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WAGE SUBSIDIES FOR THE LONG-TERM UNEMPLOYED: A SEARCH THEORETIC ANALYSIS

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ABSTRACT

The persistence of mass unemployment in many OECD countries in the 1980s and 1990s has led to renewed interest in active labour market policies. We examine one such policy, a wage subsidy for employers hiring the long-term unemployed, using a search-theoretic framework. We assume that long-term unemployment leads to a loss of human capital, and that a subsidy can offset the consequent training costs faced by employers hiring the long-term unemployed. We argue that unemployment would be unambiguously reduced by such a policy. Furthermore, the often-made criticism of wage subsidies that they mainly lead to substitution, merely churning the unemployed, is misplaced. There are positive externalities to substitution that lead firms to open more vacancies, many of which in turn will be filled by the short-term unemployed.

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Wage subsidies are not a new policy. The Weimar Republic implemented a wage subsidy for six months in 1932 (Kopits, 1978). Irving Fisher sought, albeit unsuccessfully, to persuade Roosevelt to include them in the New Deal (Allen, 1977). Theoretical analysis goes back to Pigou (1933) and Kaldor (1936). Since then they have remained a frequently-used but rarely sustained weapon in the armoury of governments faced with mass unemployment.

The persistence of high and long-term unemployment in many OECD countries during the 1980s and 1990s has led to a renewed interest in wage subsidy schemes among policy makers. In Australia the Jobstart programme, introduced in 1985, now accounts for 80% of placements of the long-term and very long-term unemployed (Byrne and Buchanan, 1994), whilst in the UK it has been estimated that an expansion of the existing Workstart pilots could reduce unemployment by 250,000 (NERA, 1996).

However, wage subsidy schemes have always attracted opposition on the grounds that they have very high levels of deadweight and substitution: those who are helped by the scheme either did not need help or were only helped at the expense of someone else. Casey and Bruche (1985), for example, claim that the net employment effect is generally only about 10%. But this scepticism is based on a partial equilibrium analysis. We show that in a general equilibrium framework there are positive externalities to substitution. Inducing employers to hire the long-term unemployed in place of the short-term unemployed reduces wage pressure and increases the attractiveness of the remaining pool of unemployed to other employers. Hence more vacancies are opened, many of which will be filled by the short-term unemployed.

The possibility that churning the pool of unemployed could reduce equilibrium wage pressure has been recognised at least since Baily and Tobin (1977). However, the claim that wage subsidies targeted on the long-term unemployed will not provoke inflationary pressures has been subject to little theoretical analysis since then. Snower (1994), for example, merely invokes it as an axiom. In contrast, Calmfors and his various collaborators have warned that active labour market policies could increase wage pressure (e.g. Calmfors and Forslund, 1990; 1991; Calmfors and Nymoen, 1990; Calmfors and Skedinger, 1995). Calmfors and Lang (1995) provides a comprehensive, if somewhat tortuous, analysis of Swedish-style programme-based active labour market policy that formalises this notion.

However, Calmfors and Lang's analysis assumes that active labour market policies take the form of specific programmes into which the unemployed are placed, such as relief work or training schemes. Wage subsidies (and job search assistance) act differently. Their purpose is to increase the probability of transitions directly from unemployment into regular employment. In an earlier paper (Richardson, 1997), we analysed the supply-side effects of a wage subsidy. If increases in the outflow of long-term unemployed workers are at the expense of the short-term unemployed, wage pressure falls. Considered from the perspective of wage-setters, any gains to the long-term unemployed are a more distant prospect than any losses to the short-term unemployed, and will be discounted more heavily. Hence, at given levels of wage pressure, gains to the long-term unemployed can outweigh losses to the short-term unemployed, allowing unemployment to fall.

In this paper, we extend this analysis to incorporate the demand side. A search model provides the natural framework to examine these issues together. We develop a model in which the subsidy serves to offset the cost of hiring the long-term unemployed. Subsidies directly reduce the costs of hiring to any firm that hires the long-term unemployed, and hence increase labour demand. But they also reduce the costs faced by other firms. Because fewer workers are rejected, the expected duration of vacancies falls and hence their expected cost, so that more firms are induced to open vacancies. In addition, more of the unemployed are 'higher quality' short-term unemployed, further reducing the cost of recruiting.

The overall effect is that unemployment unambiguously falls. However, unlike Richardson (1997), it is no longer clear what the effect will be on short-term unemployment. Here, the substitution effects that are generally assumed to increase short-term unemployment bring about positive externalities and the effect on short-term unemployment is ambiguous. At best, in general equilibrium there may be no substitution effects. Both short- and long-term unemployment can fall. At the least, the estimates of substitution derived from partial equilibrium analysis are overstated.

1. SUBSIDISING THE LONG-TERM UNEMPLOYED

Suppose the government offers a subsidy to employers hiring long-term unemployed workers. We assume that there would be some provisions within the scheme to prevent ‘subsidy-farming’, in particular that firms which were laying off other workers would be ineligible. Subsidised workers would also have to be employed continuously for a period of, say, six months. However, we do not impose any other restrictions on eligibility. Firms would not be required to show that vacancies would not otherwise have been created, nor would there be any restriction on their using the subsidy to replace workers who quit voluntarily.

It is well-known that the outflow rates from unemployment fall substantially with unemployment duration in most OECD countries (Layard *et al*, 1991). Various reasons have been suggested for this, including loss of human capital, employer discrimination and worker demoralisation. The last of these is connected to reduced search intensity and effectiveness, which we will not treat here, preferring for simplicity to assume that search intensity is fixed. These issues will be the subject of future work.

Instead, we assume that long-term unemployment leads to an attrition of the skills of the long-term unemployed, and hence that firms must pay a cost for initial training when hiring the long-term unemployed. Alternatively this cost could be seen as a measure of employers’ discrimination against the long-term unemployed – their disutility of employing the long-term unemployed. If this cost is too high it will be optimal for a firm to reject the worker and continue searching either for a short-term unemployed worker, or a lower cost long-term unemployed worker. However, once training is provided, the worker becomes fully productive. Provided the worker is properly re-integrated into regular employment, there are no permanently damaging effects from long-term unemployment.

We further assume that the initial training cost is stochastic and match-specific. It is likely that individuals' various skills will decline in varying ways that will affect their suitability differently for different potential jobs. Hence different individuals will need different patterns and extents of retraining for different jobs. Stochastic costs ensure that all unemployed workers have a positive probability of leaving unemployment, but that the probability is lower for the long-term than the short-term unemployed.

The basic idea is very similar to Pissarides' (1990) stochastic job matching model, but whereas Pissarides has a stochastic productivity that affects the worker for as long as they are in a given job, we assume that the stochastic element is an initial cost only. This is similar to the stochastic costs in Diamond's (1982) 'coconut' model and fits with the evidence from wage subsidy schemes that, beyond the initial period, the productivity of scheme participants and regular employees are the same (Arwady, 1988; Atkinson and Meager, 1994). It also ensures that subsidised hires receive the same wages as regular hires, which is again what we observe even where schemes do not stipulate that participants must be paid the going wage (Atkinson and Meager, 1994).

Separations

We assume that the separation rate, *s*, is fixed and exogenous. Within our model, this is entirely consistent. Once the initial training cost is paid, the worker is fully productive and hence the match always has positive value. Thus there is never any incentive for the firm to separate with the worker and we can assume that the rate of separation of subsidised workers is the same as unsubsidised workers.

In practise, however, there is always a concern that many subsidised jobs will only be viable for as long as the subsidy is paid, and will therefore separate at the end of the subsidy period. There is little empirical evidence on this question. Atkinson and Meager (1994) found that only one out of 329 employers had laid off Workstart recruits when their subsidy expired, but it seems likely that most of their sample were still in receipt of the subsidy at the time of the survey. Arwady (1988) in a study of the single largest user of the US Targeted Jobs Tax Credit found that employee tenure was longer for subsidised than unsubsidised workers, but the firm concerned was in a very high turnover industry (private security), and this result may not generalise.

Moreover, theoretically the effects of the subsidy on turnover are ambiguous. Inflows may increase if jobs are created that are only viable with the subsidy, and which consequently break up at the end of the subsidy period. In addition, if the scheme leads to poorer quality matches, then inflow may rise. Against this, however, the scheme is likely to extend the tenure of jobs that would otherwise have been shorter than the subsidy period, reducing inflows.

This leaves it as essentially an empirical question, on which unfortunately we have little direct data, as to whether inflows are more likely to rise or fall as a consequence of the policy. However, we do have some indirect data that is relevant. A higher break-up rate, because jobs are not viable without the subsidy, is only relevant to those jobs that the firm would not have created in the absence of the subsidy. Jobs that would have been created anyway must clearly be viable without the subsidy. Hence only a minority, about 10% (Casey and Bruche, 1985), of subsidised jobs are potentially subject to this effect. Furthermore, if the worker acquires sufficient firm-specific human capital during their subsidised employment, then a job that was initially non-viable without the subsidy may nonetheless be viable when the subsidy expires. Poorer matching quality might also increase separations, but there is little evidence for this. For example, Atkinson and Meager (1994) found only 11%

of employers reported that their subsidised workers were less productive than normal recruits by the end of the subsidy period. 12% were more productive.

Conversely, all employers receiving the subsidy, whether they would have created the vacancy without the subsidy or not, have an incentive to maintain the job at least for the duration of the subsidy: normally between six months and one year. In the UK, for example, 40% of unemployed workers who exit into employment re-enter unemployment within six months, 25% within three months (Sweeney, 1996). Thus, for a substantial proportion of subsidised workers, the subsidy may serve to increase tenure, even if they separate immediately the subsidy is withdrawn.

Overall, the evidence is patchy and inconclusive. But there is not a compelling case to suppose that inflow rates will rise. The opposite seems at least as likely. Our assumption of constant inflows seems as good, or bad, as any other.

2. THE MODEL

Following the standard search framework (e.g. Pissarides, 1990), we assume that there is an aggregate matching function $x = x(u, v)$, where x is the total number of *contacts* between firms and workers per period and u and v are the rates of unemployment and vacancies respectively. The labour force is normalised to unity. The matching function has the normal properties: increasing in both its arguments and constant returns to scale. We further assume that contacts are random and that any vacancy is contacted by no more than one worker per period.

Hence if we let $q = v/u$, we can define the probability that any given vacancy is contacted by an unemployed worker as:

$$q(q) = x(u, v)/v \tag{1}$$

where from the properties of the matching function, we have $q'(q) < 0$, and η, the absolute value of the elasticity of q with respect to θ, is between 0 and 1.

After separation, workers enter short-term unemployment. After one period, if they have not found a job, they become long-term unemployed, and remain so until they exit into employment. Let u_S, u_L be the rates of short- and long-term unemployment respectively. Since matching is random and the firm is contacted by at most one worker per period, we can define the probabilities that any given vacancy is contacted by a short- or long-term unemployed person per period as $\left(\frac{u_S}{u}\right)q(q)$ and $\left(1-\frac{u_S}{u}\right)q(q)$ respectively.

We assume that all workers search equally effectively, and hence, for the worker, the probability of contacting a vacancy is independent of their unemployment duration and given by:

$$qq(q) = x(u,v)/u \tag{2}$$

Vacancies

Our basic unit of analysis is the job. Jobs are either vacant or filled and productive. Vacant jobs incur a per period cost of γ, whilst filled jobs yield output with real value y'. Short-term unemployed workers are 'job-ready' – they have not yet suffered from any loss of human capital. Hence if a vacant job is contacted by a short-term unemployed worker, it can be filled with no additional cost. Since, as we show below, there will be a single wage greater than the benefit level, both the firm's and the worker's acceptance decisions are trivial in this case and such matches will never be rejected.

However, if the vacancy is contacted by a long-term unemployed worker, the firm must pay an additional initial training cost, α, if it hires the worker. We assume that wages are set by Nash bargaining and must be renegotiation proof. Hence the firm cannot pass on the cost to the worker. The long-term unemployed vary in how well matched they would be with any particular vacancy, and hence what costs would have to be incurred to make them fully productive. We assume, therefore, that *ex ante* the training cost α is unknown and drawn randomly from some underlying, known, distribution $G(\alpha)$. *Ex post*, once contact has been made, α is revealed and the firm can decide whether to accept or reject the worker with full information.

We assume that $G(\alpha)$ is continuous and at least once differentiable, and has finite range within the positive quadrant. Provided the lower support of $G(\alpha) \leq \gamma$, the long-term unemployed will always have a positive outflow rate. Since the firm must pay at least γ if it rejects the worker, it will always accept any worker whose training cost is less than γ. We also suppose that the upper support of $G(\alpha)$ is sufficiently above γ to ensure that rejection is optimal in some cases. Since the short-term unemployed are never rejected, this will generate negative duration dependence.

A subsidy ψ is payable when firms hire the long-term unemployed, financed by a proportional wage tax. Suppose the firm adopts a reservation training cost, α_r, hires all long-term unemployed workers with costs below α_r, and rejects all those with training cost above α_r. We show below that this is optimal, given that wages must be renegotiation proof. It follows that firms will hire a long-term unemployed worker, given that contact has been made, with probability $G(\alpha_r)$.

Let V be the expected present discounted value of a vacant job and J be the expected present discounted value of a filled job. We have:

$$\begin{aligned} rV = -g + \left(\tfrac{u_S}{u}\right)q(q)\left[J - V\right] + \\ \left(1 - \tfrac{u_S}{u}\right)q(q)G(a_r)\left[J - V + y - e\left(a \middle| a \leq a_r\right)\right] \end{aligned} \tag{3}$$

Where r is the interest rate, e is the expectations operator, and the expectation term is the *ex ante* expected training cost of hiring a long-term unemployed worker, given that this cost is low enough that they are not rejected.

There is free entry of vacancies, and hence firms open vacancies until the marginal value of a vacancy is driven to zero, giving V=0.

Hiring

Once contact has been made between a vacancy and a worker, both parties must decide whether to accept or reject the match. We will show below that all jobs offer the same wage, which is always at least as great as unemployment benefit. Hence the worker's decision is trivial: workers always accept jobs if offered.

The firm's hiring decision is slightly more complex. The return to rejecting the worker is simply the value of a vacancy, V, which equals zero. If the firm is contacted by a short-term unemployed worker, then the return to hiring them is simply J, the value of a filled job. Since this is always positive, the decision is again trivial in this case. Firms always accept short-term unemployed workers. However, if the firm is contacted by a long-term unemployed worker, with a realised training cost of α_i, then the firm will only accept them provided the return is greater than zero:

$$J - a_i + y \geq 0 \tag{4}$$

Provided the wage is renegotiation proof, J will be independent of the training cost, α_i. Hence there will exist a unique reservation training cost, α_r, such that:

$$J - a_r + y = 0$$

so that the firm will reject all workers with realisations of α greater than α_r, and accept all others.

Hence, we can write:

$$J = a_r - y \tag{5}$$

Substituting (5) and the free entry condition V=0 into (3) gives the firm’s vacancy opening condition:

$$g = \left(\tfrac{u_S}{u}\right)q(q)\left[a_r - y\right] + \left(1 - \tfrac{u_S}{u}\right)q(q)G(a_r)\left[a_r - e\left(a \middle| a \leq a_r\right)\right] \quad (6)$$

Filled jobs and wages

Filled jobs produce per period real output y' and pay real before tax wages of w and a proportional wage tax t. There is an exogenous probability, s, of separation. Hence, the value function for a filled job is given by:

$$rJ = y' - w(1+t) - sJ \quad (7)$$

Let E be the expected present discounted value to the worker of being employed and U^S the expected present discounted value of short-term unemployment. Since workers who separate always become short-term unemployed in the first instance, the value function for the worker of being employed is given by:

$$rE = w + s\left(U^S - E\right) \quad (8)$$

Wages are determined by Nash bargaining. We assume further that wage contracts are necessarily incomplete and can always be renegotiated. We focus exclusively on renegotiation-proof contracts, which in this case implies simply that neither the sunk costs of training, nor the benefits of subsidies, form part of the wage bargain. Hence, wages are set to maximise the Nash bargain:

$$\left(E_i - U^S\right)^b \left(J_i - V\right)^{1-b} \quad (9)$$

Where the i subscript denotes the particular match, and β is a measure of the worker’s relative bargaining power. Maximising (9) gives, after a little rearrangement, and noting that V=0:

$$E_i - U^S = \frac{b}{(1-b)(1+t)} J_i \tag{10}$$

However if we substitute the value functions for E_i and J_i – the match-specific forms of equations (7) and (8):

$$rE_i = w_i + s\left(U^S - E_i\right) \tag{11}$$

$$rJ_i = y' - w_i(1+t) - sJ_i \tag{12}$$

we obtain:

$$w_i = rU^S + b\left(\frac{y'}{1+t} - rU^S\right)$$

From which it follows that there will be a single wage. Hence we can drop the *i* subscript.

From (2), the probability that an unemployed worker will contact a vacancy is given by $\theta q(\theta)$. Since the short-term unemployed are always accepted, this is also their probability of being hired, whilst for the long-term unemployed the probability of being hired is given by $G(a_r)qq(q)$.

Hence, the value functions for unemployment are given by:

$$U^S = qq(q)E + \frac{\left[1 - qq(q)\right]}{1+r}\left(b + U^L\right) \tag{13}$$

$$U^L = G(a_r)qq(q)E + \frac{\left[1 - G(a_r)qq(q)\right]}{1+r}\left(b + U^L\right) \tag{14}$$

Where *b* is the per period real level of benefits. We assume, both here and in determining flow equilibrium below, that transitions from unemployment into employment occur at the beginning of the period. This simplifies the algebra somewhat and prevents unemployment from being bounded below at the per period inflow (Manning, 1993). However, our results do not depend on this assumption. Solving (10) –(14), and substituting from (5), we obtain the wage equation:

$$w = b + \frac{b}{(1-b)(1+t)}\left(a_r - y\right)\left[r + s + \frac{qq(q)\left[r + G(a_r)\right]}{1 - qq(q)}\right]$$

(15)

If we further assume that benefits are set to maintain a constant replacement ratio ρ then we have:

$$w = \frac{b}{(1-b)(1+t)(1-r)}\left(a_r - y\right)\left[r + s + \frac{qq(q)\left[r + G(a_r)\right]}{1 - qq(q)}\right]$$

(16)

Combining equations (5), (7) and (16) gives the reservation training cost schedule:

$$y' - \frac{b}{(1-b)(1-r)}\left(a_r - y\right)\left[r + s + \frac{qq(q)\left[r + G(a_r)\right]}{1 - qq(q)}\right] - (r+s)\left(a_r - y\right) = 0$$

(17)

Finally, we impose a balanced budget requirement:

$$tw(1-u) = rwu + y\,G(a_r)qq(q)u_L \tag{18}$$

Total taxes must equal benefit payments to the unemployed plus subsidy payments to the per period flow out of long-term unemployment.

Flow equilibrium

We consider stationary equilibria in which unemployment is constant. Hence the flows into and out of unemployment must be equal. If we define stocks at the end of period to allow for the fact that some proportion of the inflow into unemployment exit during the period, then we have:

$$[1-qq(q)]s(1-u) = u_S \tag{19}$$

$$u_S[1-G(a_r)qq(q)] = G(a_r)qq(q)u_L \tag{20}$$

Since short-term unemployment lasts only for one period, the existing stock must always have flowed out by the following period. Hence, the stock of short-term unemployed is simply the inflow into unemployment, less those who flow out again during the period.

Similarly, the inflow into long-term unemployment is made up of all those who were short-term unemployed at the end of the last period, less those who flow back into employment during the period. Since we assume that the stocks are constant in equilibrium, this net inflow must equal the outflow from the pre-existing stock of long-term unemployed.

Solving the flow conditions gives:

$$u = \frac{s[1 - qq(q)]}{G(a_r)qq(q) + s[1 - qq(q)]}$$

(21)

$$\frac{u_S}{u} = G(a_r)qq(q)$$

(22)

where (21) is the Beveridge curve.

Equations (6), (16), (17), (18), (21) and (22) determine the model which has six unknowns: θ, α_r, w, t, u and u_S/u. If we substitute (22) into (6), then the system is recursive: Equations (6) and (17) determine labour market tightness, θ, and the reservation training cost α_r. Equation (21) then determines unemployment, whilst (16) and (18) solve for wages and taxes.

However, we can simplify things somewhat by assuming a particular form for the distribution of α[ι]. In particular, we shall assume that α is uniformly distributed on $[k, k+1]$, where, $0 \leq k \leq \gamma$. Hence:

$$G(a_r) = a_r - k$$

$$e(a | a \leq a_r) = \tfrac{1}{2}(a_r + k)$$

Substituting the above gives the determining equations of the model as:

$$g = \left(\tfrac{u_S}{u}\right)q(q)[a_r - y] + \tfrac{1}{2}\left(1 - \tfrac{u_S}{u}\right)q(q)[a_r - k]^2 \qquad (23)$$

$$y' - \frac{b}{(1-b)(1-r)}(a_r - y)\left[r + s + \frac{qq(q)[r + a_r - k]}{1 - qq(q)}\right] -$$
$$(r + s)(a_r - y) = 0$$

(24)

$$\frac{u_S}{u} = qq(q)(a_r - k) \qquad (25)$$

$$u = \frac{s[1-qq(q)]}{(a_r - k)qq(q) + s[1-qq(q)]}$$

(26)

$$w = \frac{b}{(1-b)(1+t)(1-r)}(a_r - y)\left[r + s + \frac{qq(q)[r + a_r - k]}{1-qq(q)}\right]$$

(27)

$$tw(1-u) = rwu + y\,(a_r - k)qq(q)u_L$$

(28)

where $u_L = u\left(1 - \frac{u_S}{u}\right)$.

3. POLICY

The policy variable of interest is ψ, the level of subsidy offered to employers who hire the long-term unemployed. To obtain the effect of ψ on unemployment, wages and taxes we first need to differentiate (23)–(25) to obtain the effect on θ and α_r. Differentiating (24) is straightforward and yields:

$$\left\{\frac{y'}{(a_r - y)} + \frac{b(a_r - y)qq(q)}{(1-b)(1-r)[1-qq(q)]}\right\}\frac{da_r}{dy} + \left\{\frac{b(a_r - y)(r + a_r - k)q(q)(1-h)}{(1-b)(1-r)[1-qq(q)]^2}\right\}\frac{dq}{dy} = \frac{y'}{(a_r - y)}$$

(29)

Where all the terms are positive. However, differentiating (23) and (25) yields:

$$q(q)\left\{\left(\tfrac{u_S}{u}\right)+\left(1-\tfrac{u_S}{u}\right)\left(a_r-k\right)+zqq(q)\right\}\frac{da_r}{dy}+$$

$$\frac{1}{q}\left\{-hg+zq(q)(1-h)\left(\tfrac{u_S}{u}\right)\right\}\frac{dq}{dy}=q(q)\left(\tfrac{u_S}{u}\right)$$

(30)

where: $z=\left(a_r-y\right)-\tfrac{1}{2}\left(a_r-k\right)^2=J-G\left(a_r\right)\left[J+y-e\left(a\,\middle|\,a\leq a_r\right)\right]$ the difference between the *ex ante* expected value of contacting a short-term unemployed worker versus contacting a long-term unemployed worker. We shall assume that subsidies are not so large that ζ becomes negative. The first and last terms of (30) are always positive, but the middle term is ambiguous: if η is sufficiently small it could be positive.

The term represents the (partial) marginal effect of an increase in labour market tightness on the value of a vacancy. There are two offsetting components: an increase in θ makes it less likely that you will contact a worker in any period, tending to increase the cost of vacancies. However, there is also a compositional effect, an increase in θ means that more of the unemployed are short-term unemployed. If the short-term unemployed are less costly than the long-term unemployed, i.e. if ζ>0, then the change in composition tends to reduce the cost of vacancies. If this effect dominates, then as the labour market tightens the firm will open more vacancies, further tightening the market. This is similar to the thin market externality in Pissarides (1992). However, it is somewhat perverse in this case, and provided η is not too small we can rule it out. In general, we will assume therefore that this term is negative[ii].

This allows us to solve (29) and (30) to give:

$$l\,\frac{da_r}{dy}=\frac{y'\left\{hg-zq(q)(1-h)\left(\frac{u_S}{u}\right)\right\}}{(a_r-y)}+\frac{b(a_r-y)qq(q)(r+a_r-k)q(q)(1-h)\left(\frac{u_S}{u}\right)}{(1-b)(1-r)\left[1-qq(q)\right]^2}$$

(31)

$$l\,\frac{dq}{dy}=\frac{y'qq(q)\left[\left(1-\frac{u_S}{u}\right)(a_r-k)+zqq(q)\right]}{(a_r-y)}-\frac{bqq(q)qq(q)(a_r-y)\left(\frac{u_S}{u}\right)}{(1-b)(1-r)\left[1-qq(q)\right]}$$

(32)

where:

$$l=\frac{y'\left\{hg-zq(q)(1-h)\left(\frac{u_S}{u}\right)\right\}}{(a_r-y)}+\frac{bqq(q)(a_r-y)q(q)(1-h)}{(1-b)(1-r)\left[1-qq(q)\right]^2}\text{ x}$$
$$\left\{(r+a_r-k)\left[\left(\frac{u_S}{u}\right)+\left(1-\frac{u_S}{u}\right)(a_r-k)\right]+zqq(q)\left(r+\frac{u_S}{u}\right)+\frac{hg\left[1-qq(q)\right]}{q(q)(1-h)}\right\}>0$$

Hence, $0\leq\frac{da_r}{dy}\leq 1$. The subsidy serves to offset the training cost the firm must incur if it hires the long-term unemployed. Hence it is able to relax its hiring criterion, hiring long-term unemployed workers who previously would have been too expensive. However, as firms relax α_r, the outflow rate of the long-term unemployed rises which puts upward pressure on wages. This chokes off the increase in α_r, so that the increase is less than the full amount of the subsidy. We can show this directly by substituting (5) into (7) and differentiating to give:

$$\frac{da_r}{dy} = 1 - \frac{1}{(r+s)} \frac{d\tilde{w}}{dy} \quad \text{where: } \tilde{w} = w(1+t)$$

(33)

α_r rises by the amount of the subsidy, less the increase in the wage costs discounted over the expected duration of the job.

The effect on θ is ambiguous. As we shall see below, *u* falls, which tends to make θ increase. However, the effect on vacancies is more complex. The increase in labour demand leads to more vacancies being opened, and hence tends to make θ rise. However, the long-term unemployed are now less likely to be rejected, and hence vacancies durations fall, tending to reduce θ. Note, however, that whilst a fall in θ will cause the outflow rate of the short-term unemployed to fall, it need not prevent the outflow rate of the long-term unemployed from rising, provided the increase in α_r is sufficient.

Unemployment

Our primary interest is in the effect on unemployment. Differentiating (26) and substituting from (31) and (32) yields:

$$\frac{du}{dy} = \frac{-u(1-u)q(q)(1-h)}{l} \text{ x}$$

$$\left\{ \begin{array}{l} \dfrac{y'}{(a_r - y)} \left[\dfrac{\left(1 - \frac{u_S}{u}\right)(a_r - k)}{[1 - qq(q)]} + \dfrac{hg}{q(q)(1-h)(a_r - k)} + \dfrac{z[qq(q)]^2}{[1 - qq(q)]} \right] + \\ \dfrac{rb(a_r - y)}{(1-b)(1-r)} \left(\dfrac{qq(q)}{1 - qq(q)} \right)^2 \end{array} \right\}$$

(34)

Which is negative. Hence unemployment unambiguously falls. There are two principal effects: the first term is the labour demand effect, the second a net wage pressure effect. The labour demand effect has three components:

i. The direct effect of the subsidy is to lower the cost of recruiting the long-term unemployed and hence to make recruiting more attractive;

ii. Because it increases the probability that contact with a worker will lead to hiring, the subsidy also reduces the expected duration of any given vacancy, and hence lowers the cost of vacancies;

iii. Finally, there is a composition effect. Increased outflow rates among the long-term unemployed mean that more of the unemployed are short-term unemployed, who are more desirable, provided $\zeta>0$.

The net wage pressure effect arises because an increase in the outflow rate of the long-term unemployed is discounted more heavily by wage setters than a fall in the outflow rate of the short-term unemployed. Hence, at constant disutility of unemployment the long-term outflow rate can be increased by more than the short-term outflow rate falls. Thus, even if there were no labour demand effect, it would be possible to reduce unemployment by inducing employers to substitute hiring the long-term unemployed instead of the short-term unemployed, as in Richardson (1997). Note that this term would be zero if r=0.

Substitution

Much of the discussion of wage subsidy programmes has focused on substitution effects (OECD, 1993) although some economists, notably Layard (1996), have sought to play them down. Substitution is where the firm fills a vacancy with a long-term unemployed (or other target group) worker in response to the subsidy, but where they would otherwise have filled the vacancy anyway, but with a short-term unemployed or other non-target group worker. Substitution effects are generally measured through surveys of employers participating in wage subsidy schemes (e.g. Atkinson and Meager, 1994; Byrne and Buchanan, 1994) and are usually found to be quite high, about 60–70% of the non-deadweight effect (OECD, 1993).

However, much of the concern about substitution effects is misplaced. Substitution does not simply involve churning the unemployed pool with no net gain. Instead there are positive externalities to inducing employers to hire the long-term unemployed in place of the short-term unemployed. Wage pressure is reduced, allowing lower equilibrium unemployment, and a larger pool of highly employable short-term unemployed are available to other firms. This reduces the costs of opening vacancies, so that more jobs are created. Employers observe these as improvements in the general economic climate, rather than the specific effects of the wage subsidy scheme. Nor are they specific to those employers who participate in the scheme. But many of these additional jobs will go to the short-term unemployed.

We can formalise this by considering the effect of policy on the short-term unemployed. From (19), we have:

$$\frac{du_S}{dy} = -\left\{q(q)(1-h)s(1-u)\frac{dq}{dy} + s[1-qq(q)]\frac{du}{dy}\right\} \tag{35}$$

which is ambiguous. The first term is the effect of changes in labour market tightness, and will tend to make short-term unemployment fall if the labour demand effects are sufficiently high, i.e. if $\frac{dq}{dy} > 0$. The second effect arises because, with fixed inflow rate s, a reduction in unemployment, (i.e. an increase in employment), increases the inflow in to short-term unemployment.

There are no restrictions within our model on firms' ability to use wage subsidies for vacancies that they would have filled anyway.

Nonetheless, at the aggregate level, there need be no substitution effect: both short- and long-term unemployment can fall.

Wages and taxes

We have seen in equation (33) that the total wage bill $w(1+t)$ rises with increased labour demand. However, the separate effects on wages and taxes are more complex. If the costs of the subsidy – which includes deadweight payments to employers who would anyway have hired the long-term unemployed – exceed the savings from reduced benefits payments then taxes will have to rise. Potentially this could lead to a fall in take-home pay for employees, so that the policy would be redistributive rather than improving the lot of both the employed and the unemployed.

Formally, we can solve for wage and tax effects by differentiating the balanced budget constraint (28) and substituting from (33) to obtain:

$$\frac{dw}{dy} = \frac{1}{\left[1-(1-r)u\right]} \text{ x}$$

$$\left\{ \begin{array}{l} (r+s)\left[1-\dfrac{da_r}{dy}\right]-(r+t)w\dfrac{du}{dy}+ \\ y\left[\dfrac{u_S u_L}{u^2}\dfrac{du}{dy}-\left(\frac{u_S}{u}\right)\dfrac{du_L}{dy}-\left(1-\frac{u_S}{u}\right)\dfrac{du_S}{dy}\right]-\left(\frac{u_S}{u}\right)u_L \end{array} \right\}$$

(36)

which is ambiguous. There are four effects. Wages tend to rise because of increased labour demand. Lower benefit payments and higher tax revenues from reduced unemployment tend to reduce the tax burden and hence increase wages. The third term is the effect of changes in the outflow from long-term unemployment on the amount of subsidy that is paid. A higher subsidy increases the outflow rate, increasing subsidy payments. At the same time, however, a reduction in the number of long-term unemployed lowers the total deadweight. Furthermore, if short-term unemployment is also falling, then the number of people entering long-term unemployment, and hence eligible for the subsidy, will also fall. Hence this effect is ambiguous. Finally, a higher level of subsidy needs to be financed, tending to increase taxes, lowering wages.

The parallel effect on taxation is given directly from (33) as:

$$\frac{dt}{dy} = \frac{(r+s)}{w}\left[1 - \frac{da_r}{dy}\right] - \frac{(1+t)}{w}\frac{dw}{dy}$$

(37)

which is, unsurprisingly, also ambiguous.

4. CONCLUSION

The persistence of mass unemployment in many OECD countries throughout the 1980s and 1990s has led to a renewed interest in the use of wage subsidies, and in particular in targeted policies aimed at the long-term unemployed. Search theory provides a framework in which the full general equilibrium effects of wage subsidies can be considered. This allows us to consider both the labour demand effects that dominated the traditional literature, starting with Pigou (1933) and Kaldor (1936), and the wage pressure, or supply side, effects that are particularly prominent in the work of Calmfors and his collaborators (see especially Calmfors and Lang, 1995).

We are able to show that a policy of targeted wage subsidies for the long-term unemployed unambiguously reduces unemployment. Moreover, we show that the analysis of substitution effects that has dominated much of the debate about wage subsidies is flawed. There are positive externalities to persuading employers to favour the long-term unemployed, and those externalities lead to an increase in the total number of jobs. Many of these new jobs will go to the very short-term unemployed people who are apparently the victims of substitution.

Wage subsidies have been tried before in many countries at various times. If they alone could slay the giant of unemployment, we would surely know by now. In many cases they have proved relatively ineffective because they have been introduced at times of high cyclical unemployment when firms may well have been hoarding labour anyway, and when active labour market policies in general appear to be at their least effective (Robinson, 1995). But in other cases they have undoubtedly been undermined by an excessive concern among policy-makers with substitution effects, arising from partial equilibrium analysis. We have shown that these concerns are at least overstated, and possibly wholly misplaced. With unemployment remaining stubbornly high, it is time to look again at wage subsidies.

ENDNOTES

1. In general our results will go through for any distribution for which $\frac{d}{d\alpha_r}\left[e\left(\alpha \mid \alpha \le \alpha_r\right)\right] \le 1$ holds.

2. This condition is sufficient to ensure that λ is non-negative. However, provided β is not very small, this condition is unlikely to bind.

REFERENCES

Allen, W. (1977), 'Irving Fisher, F.D.R. and the Great Depression', History of Political Economy, 9 (4), pp.560–587.

Arwady, J. (1988), *Wage Subsidies and Jobs for the Disadvantaged: applying the targeted jobs tax Credit in an operating environment*, Manpower and Human Resources Studies No. 12, Industrial Research Unit, University of Pennsylvania.

Atkinson, J. and Meager, N. (1994), *Evaluation of Workstart Pilots*, Institute for Employment Studies Report 279.

Baily, M. and Tobin, J. (1977), 'Macroeconomic Effects of Selective Public Employment and Wage Subsidies', Brookings Papers on Economic Activity, pp.511–544.

Byrne, A. and Buchanan, K. (1994), *Survey of Jobstart Employees*, Department of Employment, Education and Training, Australia.

Calmfors, L. and Forslund, A. (1990), 'Wage Formation in Sweden' in Calmfors (ed), *Wage Formation and Macroeconomic Policy in the Nordic Countries*, Oxford University Press: Oxford.

Calmfors, L. and Forslund, A. (1991), 'Real Wage Determination and Labour Market Policies: the Swedish Experience', Economic Journal, 101, pp.1130–1148.

Calmfors, L. and Lang, H. (1995), 'Macroeconomic Effects of Active Labour Market Programmes in a Union Wage-Setting Model', Economic Journal, 105, pp.601–619.

Calmfors, L. and Nymoen, R. (1990), 'Nordic Employment', Economic Policy, pp.398–448.

Calmfors, L. and Skedinger, P. (1995), 'Does Active Labour Market Policy Increase Employment? Theoretical Considerations and Some Empirical Evidence from Sweden', Oxford Review of Economic Policy, 11 (1), pp.91–109.

Casey, B. and Bruche, G. (1985), 'Active Labor Market Policy: An International Overview', Industrial Relations, 24 (1), pp.37–61.

Diamond, P. (1982), 'Aggregate Demand Management in Search Equilibrium', Journal of Political Economy, 90 (5), pp.881–894.

Kaldor, N. (1936), 'Wage Subsidies as a Remedy for Unemployment', Journal of Political Economy, 44 (6), pp.721–742.

Kopits, G. (1978), 'Wage subsidies and employment: an analysis of the French experience', IMF Staff Papers, 25, pp.494–527.

Layard, R. (1996), 'The Road Back to Full Employment', Centre for Economic Performance Occasional Paper No. 10.

Layard, R., Nickell, S. and Jackman, R. (1991), *Unemployment: macroeconomic performance and the labour market*, Oxford University Press: Oxford.

Manning, A. (1993), 'Wage Bargaining and the Phillips Curve: The identification and specification of aggregate wage equations', Economic Journal, 103, pp.98–118.

NERA (1996), *Right to Work Assessment*, National Economic Research Associates: London.

OECD (1993), 'Active Labour Market Policies: Assessing Macroeconomic and Microeconomic Effects', OECD Employment Outlook, pp.39–80.

Pigou, A. (1933), *The Theory of Unemployment*, Macmillan & Co: London.

Pissarides, C. (1990), *Equilibrium Unemployment Theory*, Basil Blackwell: Oxford.

Pissarides, C. (1992), 'Loss of Skill During Unemployment and the Persistence of Employment Shocks', Quarterly Journal of Economics, pp.1371–1391.

Richardson, J. (1997), 'Can Active Labour Market Policy Work? Some theoretical considerations', Centre for Economic Performance Discussion Paper No. 331.

Robinson, P. (1995), 'The Decline of the Swedish Model and the Limits of Active Labour Market Policy', Centre for Economic Performance Discussion Paper No. 259.

Snower, D. (1994), 'Converting Unemployment Benefits into Employment Subsidies', The American Economic Review, 84 (2), pp.65–70.

Sweeney, K. (1996), 'Destination of Leavers from Claimant Unemployment', Labour Market Trends, pp.443–452.

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