shirking. Thus, wages can fall with RPs without reducing effort. Suppose, RPs are paid out unconditionally ($\alpha = 0$). Employment will be unaffected if the payroll tax rate and the firing cost mark-up are the same ($\mu = \xi$). This is because the fall in wages exactly compensates the rise in expected RPs in order to induce workers to bring forward the same level of effort. If the fall in wages is amplified by the payroll tax to the same extent as the increase in expected RPs is raised by the firing-cost mark-up, marginal employment costs and, hence, employment will remain constant. If payroll taxes exceed firing costs ($\mu > \xi$), the wage reduction will remain unchanged. However, the reduction in marginal employment costs owing to the fall in wages is magnified since firms save not only on wages but also on tax payments. Employment becomes cheaper at the margin and an increase in RPs raises the number of jobs. Garibaldi and Violante (1999) calculate that the non-transfer component of firing costs in Italy and the UK is less than 15%. Given non-wage labour costs which might easily exceed 20% of wage payments,[3] this suggests that higher RPs raise the number of jobs. Their employment effects can, thus, be opposite to those of SPs for individual dismissals unless shirkers can be excluded from the receipt of SPs. If there are no payroll taxes or additional firing costs and if the receipt of RPs reduces unemployment benefits, the wage reduction owing to a rise in S will be mitigated while the cost increase due to higher RPs remains the same. Employment falls. Firing costs in addition to RPs and reductions of unemployment benefits, thus, have the same impact: they introduce a wedge between the firm's payment and the transfer which a worker receives.

3.2 Welfare

The investigation of the welfare impact of RPs concentrates on the case of positive employment effects, that is a situation with RPs which do not reduce unemployment benefits and a positive payroll tax rate, while the firing cost mark-up is normalised to zero ($\alpha = 0$, $\mu > \xi = 0$). Let welfare consist of the sum of profits, the workers' utility and government revenues. It can be shown that the utility of no worker declines while any decrease in government revenues is exceeded by a rise in profits. Starting with profits, the change in instantaneous expected profits per firm owing to higher RPs for $\alpha = 0$ is:

$$\frac{dE(\Pi)}{dS} = \frac{\partial E(\Pi)}{\partial n}\frac{\partial n}{\partial S} + \frac{\partial E(\Pi)}{\partial w^e}\frac{\partial w^e}{\partial S} + \frac{\partial E(\Pi)}{\partial S} = \frac{nh\mu}{r} > 0 \qquad (12)$$

Hence, firms are better off owing to higher RPs. If wages fall and employment rises, the payroll and government revenues might change in either direction. However, it can be shown that the increase in profits always exceeds the possible decline in tax receipts (see appendix I).[4]

Turning to workers, the payoffs of someone who is dismissed ($V^{U,D}$) or someone who works at the required level of effort ($V^{E,N}$) are independent of redundancy pay since the changes in wages and RPs cancel out. Moreover, the payoff of a worker who has lost the job owing to a mass redundancy rises, irrespective of whether RPs affect unemployment benefits or not.

$$\frac{dV^{U,M}}{dS} = \frac{a\frac{\partial w^e}{\partial S} + \frac{\partial \tilde{S}}{\partial S}\left(ah + r(r+h+a)\right)}{r(r+h+a)} = \frac{\partial \tilde{S}}{\partial S} = \frac{a + (1-\alpha)r}{r(r+a)} > 0 \qquad (13)$$

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[3] See also OECD (1986); table 36 inter alia.

[4] If government expenditure were taken into account, the positive welfare effects would become more pronounced as the positive employment impact of RPs would reduce expenditure for unemployment compensation.

The above calculations are based on the assumption that the job acquisition rate a is constant. While this is assumption is adequate for each individual worker, since s/he takes this probability as given, a rise in employment and a constant probability of dismissal implies a higher steady-state job acquisition rate, a = hN/(L - N). Since the payoffs of workers increase with a rise in the job acquisition rate, taking into account the equilibrium repercussions implies that all workers are better off. Note, moreover, that the above argument assumes that variations in the job acquisition rate a do not affect the wage. This counterfactual assumption (cf. equation (7)) is permissible since the additional wage change, positive due to the rise in the job acquisition rate, lowers profits by the same amount as it raises tax revenues and the expected utility of all workers together. Therefore, the effects of changes in wages due to a variation in the job acquisition rate a have no impact on aggregate welfare. These considerations yield:

Proposition 3:
Higher redundancy pay will raise welfare in a shirking economy with a dichotomous effort decision if such payments do not affect unemployment benefits, the payroll tax rate is positive and the firing cost mark-up is zero.

This result seems to be in contrast with that by Shapiro and Stiglitz (1984) according to which welfare maximising unemployment benefits - or SPs - are zero. This is because the primary effect of higher benefits is to increase the incentive to shirk. If only the payments to people rise who have lost their job owing to mass redundancies, shirking will become less attractive.[5]

Before completing this section, an additional question need to be answered, namely, if there limits to the beneficial employment and welfare effects of RPs? In response it should be noted that all the derivations have assumed that the utility stream from working $V^{E,N}$ is greater than the utility from being unemployed. This restriction implies $V^{E,N} > V^{U,M} \geq V^{U,D}$. While the latter inequality is warranted for all non-negative values of S, the former inequality imposes an upper limit on S. Repeated substitutions in accordance with equations (5) to (7) shows that $V^{E,N} > V^{U,M}$ holds for a value of S such that:

$$\frac{w - \bar{e} + hV^{U,D} + h\tilde{S}}{r + h} > V^{U,D} + \tilde{S} \Rightarrow \frac{\bar{e}}{q} > \tilde{S} \Rightarrow S < \frac{\bar{e}r(r+a)}{q(a+(1-\alpha)r)} \equiv S^{max} \qquad (14)$$

If RPs exceed a critical level, workers will have an incentive to remain unemployed and the beneficial effects only arise for $S < S^{max}$.[6]

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[5] Accordingly, SPs from which shirkers can be excluded by assumption also raise welfare (cf. Bull (1985), Shapiro and Stiglitz (1985) and, in particular, Fella (2000)) because welfare losses are caused by the inability to monitor workers perfectly. This inability will become less pronounced if SPs are restricted to non-shirkers.

[6] The requirement $V^{E,N} > V^{U,M}$ is equivalent to the condition for the efficiency wage w^e to rise with a higher probability h of a mass redundancy, that is $dw^e/dh > 0$. This is because the efficiency wage will only increase with h if a job loss due to a collective dismissal lowers the utility of a worker and $V^{E,N} > V^{U,M}$ holds.

4. Wage-Dependent Redundancy Payments

In contrast to the assumption of Section 3, RPs in many countries are differentiated according to age, tenure and wages prior to the job loss (OECD 1999). While age and tenure do not play a role in the model, a wage-dependency of RPs can be taken into account. Assume, therefore, that RPs can be decomposed into a lump-sum element G, $G \geq 0$, and a wage-related part σw, $\sigma \geq 0$, such that $\tilde{S} = S/r = (G + \sigma w)/r$. Since a sufficient condition for employment to increase with RPs is a payroll tax rate in excess of the firing cost mark-up ($\mu > \xi$) and the absence of reductions in unemployment benefits ($\alpha = 0$), these restrictions are, henceforth, imposed.

Section 4.1 looks at the impact of a wage-dependency of RPs in the context of the efficiency wage model of Section 2. Since the efficiency wage is only influenced by the level of RPs, but not by their structure, Section 4.2 sets up a shirking model with a continuous choice of effort. In such a model, lump-sum RPs increase employment, while wage-dependent RPs have ambiguous consequences. A substitution of wage-dependent for lump-sum RPs reduces employment since the incentives to raise the efficiency wage become more pronounced with wage-dependent RPs.

4.1 Dichotomous Choice of Effort

In the model of Section 2, introducing wage-dependent RPs implies an efficiency wage w^e which is defined by:

$$w^e - \frac{1}{r + h\sigma}\left[\frac{\bar{e}}{q}(r + h + a) + \bar{e} + \overline{w}\right] + \frac{hG}{r + h\sigma} = 0 \tag{15}$$

Since an increase in the lump-sum element G of RPs reduces wages, which in turn lowers RPs owing to their wage dependency, the wage reduction is mitigated by a wage-dependent component. Nevertheless, higher RPs - be they due to an increase in the lump-sum or the wage-related part - raise employment. Moreover, the increase in employment owing to a rise in the lump-sum component of RPs decreases with the parameter σ which measures the wage-dependency of S.

$$\left.\frac{dn}{dG}\right|_{\substack{\mu>\xi,\\ \alpha=0}} = \frac{h(\xi - \mu)}{\hat{f}''(r + h\sigma) - \left\{(1+\mu) + h(1+\xi)\frac{\sigma}{r}\right\}\frac{L\tau\bar{e}h}{q(L-N)^2}} = \frac{1}{w}\left.\frac{dn}{d\sigma}\right|_{\substack{\mu>\xi,\\ \alpha=0}} > 0 \tag{16}$$

From equation (15) it can be noted that a change in the composition of RPs, holding constant their overall level, does not alter the efficiency wage. Moreover, labour demand is determined by the level of RPs which is the same by assumption. If neither the wage nor the expected costs of RPs vary, each firm will demand the same amount of labour and unemployment will be unaffected by a change in the composition of RPs. The results can be summarised as follows:

Proposition 4:

If the payroll tax rate exceeds the firing cost mark-up and redundancy payments do not alter unemployment benefits, a rise either in the lump-sum or the wage-dependent component of redundancy pay will raise employment in a shirking economy with dichotomous effort decision. A substitution of one component for the other leaves wages and employment unaffected.

The irrelevance of the composition of RPs is due to the assumption that effort can either be zero or attain the required level $\bar{e}$. In order to induce workers to bring forth the required level of effort, the expected utility from providing this effort must at least equal the utility from not doing so. Accordingly, only the level of RPs affects the employment performance of an economy. However, this irrelevance result does not apply for an economy in which effort can be varied continuously.

4.2 Continuous Effort Function

Suppose, effort e can be varied continuously in the interval [0, 1]. The probability that a worker is dismissed because s/he has been detected delivering an insufficient level of effort is denoted by q(e) and decreasing with effort e at a non-increasing rate, q' < 0, q'' > 0, q''' > 0. A dismissal for shirking is feasible for any e < 1. Denote by V_t^E the utility stream of an employed worker at period t. Since the utility stream $V_{t+1}^{U,M}$ of a worker who has lost the job owing to a mass redundancy at the end of period t consists of the utility stream of a worker who has been dismissed $V_{t+1}^{U,D}$ and RPs (cf. equation (5)), given that RPs do not affect unemployment benefits, V_t^E can be expressed as:

$$rV_t^E = w_t - e_t + [q(e_t) + h]\left(V_{t+1}^{U,D} - V_{t+1}^E\right) + h\tilde{S} \qquad (17)$$

The worker chooses the optimal level of current effort, given the utility from unemployment and the wage which is set by the firm. Maximisation of V_t^E with respect to current effort e_t yields:

$$\frac{\partial V_t^E}{\partial e_t} = -1 + q'(e_t)\left(V_{t+1}^{U,D} - V_{t+1}^E\right) = 0 \qquad (18)$$

In a steady-state, effort, wages and employment do not change over time, such that $w_t = w_{t+1}$, $V_t^E = V_{t+1}^E$ etc. hold. Substitution in equation (18) and omission of the time index gives rise to:

$$\omega \equiv [r + q(e) + h] + q'(e)\left\{w - e - rV^{U,D} + h\tilde{S}\right\} = 0 \qquad (19)$$

For the subsequent analysis it is presumed that the effort level implied by (19) is greater than zero but less than unity such that the term in curly brackets is positive. The second-order condition ($\omega_e > 0$) is warranted, given the restriction on q(e). Effort rises with the wage and RPs, while it declines with a higher utility stream from unemployment. Moreover, $e_{ww} < 0$ holds.[7]

While the above considerations hold for an individual worker, in an equilibrium the utility stream from unemployment is determined endogenously. The utility stream from unemployment due to individual dismissal $V^{U,D}$ consists of unemployment benefits $\overline{w}$ and the expected utility gain $a(V^E - V^{U,D})$ from finding a new job. Since all workers shirk, having become unemployed is no indication of an effort level below average and does not reduce one's probability of finding a new job. A steady-state requires the inflow into unemployment (q(e) + h)N to equal the outflow a(L - N). Substituting for V^E in accordance with equation (17) and the constraint implies:

$$V^{U,D} = \frac{\overline{w}(r + q(e) + h) + N\kappa(e)\left[w - e + h\tilde{S}\right]}{r\left[r + \kappa(e)\right]}, \quad \text{where } \kappa(e) \equiv \frac{q(e) + h}{L - N} > 0 \qquad (20)$$

Moreover, given equilibrium repercussions via $V^{U,D}$, the change in effort owing to variations in the exogenous parameters can be derived from equation (19) where $V^{U,D}$ and q(e) + h have been substituted in accordance with (20), and is determined by:

$$\Omega = \left[r + \kappa(E)\right] + q'(E)\left\{w - E + h\tilde{S} - \overline{w}\right\} = 0 \qquad (21)$$

To indicate that the variations in effort are calculated for changes which affect the entire economy, the respective level of effort is denoted by E. The changes in effort owing to a rise in the wage or the employment level are then determined by $E_w = -\Omega_w/\Omega_E$ and $E_N = -\Omega_N/\Omega_E$, where Ω_N, Ω_w etc. are the partial derivatives of Ω with respect to employment and wages, that is, they are calculated for a given level of effort:

$$\Omega_E = q''(E)\left\{w - E + h\tilde{S} - \overline{w}\right\} + \frac{Nq'(E)}{L - N} \qquad (22)$$

$$\Omega_N = \frac{\kappa(E)}{L - N} > 0 \qquad (23)$$

$$\Omega_w = q'(E)(1 + h\sigma / r) < 0 \qquad (24)$$

While the sign of Ω_E is not certain a priori, since higher effort reduces the utility from unemployment and thereby has a positive impact on effort, an aggregate effort function E which rises with wages and declines with employment requires $\Omega_E > 0$. This sign restriction is assumed to hold, henceforth. For later use it is helpful to note from equation (21) (see appendix II):

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[7] The second derivative of the effort function with respect to the wage is:

$$e_{ww} = -\frac{q''(e)(1 + h\sigma / r)e_w}{\omega_e} + q'(e)\frac{1 + h\sigma / r}{(\omega_e)^2}\left[q'''(e)\left\{w - e - rV^{U,D} + h\tilde{S}\right\}e_w + q''(e)\left[1 + h\sigma / r - e_w\right]\right]$$

Without further restrictions, $e_{ww} < 0$ cannot be inferred since the term $1 + h\sigma/r - e_w$ has a potentially ambiguous sign. However, as shown below, optimal wage setting implies $e_w w/e < 1$. In conjunction with w > e from the definition of instantaneous utility, $w(1 + h\sigma/r)/e - e_w w/e > 0$ can be derived and, hence, $e_{ww} < 0$ is warranted.

$$E_\sigma = wE_G = \frac{E_w wh/r}{1+h\sigma/r} > 0 \tag{25}$$

$$E_{w\sigma} = wE_{wG} + \frac{E_w h/r}{1+h\sigma/r} = \frac{h/r}{1+h\sigma/r}\left(E_{ww}w + E_w\right) \tag{26}$$

The analysis of the firm's behaviour is not affected by the modification of the effort function, with one exception. Since effort is a continuous variable, the firm maximises expected profits by selecting employment (cf. equation (10)) *and* the wage:

$$\frac{\partial(E(\Pi))}{\partial w} \equiv \pi_w = n\left[\hat{f}'e_w - (1+\mu) - h\sigma(1+\xi)/r\right] = 0 \tag{27}$$

The second-order conditions will be warranted if f is strictly concave and $e_{ww} < 0$ applies. The combination of equations (10) and (27) yields a modified Solow-condition (Solow 1979). From this condition $e_w w/e < 1$ can be inferred, such that $e_{ww} < 0$ is warranted at the firm's optimal choices of wages and employment.

The equilibrium of the efficiency wage economy can be depicted by the firm's first-order condition with respect to employment and the modified Solow-condition, taking into account that employment N and the utility stream from unemployment $V^{U,D}$ are determined endogenously.

$$F \equiv \hat{f}'(E(w,N,\tilde{S})N)E(w,N,\tilde{S}) - w(1+\mu) - h(1+\xi)(G+\sigma w)/r = 0 \tag{28}$$

$$H \equiv \frac{E(w,N,\tilde{S})}{E_w(w,N,\tilde{S})} - w - \frac{h(1+\xi)G/r}{1+\mu+h(1+\xi)\sigma/r} = 0 \tag{29}$$

The endogenous variables of the system are the wage w and aggregate employment N, the exogenous ones are the parameters G and σ of RPs. For further use note that $E_w = e_w + \Gamma$, where $\Gamma \equiv (\partial e/\partial V^{U,D})(\partial V^{U,D}/\partial w) < 0$, as $\partial e/\partial V^{U,D} < 0$ and $\omega_e > 0$ from equation (19), and $\partial V^{U,D}/\partial w > 0$ from (20). Differentiation with respect to the endogenous variables yields:

$$F_w = \hat{f}''ENE_w + \hat{f}'(e_w + \Gamma) - 1 - \mu - h(1+\xi)\sigma/r = \hat{f}''ENE_w + \Gamma < 0 \tag{30}$$

$$F_N = \hat{f}''E^2 + (\hat{f}''EN + \hat{f}')E_N < 0, \tag{31}$$

for $\hat{f}''EN + \hat{f}' \geq 0$.[8] Given the restrictions on the q(E), H_w will be positive and H_N negative if at least 50% of the labour force are employed ($N \geq L/2$, see appendix II):

$$H_w = -\frac{EE_{ww}}{(E_w)^2} > 0 \tag{32}$$

$$H_N = \frac{E_N E_w - EE_{wN}}{(E_w)^2} > 0 \tag{33}$$

[8] This sign restriction, which is also assumed subsequently and has usually been imposed (cf. Akerlof and Yellen (1985), Pisauro (1991), and Chang et al. (1999)), holds, for example, for a Cobb-Douglas production function at the firm-level and implies that employment increases with effort.

In order to calculate the employment effects of changes in the components of RPs, the impact of variations in G and σ on F and H need to be computed. They are given by:

$$F_G = \frac{h/r}{1+\sigma h/r}\left[\hat{f}''ENE_w + (\mu-\xi) + \Gamma\right] = \frac{F_w h/r}{1+\sigma h/r} + \frac{(\mu-\xi)h/r}{1+\sigma h/r} = \frac{F_\sigma}{w} \tag{34}$$

$$H_G = \frac{h/r}{1+\sigma h/r}\left[\frac{\mu-\xi}{1+\mu+h(1+\xi)\sigma/r} - \frac{EE_{ww}}{(E_w)^2}\right]$$

$$= \frac{H_w h/r}{1+\sigma h/r} + \frac{h(\mu-\xi)/r}{(1+\mu+h(1+\xi)\sigma/r)(1+\sigma h/r)} \tag{35}$$

$$H_\sigma = -\frac{h/r}{1+\sigma h/r}\left[\frac{(1+\xi)hG(\mu-\xi)/r}{(1+\mu+h(1+\xi)\sigma/r)^2} + \frac{EE_{ww}w}{(E_w)^2}\right]$$

$$= H_G w - \frac{h(\mu-\xi)/r}{(1+\sigma h/r)(1+\mu+h(1+\xi)\sigma/r)}\left[w + \frac{(1+\xi)hG/r}{1+\mu+h(1+\xi)\sigma/r}\right] \tag{36}$$

The employment effects of changes in the components of RPs are:

$$\left.\frac{dN}{dG}\right|_{\substack{\mu>\xi,\alpha=0\\ e=e(w)}} = \frac{F_w H_G - F_G H_w}{D} = \frac{h(\mu-\xi)/r}{D(1+h\sigma/r)}\left[\frac{F_w}{1+\mu+h(1+\xi)\sigma/r} - H_w\right] > 0 \tag{37}$$

$$\left.\frac{dN}{d\sigma}\right|_{\substack{\mu>\xi,\alpha=0\\ e=e(w)}} = -\frac{h(\mu-\xi)/r}{D(1+h\sigma/r)}\left[H_w w + \frac{(1+\xi)hGF_w/r}{(1+\mu+h(1+\xi)\sigma/r)^2}\right] \tag{38}$$

Since F_w, $D \equiv F_N H_w - H_N F_w < 0$, and $H_w > 0$, and $\mu > \xi$ by assumption, the effects may be summarised as:

Proposition 5:

If (a) the payroll tax rate exceeds the firing cost mark-up, (b) redundancy payments do not affect unemployment benefits, and (c) the effort function is continuous, an increase in lump-sum redundancy pay will raise employment. Higher wage-dependent redundancy payments have ambiguous employment effects.

For $\mu = \xi$, there is no employment change due to a variation in RPs, as it is the case for a dichotomous effort decision. Therefore, irrespective of the composition of RPs, in the present set-up they will only have employment effects if a wage change has a differential profit effect than a variation of expected RPs. For $\mu > 0$, it can be derived from the modified Solow-condition that wages fall more strongly for a given rise in RPs and a given level of aggregate employment than in the absence of a payroll tax. The combined impact of wages and RPs on effort or marginal effort will remain the same if RPs are lump-sum transfers. Thus, the more pronounced fall in wages translates into higher labour demand per firm and greater aggregate employment for $\mu > \xi$. The wage-dependency of RPs does not affect the prediction that higher lump-sum payments raise employment. However, if RPs are wage-related, marginal effort will fall by less with a rise in the wage-dependent component than with the lump-sum part (cf. equation (26)) as $E_{wG} < 0$ holds. This is the case because an increase in wage-related RPs also affects effort via the wage-dependency while this is not the case for lump-sum RPs. If wages fall by less than for a rise in lump-sum RPs, the positive employment impact might be reversed.

The employment consequences of changes in the lump-sum and the wage-dependent component of RPs can be combined by substituting the latter for the former, holding constant the overall level of RPs at the initial wage.

$$\left.\frac{dN}{d\sigma}\right|_{\substack{\mu>\xi,\alpha=0 \\ e=e(w),G=G(\sigma)}} = \left.\frac{dN}{d\sigma}\right|_{\substack{\mu>\xi,\alpha=0 \\ e=e(w)}} - w\left.\frac{dN}{dG}\right|_{\substack{\mu>\xi,\alpha=0 \\ e=e(w)}}$$

$$= -\frac{F_w h(\mu-\xi)/r}{D(1+h\sigma/r)(1+\mu+h(1+\xi)\sigma/r)}\left[w+\frac{(1+\xi)hG/r}{1+\mu+h(1+\xi)\sigma/r}\right] < 0 \qquad (39)$$

Equation (39) yields:

Proposition 6:

If (a) the payroll tax rate exceeds the firing cost mark-up, (b) redundancy payments do not affect unemployment benefits, and (c) the effort function is continuous, a substitution of wage-dependent redundancy pay for lump-sum payments, holding constant the level at the initial wage, will reduce employment.

Higher lump-sum RPs can raise employment as they allow firms to reduce wages. However, an increase in the wage-dependent component of RPs makes a higher wage more attractive for firms. If the level of RPs is held constant at the initial wage, only the positive wage effect of a substitution of wage-dependent for lump-sum RPs will remain. This entails less employment for $\mu > \xi$. Since higher wages drive up RPs, given their wage-dependency, the negative employment effect will become more pronounced, holding constant the level of RPs and taking into account the wage change, if a reduction either in the lump-sum or the wage-related component of RPs actually lowers RPs, once wage adjustments have been incorporated.

5. Summary

In this paper, it has been argued that payments for dismissed workers can have substantially different consequences, depending on whether they are made for individual or collective dismissals. Using a dynamic shirking model of efficiency wages with a dichotomous decision about effort it has been shown that an increase in redundancy payments for workers who loose their jobs due to collective dismissals reduces wages. This theoretical prediction contrasts with the result for severance payments for individually dismissed workers unless shirkers can be excluded from such payments. In the absence of wage-related labour costs on top of wages, additional firing costs, and restrictions on unemployment benefits owing to the receipt of redundancy pay, the increase in expected labour costs due to higher redundancy payments in the case of mass dismissals is exactly compensated by the reduction in wages. In this special case, a variation in redundancy pay does not affect employment or welfare. If the payroll tax rate exceeds the firing cost mark-up, employment and welfare will rise. If unemployment benefits are reduced for the recipients of redundancy pay, the employment effects can be mitigated or even reversed. Finally, the potentially positive employment effects of higher redundancy pay will be less pronounced if these payments are an increasing function of wages and a substitution of wage-dependent for lump-sum payments will reduce employment if effort varies continuously with the wage.

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7. Appendix

I: Combining Changes in Profits and Revenues

Denote optimal employment in the presence of payroll taxes, that is the value of n which satisfies equation (10) for $\mu > 0$ by $n^{\mu} \equiv n(\mu > 0)$. Expected profits for $\mu > 0$ can be rewritten as $E(\Pi(\mu > 0)) = E(\Pi(\mu = 0)) - (w^e n^{\mu})\mu$, where $E(\Pi(\mu = 0))$ depicts profits at the employment level n^{μ} but excludes payroll taxes. The derivative of $E(\Pi(\mu > 0))$ with respect to S is:

$$\frac{\partial E(\Pi(\mu > 0))}{\partial S} = \frac{\partial E(\Pi(\mu = 0))}{\partial n^{\mu}}\frac{\partial n^{\mu}}{\partial S} + \frac{\partial E(\Pi(\mu = 0))}{\partial w^{e}}\frac{\partial w^{e}}{\partial S}$$
$$+ \frac{\partial E(\Pi(\mu = 0))}{\partial Z}\frac{\partial Z}{\partial S} - \frac{\partial (w^{e} n^{\mu})}{\partial S}\mu$$
$$= \frac{\partial E(\Pi(\mu = 0))}{\partial n^{\mu}}\frac{\partial n^{\mu}}{\partial S} - n^{\mu}\left[\frac{\partial w^{e}}{\partial S} + h\frac{\partial Z}{\partial S}\right] - \frac{\partial (w^{e} n^{\mu})}{\partial S}\mu \qquad \text{(I.1)}$$

The expression is square brackets in (I.1) is equal to zero. Since the derivative of $E(\Pi(\mu = 0))$ with respect to employment is evaluated at n^{μ}, and as payroll taxes reduce the optimal level of employment, $\partial E(\Pi(\mu = 0))/\partial n^{\mu}$ will be positive if evaluated at $n = n^{\mu}$. Rewriting (I.1) shows:

$$\frac{\partial E(\Pi(\mu > 0))}{\partial S} + \frac{\partial (w^{e} n^{\mu})}{\partial S}\mu = \frac{\partial E(\Pi(\mu = 0))}{\partial n^{\mu}}\frac{\partial n^{\mu}}{\partial S} > 0 \qquad \text{(I.2)}$$

Thus, the increase in profits - the first term on the left-hand side of (I.2) - exceeds a potential fall in tax revenues, that is the second term on the left-hand side of (I.2).

II: Comparative Static Effects of Marginal Effort E_W

Marginal effort is given by $E_W = - \Omega_{W}/\Omega_{E}$, where the partial derivatives of Ω are defined in equations (22) and (24). Differentiation of E_W with respect to the wage w, taking into account that the effort level E is a function of the wage yields:

$$E_{ww} = -\frac{\Omega_E \Omega_{wE} E_w - \Omega_w \Omega_{Ew} - \Omega_w \Omega_{EE} E_w}{(\Omega_E)^2} = -\frac{E_w}{\Omega_E}\left(2\Omega_{wE} + E_w \Omega_{EE}\right)$$

$$= -\frac{E_w}{\Omega_E}\left[2q''(E)(1+h\sigma/r)\right] - \frac{(E_w)^2}{\Omega_E}\left(q'''(E)\left\{w - E + h\tilde{S} - \overline{w}\right\} - q''(E)\frac{L-2N}{L-N}\right) \quad \text{(II.1)}$$

$E_{ww} < 0$ will be warranted if more than 50% of the labour force are employed ($L < 2N$). For $E_{ww} < 0$, $H_w = -EE_{ww}/(E_w)^2 > 0$ holds. $L < 2N$ also ensures $E_{wN} > 0$ and, hence, $H_N < 0$.

$$E_{wN} = \frac{-\Omega_E \Omega_{wE} E_N + \Omega_w(\Omega_{EN} + \Omega_{EE} E_N)}{(\Omega_E)^2}$$

$$= E_N \frac{\dfrac{\Omega_w}{\Omega_E}\left[\dfrac{q'(E)}{(L-N)^2 E_N} + q'''(E)\left\{w - E + h\tilde{S} - \overline{w}\right\} - q''(E)\dfrac{L-2N}{L-N}\right] - \dfrac{rq''(E)}{(r+h\sigma)^{-1}}}{\Omega_E} > 0$$

(II.2)

The change in marginal effort due to a rise in the lump-sum component of RPs is:

$$E_{wG} = -\frac{\Omega_{wG}\Omega_E + \Omega_{wE} E_G \Omega_E - \Omega_w \Omega_{EG} - \Omega_w \Omega_{EE} E_G}{(\Omega_E)^2} \quad \text{(II.3)}$$

Since $\Omega_{wG} = 0$ and $\Omega_{EG} = \Omega_{Ew} h/[(1 + h\sigma/r)r]$, and because E_w and E_G are related according to equation (25), (II.3) yields the proportionality between E_{ww} and E_{wG}, as it is captured by equation (26). Finally, using $\Omega_{E\sigma} = \Omega_{Ew}\, hw/[(1 + h\sigma/r)r]$ and equation (25), the impact of a rise in the wage-dependent component of RPs on marginal effort is found to be:

$$E_{w\sigma} = -\frac{\Omega_{w\sigma}\Omega_E + \Omega_{wE} E_\sigma \Omega_E - \Omega_w \Omega_{E\sigma} - \Omega_w \Omega_{EE} E_\sigma}{(\Omega_E)^2}$$

$$= -\frac{q'(E)h/r}{\Omega_E} + E_{ww}\frac{hw/r}{1 + h\sigma/r} = \frac{h/r}{1 + h\sigma/r}\left[E_{ww} w + E_w\right] \quad \text{(II.4)}$$