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UNEMPLOYMENT AND THE STRUCTURE OF LABOUR COSTS

by

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## Introduction

The last ten years has witnessed a dramatic rise in the level of unemployment throughout most of Western Europe. As Table 1 indicates, the level of registered unemployment has doubled over the last four years in the United Kingdom and West Germany and this is reflected in most other European nations. Sweden is, however, an exception (see again Table 1).<sup>1</sup> Over this period there have been a number of other notable changes in the labour markets of Western Europe and it is the relationship between two distinct areas of such change and the pattern of unemployment which is the concern of this paper. The first such change is the upsurge in what might loosely be termed "employment protection". This refers to the increased difficulty experienced by employers who wish to reduce the size of their labour force. In particular there has been a series of increases in the period of notice required prior to dismissal, in the compensation payments which must be made to workers who are made redundant and in the legal requirements which must be satisfied before an employee may be dismissed. These changes have been brought about both via new legislation and via the increased attention paid to such matters by Trade Union negotiators. The second major change referred to above has been the increasing recourse by governments to so-called "special employment measures" which refer, among other things, to wage subsidies of one kind or another which are introduced in order to reduce unemployment.

Both these changes imply an alteration in the relationship between the employer's labour costs and the employee's wage but they are alterations of rather different kinds. The first change implies an increase in those labour costs which are, at least, partly fixed with respect to an employee's duration of employment with the firm. The second change implies a short term increase in the level of subsidisation of wages for certain employees. Their implications for employment and unemployment are thus very different and will be analysed separately. The remainder of the paper is set out as follows. In section I we shall consider in

TABLE 1  
Registered unemployment (%)

	United Kingdom		West Germany		Sweden	
	Men	Women	Men	Women	Men	Women
1967	2.96	1.26	2.04	1.30	2.18	2.65
1968	3.26	1.01	1.44	0.93	2.52	2.44
1969	3.24	0.94	0.76	0.56	2.02	2.25
1970	3.52	1.02	0.56	0.58	1.48	2.02
1971	4.67	1.43	0.60	0.87	2.71	3.24
1972	5.02	1.67	0.84	1.09	2.87	3.47
1973	3.61	1.18	0.90	1.26	2.53	3.29
1974	3.62	1.19	1.98	2.61	1.90	2.86
1975	5.57	2.19	3.88	4.60	1.53	2.40
1976	7.67	3.69	3.58	5.06	1.47	2.44
1977	7.99	4.47			1.74	2.62

Note: The actual unemployment of women in the U.K. is about twice as great as the figure for registered unemployment.

some detail the recent changes that have occurred in "employment protection" in Britain with only brief references to other European countries where the picture is very similar. We shall then provide a theoretical analysis of the likely effects and follow this with an empirical investigation to see to what extent the theoretical implications are borne out by the facts and to try and isolate the impact of these measures on unemployment. In section II we turn to a discussion of those "special employment measures" which are of the wage subsidy type, where we shall give some examples from various West European countries and present a theoretical analysis of their consequences. We shall then look at one of them in more detail to see how it has turned out in the light of this analysis.

Before going on to look at the details, it is worth noting that this paper does not provide a comprehensive discussion of all the recent changes in the relationship between employers' labour costs and the net wages received by employees. In particular we shall have nothing specific to say about changes in payroll taxes (or indeed income taxes) where recent upward trends are noticeable across Europe, particularly in Sweden. Indeed the typical Swedish employer's contribution (to various forms of health, pension, and other funds) required by law and by collective agreement now comes to 39.1% of gross wages for workers and 44.9% of gross salaries for salaried employees.<sup>2</sup> Such taxes are, of course, the opposite of wage subsidies and when these latter are discussed, much of what is said will apply equally to the former. We shall not, however, attempt to estimate the employment effects of changes in these taxes basically because the long run effects are presumably negligible<sup>3</sup> and the short run effects are not of great interest except in the context of fiscal policy in general, which is beyond the purview of this paper.

# I. Fixed Costs and Employment Protection

## Recent "Employment Protection" policies in Britain

There have been a number of legislative changes in Britain in recent years which have considerably increased the costs associated with a firm reducing its labour force. In Table 2, we present details of the periods of notice which an employer is required by law to give. It shows clearly how these have been increasing as has the number of workers to which they apply. These are, of course, legal minima and Trade Unions may negotiate for longer periods. Indeed, in West Germany, notice periods of up to nine months have been negotiated in recent years.<sup>4</sup>

TABLE 2

Contract of Employment Act 1963		Contract of Employment Act 1972		Employment Protection Act 1975	
Period of employment (PE)	Period of notice	Period of employment (PE)	Period of notice	Period of employment (PE)	Period of notice
26 weeks $\leq$ PE < 2 yrs.	1 week	13 weeks $\leq$ PE < 2 yrs. 2 yrs. $\leq$ PE < 5 yrs.	1 week 2 weeks	4 weeks $\leq$ PE < 2 yrs.	1 week
2 yrs. $\leq$ PE < 5 yrs.	2 weeks	5 yrs. $\leq$ PE < 10 yrs. 10 yrs. $\leq$ PE < 15 yrs.	4 weeks 6 weeks	2 yrs. $\leq$ PE < 12 yrs. (PE in yrs.)	PE weeks
5 yrs. $\leq$ PE	4 weeks	15 yrs. $\leq$ PE	8 weeks	12 yrs. $\leq$ PE	12 weeks

In 1966, the Redundancy Payments Act was introduced and this made employers legally liable to provide compensation for employees who were made redundant.<sup>5</sup> Some part of this compensation comes from a central fund and some is paid direct. As Table 3 indicates, the average number of weeks earnings paid directly by the employer for each redundancy rose in the late 60s after which it has remained relatively stable.

TABLE 3  
Redundancy payments

Year	Average payment per redundancy (£)	Multiple of average weekly earnings	Number of redundancies within the scheme ('000)
1966	48.2	2.6	137
1967	51.4	2.7	242
1968	58.3	2.8	265
1969	93.2	4.2	251
1970	121.8	4.9	276
1971	130.3	4.7	370
1972	153.4	4.9	284
1973	183.1	5.2	169
1974	202.2	4.9	198
1975	239.9	4.6	321
1976	280.0	4.6	314
1977 (first 3 quarters)	303.2	4.6	202

Source: D.E. Gazette, quarterly.

On 28th February, 1972, the unfair dismissal provisions of the Industrial Relations Act were brought into effect. Since that time various changes have been made under subsequent acts but essentially the Act laid down criteria for dismissals other than for redundancy, and procedures which employers must follow. It also gave the employee considerable rights to appeal against dismissal to an Industrial Tribunal so long as he or she had been employed for two years, a qualifying period which had been reduced to six months by 1975. In Table 4 we present the numbers of applications to Industrial Tribunals and this reveals a dramatic increase over the years. The proportion of cases in which monetary compensation has been awarded has also increased but the average amount of compensation has declined in real terms.

TABLE 4

Year	Number of unfair dismissal cases considered	% of cases in which monetary compensation was awarded	Average compensation (£)	Number of weeks earnings represented by average compensation
1972 (10 months)	5197	34	273	8.8
1973	9350	35.5	309	8.8
1974	10109	40	298	7.2
1975	22632	44.3	284	5.4
1976	33701	45	291	4.8
1977	35389	44.2	368	5.5

Source: D.E. Gazette, May 1978 and June 1976. The percentage of cases in which monetary compensation was awarded refers to those cases in which either compensation or redundancy money was paid as a result of conciliation or action by a Tribunal. The average compensation is only approximate having been computed from a frequency distribution using the midpoint of each payment segment as the group mean.

It should, however, be recognised that the compensation eventually paid by an employer if he loses the case is small compared with the legal and other costs involved whether he wins or loses.<sup>6</sup> This legislation seems to have had a considerable impact on dismissals for, as Daniel and Stilgoe (1978) report, in 1969 the proportion of plants employing between 100 and 499 workers who sacked (excluding redundancies) more than 6% of their work force in the previous twelve months was 13% whereas in 1977 the proportion of similar plants who sacked more than 3.5% of their work force in the same period was a mere 5%.

All this legislation indicates the increasing difficulty and expense which must be incurred by firms who wish to reduce their labour force. The question then arises as to the impact of such changes on the pattern of labour demand and this is the topic discussed in the next section.

### The impact of increased costs of dismissal

It is theoretically convenient to separate the impact of increased costs of dismissal on patterns of employment and unemployment into two parts. First we consider the effect on flows from employment to unemployment and second we look at the likely effects on the duration of unemployment. In both cases we are thinking in terms of secular effects and so we consider equilibrium models.

Consider first the following simple deterministic model which is similar to those of Feldstein (1976) and Baily (1977). Imagine an economy consisting of a large number of firms where, due to changes in tastes or other random shocks, the demand for each firm's output shifts around over time. When these shifts occur, firms adjust their output and employment and we may suppose that (homogeneous) workers move from firm to firm via redundancies and vacancies rather than via relative wage adjustments.<sup>7</sup> Each move implies a bout of unemployment and the level of such "frictional" unemployment simply depends on the amount of employment adjustment. We may model this situation deterministically by supposing that we have a pair of firms which are identical except that the output price of one firm follows the pattern  $p_1, p_2, p_1, p_2 \dots$  in successive periods and that of the other follows the reverse pattern  $p_2, p_1, p_2, p_1, \dots$ . Workers shift back and forth between the two firms and frictional unemployment is proportional to the number of workers who move in each period. Consider one firm which produces output  $g(N)$  per hour worked with employment  $N$ ,  $g$  being concave. Suppose it employs  $N_1$  workers for  $h_1$  hours during the period when output price is  $p_1$ . If  $p_2 > p_1$ , it will hire  $N_2 - N_1$  at the beginning of a  $p_2$  period and fire  $N_2 - N_1$  at the end. Suppose the total cost of doing this is  $\alpha(N_2 - N_1)$ . Then, ignoring discounting, it is clear that the firm will wish to choose  $N_1, h_1$  to maximise

$$(1) \quad p_1 g(N_1) h_1 + p_2 g(N_2) h_2 - w(h_1) N_1 - w(h_2) N_2 - \alpha (N_2 - N_1).$$



$w(h)$  is the function relating wages to hours worked and is assumed convex. We may also suppose that  $\alpha$  does not only incorporate hiring and firing costs but contains an element of worker compensation for the probability of becoming unemployed. That is, workers receive  $w(h)$  plus some part of  $\alpha$  which is smaller, the larger is the level of government provided unemployment compensation.<sup>8</sup>

What we are interested in is, of course, the impact of changes in  $\alpha$  on  $(N_2 - N_1)$ , the inflow into unemployment in each period where we should simultaneously allow equi-proportional changes in  $p_i$  to keep aggregate employment,  $N_1 + N_2$ , constant (i.e. we change real wages in such a way as to preserve "full-employment" equilibrium). Standard comparative statics reveals that so long as employment demand increases with output price then  $(N_2 - N_1)$  is decreasing in  $\alpha$  and  $(h_2 - h_1)$  is increasing in  $\alpha$ . Thus an increase in firing costs will decrease the equilibrium flow into unemployment, reduce the dependence of the firm on employment adjustment and increase its dependence on hours adjustment in response to demand shifts. On the other hand an increase in unemployment compensation will reduce  $\alpha$  and hence have the opposite effect. We mention the latter here because when we come to consider the facts, we must remember that unemployment compensation may have been changing over the relevant period.

This sort of model is all very well but it tells us nothing about the likely effects of increased firing costs on the process of hiring and hence on the duration of unemployment. We know that increased unemployment compensation should increase unemployment duration from the supply side, but what of the demand side effects of firing costs? One might hypothesise that increased costs of dismissal may make employers more choosy about whom they take on and this will increase the time required to fill any vacancy given a fixed flow of applicants.<sup>9</sup> The following simple model bears this out. Suppose there are two types of workers, reliable (R) and unreliable (U). Suppose an employer can observe a

characteristic,  $z$ , and knows that  $p(z)$  is the probability of a  $z$  person being reliable, where  $p'(z) > 0$ . Suppose he has one vacancy, it costs  $v$  per applicant to discover  $z$  and it costs him  $D$  if he hires an unreliable worker.<sup>10</sup> Then if  $f(z)$  is the density of  $z$  across the applicants, the employer must choose a cut off value of  $z$ , namely  $z^*$ , above which he hires the person concerned. The mean cost of hiring is  $v/(1 - F(z^*))$  where  $F$  is the distribution function and the probability of a hired worker turning out to be unreliable is simply

$\int_{z^*}^{\infty} \frac{(1 - p(z)) f(z) dz}{1 - F(z^*)}$ . So he chooses  $z^*$  to minimise the total expected cost of filling the vacancy, that is to solve

$$(2) \quad \text{minimize } v/(1 - F(z^*)) + D \int_{z^*}^{\infty} (1 - p(z)) f(z) dz / (1 - F(z^*)).$$

$z^*$  is thus chosen to satisfy

$$v + D \left\{ \int_{z^*}^{\infty} (1 - p) f dz - (1 - p(z^*)) (1 - F(z^*)) \right\} = 0$$

and it is easy to show that  $\frac{dz^*}{dD} > 0$ . That is, as the cost of firing goes up, the probability of hiring will go down.<sup>11</sup>

To summarise this section we can expect that an increase in firing costs will increase hours fluctuations and reduce employment fluctuations relative to changes in demand. It will reduce the inflow into unemployment via redundancies and other dismissals but will make employers more choosy when hiring and will thus reduce the rate at which job applicants are hired. In the next section we shall interpret some of the empirical evidence in the light of these results.

### Changes in the pattern of employment and unemployment in Britain

It is a commonplace that the relationship between employment and output in Britain has changed considerably since the 1950s. The simple regression equations in Table 5 reveal what has occurred.<sup>12</sup> In order to interpret the

Table 5

Employment - Output Equations for U.K. Manufacturing

Independent Variables	Dependent Variable and Period			
	log (total employment) <sub>t</sub>		log (operatives employment) <sub>t</sub>	
	1954(2)- 1966(3)	1966(4)- 1973(2)	1955(1)- 1966(3)	1966(4)- 1976(4)
Constant	1.63 (3.22)	0.73 (1.1)	0.05 (0.14)	-0.08 (0.40)
log (output) <sub>t</sub>	0.154 (8.53)	0.238 (4.61)	0.28 (3.09)	0.16 (4.32)
log (total employment) <sub>t-1</sub>	0.744 (12.36)	0.807 (10.8)		
log (operatives employment) <sub>t-1</sub>			0.39 (2.77)	0.75 (7.5)
trend	-0.00128 (5.58)	-0.00223 (4.02)	-0.0027 (3.15)	-0.0020 (3.4)
DW or 1st order auto- correlation coefficient (p)	1.76	1.89	2.22	

Asymptotic t-ratios in brackets.

changes, particularly in the coefficients on output and lagged employment, we must provide some theoretical structure. Consider the following standard dynamic model of a firm choosing its labour input to minimise the cost of producing an exogenously given time path of output. It will solve the problem

$$\min \sum_{t=0}^{\infty} \frac{(1+g)^t}{(1+r)^t} \left\{ w(h(t)) N(t) + b(N(t) - N(t-1))^2 \right\}$$

$$\text{subject to } y^e(t) = g(N(t)) h(t) e^{\beta t}, \text{ all } t$$

where  $y^e(t)$  is expected output,  $h(t)$  is hours,  $w(\cdot)$  is the wage function,  $b(1+g)^t$  is the level of adjustment costs and  $\beta$  is the rate of growth of productivity. We have assumed quadratic adjustment costs for simplicity and  $b$  will clearly be increasing in firing costs. The solution to this problem (where standard certainty equivalence results apply, see Simon (1956)) is a second order difference equation in  $N(t)$  which may be linearised. The resulting equation has one stable root and the solution may be written as

$$(3) \quad \log N(t) - \mu \log N(t-1) = \alpha_0 + \epsilon(1-\mu) \sum_{s=t}^{\infty} (\alpha\mu)^{s-t} \log y^e(s) - \epsilon(1-\mu)\beta t$$

where  $\alpha_0$  is a constant,  $\alpha = \frac{(1+g)}{(1+r)}$ ,  $\epsilon = \partial \log N / \partial \log g$  and  $\mu$  lies between zero and one. Furthermore  $\frac{\partial \mu}{\partial b} > 0$ . These results are, by now, fairly standard, a similar problem and solution having been presented in Tinsley (1971).<sup>13</sup> Notice that the equation has the standard partial adjustment form but the point to be aimed at is a geometrically declining function of all the future expected levels of output. Since the weights take the form  $(\alpha\mu)^{s-t}$ , the future is more important if  $r$  is lower and  $\mu$  is higher and hence if adjustment costs are more important, since  $\mu$  is increasing in  $b$ . This is, of course, only to be expected. In order to interpret the equation of Table 5 it remains to specify an expectations formation mechanism and here we shall follow a notion of Sims (1974))

and suppose that there is a known deterministic trend path of output,  $\bar{y}e^{\gamma t}$ , say, which the firm assumes that current output will approach at some rate. So we have

$$y^e(s) = e^{\gamma s} \bar{y} \left( 1 + \phi^{s-t} \left( \frac{y(t)}{\bar{y}e^{\gamma t}} - 1 \right) \right)$$

where  $0 \leq \phi \leq 1$  and the closer is  $\phi$  to zero, the faster the trend path is approached.<sup>14</sup> Inserting this in (3) gives the following equation which has precisely the form displayed in Table 5.

$$(4) \quad \log N(t) = \beta_0 + \epsilon \frac{(1-\mu)(1-\alpha\mu)}{(1-\alpha\mu\phi)} \log y(t) + \mu \log N(t-1) + \beta_1 t$$

where  $\beta_0$  is a constant and  $\beta_1 = (\gamma - \beta)(1-\mu) - \epsilon\gamma \frac{(1-\mu)(1-\alpha\mu)}{(1-\alpha\mu\phi)}$ . If we now interpret the parameter estimates in table 5 in the light of this specification we see that both in the equations for total employment and in those for operatives, the coefficient on the lagged dependent variable increases in the later period. Although this increase in  $\mu$  is not significant in either case, it is at least consistent with an increase in adjustment costs. However, in the total employment equations there has also been a rise in the output coefficient and under the assumption of a fixed technology (i.e.,  $\epsilon$  constant) this implies a dramatic change in the expectations parameter  $\phi$  in order that the increased output coefficient can be consistent with an increase in  $\mu$ . This problem does not arise in the operatives equation which in some respects is the more relevant since flexibility in the labour force of a firm tends to have a greater impact on the employment of operatives as opposed to any other group. Nevertheless the evidence here is by no means convincing.

Turning to the response of hours worked, in table 6 we present the results of regressing the log of hours worked on the change in log output and a trend with appropriate dynamics. We have chosen this formulation because, in the

TABLE 6

Hours -  $\Delta$  output equations for British manufacturing

Dependent variable :  $\log(\text{hours})_t$

Period	1956(1) - 1966(4)	1967(1) - 1976(3)	
Constant	0.95	2.1	3.8
$\Delta \log(\text{output})_t$	0.16 (3.9)	0.36 (3.4)	0.29 (3.0)
$\Delta \log(\text{output})_{t-1}$	0.0007 (0.5)	0.0003 (0.003)	
$\log(\text{hours})_{t-1}$	0.75 (7.3)	0.44 (2.6)	
t	- 0.0004 (2.7)	- 0.0007 (2.2)	- 0.0014 (4.7)
$\rho$ (autoregression parameter)			0.4 (2.3)
D.W.	2.3	2.4	
Test for 1st order autoregression against 1st order lags	15.5	3.0	

Notes: Asymptotic t-statistics in brackets.

All equations also include seasonal dummies which are omitted.

Hours refers to average hours of work per week per operative.

long run, weekly hours of work will be independent of the level of output although they will, of course, adjust in the short run as output fluctuates. In the first period, the dynamics consist of 1st order lags with the restriction of zero lags and autocorrelation being rejected ( $\chi^2(1) = 15.5$ ). In the second period, however, the relevant significance test implies non-rejection of the zero lag, 1st order autocorrelation restriction at the 5% level ( $\chi^2(1) = 3.0$ ) but I still prefer the more general formulation since the non-rejection is marginal and the restriction implies that hours revert back to their equilibrium level in the quarter following a jump in output. In any case the results are relatively clear-cut in the sense that a given change in output is associated with an immediate hours change which is twice as large in the period after 1966 as previously. This difference is on the borderline of significance ( $t = 1.78$ ) and is again consistent with the effects of increasing firing costs.

Having discovered that movements in employment and hours variations are at least consistent with our theoretical analysis of the impact of increased costs associated with firms reducing their labour force, we can now attempt to measure their impact on the level of unemployment. From our theoretical analysis we should expect these increased costs to lead to a secular reduction in the involuntary part of the inflow into unemployment, although such a reduction could be offset by rises in the relative levels of unemployment compensation. First, in Table 7 we can see that the average level of unemployment benefit paid out relative to average after-tax net earnings has not exhibited any secular trend over the period since 1967, so we cannot expect this to have had much influence. Turning to the inflow into unemployment, we have no time series information on voluntary and involuntary inflows although we do know

TABLE 7

Annual expenditure on unemployment benefit per claimant/Average  
net of tax earnings in the United Kingdom

1967	0.36
1968	0.39
1969	0.38
1970	0.39
1971	0.37
1972	0.35
1973	0.35
1974	0.42
1975	0.35

Source: Private communication from J. Taylor, University of Lancaster.

TABLE 8

Standardized and seasonally adjusted inflow into unemployment  
in Great Britain (males) and male unemployment for each October

Year	67	68	69	70	71	72	73	74	75	76
Inflow ('000)	249	241	250	250	254	227	206	238	264	242
Unemployment ('000)	429	450	456	483	684	655	425	507	855	972

Source: Figures from D. E. Gazette, December 1976, September 1978.



that the bulk of the inflow is involuntary.<sup>15</sup> Table 8 shows the movement of the aggregate male inflow over time and also gives male unemployment for comparison purposes. The most striking thing about these data is the stability of the inflow and its complete lack of any secular trend over a period when male unemployment has more than doubled. It certainly rises and falls slightly when unemployment rises and falls but the inflow in October 1976 is marginally lower than that ten years previously, in spite of the massive increase in unemployment. Nevertheless it is worth specifying an equation explaining the inflow into unemployment in order to see if we can detect any residual downward trend. We would expect, for obvious reasons, that the voluntary part of the inflow,  $i_1$ , would depend on the level of job opportunities which we may proxy by the ratio of vacancies to unemployment,  $V/U$ , and on the unemployment benefit to income or replacement ratio,  $R$ . The involuntary part of the inflow,  $i_2$ , will depend on recent changes in the level of output,  $\Delta y$ , the replacement ratio and any residual reduction due to increased adjustment costs should show up with a negative time trend. Hence we have an equation of the form

$$i/e = (i_1 + i_2)/e = f(V/U, \Delta y, R, t)$$

where we have normalised the total inflow into unemployment,  $i$ , by total employment,  $e$ . The log linear version of this equation without dynamics would be

$$(5) \log(i/e) = a_0 + a_1 \log(V/U) + a_2 \Delta \log y + a_3 \log R + a_4 t$$

$$a_1 > 0, a_2 > 0, a_3 > 0, a_4 < 0$$

and in table 9 we present parameter estimates for this equation with suitably estimated dynamics. The estimated coefficients are reasonably satisfactory although the strong negative coefficient on the current vacancies to unemployment ratio indicates that this variable is picking up a lot of the cyclical effects

TABLE 9

Regressions explaining one month inflows into unemployment in Great Britain (standardised and seasonally adjusted). The observations refer to single months which are at three monthly intervals from 1967 (Jan.) to 1977 (Oct.)

Independent Variables	Dependent Variable	
	log (male inflow/ male employment) <sub>t</sub>	log (total inflow/ total employment) <sub>t</sub>
$\Delta \log (\text{output})_t$ (previous quarter)	-0.64(1.6)	-0.13(0.21)
$\Delta \log (\text{output})_{t-1}$		0.58(0.95)
log (vacancies/unemployment) <sub>t</sub> (beginning of month)	-0.16(5.5)	-0.14(3.6)
log (vacancies/unemployment) <sub>t-1</sub>	0.13(5.4)	0.12(3.4)
log (replacement ratio) <sub>t</sub>	-0.21(1.3)	-0.29(1.2)
log (inflow/employment) <sub>t-1</sub>	0.48(3.8)	0.75(4.7)
t	-0.00095(1.7)	-0.0001(0.1)
constant	2.23(2.8)	1.7(1.5)
D.W.	2.14	2.25
Box-Pierce random correlogram statistic $\chi^2(8)$	4.44	6.1

't' statistics in brackets. All variables with the exception of the replacement ratio are current published monthly in the final section of the D.E. Gazette. This latter variable is obtained from the same source as that in Table 7.

in the involuntary inflow which are only being partially captured by the change in output. The fact that it is a beginning of month variable should rule out any simultaneity problems. The time trend in the male equation indicates a ceteris paribus secular inflow reduction of 0.18% per quarter and the hypothesis that this reduction is zero may be rejected at the ten percent level. The time trend in the total inflow equation is zero but this equation suffers from the fact that the female inflow into registered unemployment is a variable proportion of the total female inflow into unemployment and this variability is something about which very little is known for recent years. The results for the male equation are, consequently, vastly more meaningful and the time trend coefficient seems to indicate some ceteris paribus secular reduction in the inflow into unemployment which is again consistent with a rising level of firing costs.

The other aspect of the impact of rising firing costs which we discussed concerns the reduction in the chances of any job applicant being hired as employers become more choosy about whom they take on. In order to analyse this empirically we may consider the following simple aggregate model. Suppose that in labour market  $i$ , there are  $U_{it} + E_{it}$  active searchers in period  $t$  where  $U_i$  are the unemployed and  $E_i$  are the employed. Assume that each searcher searches a certain number of open vacancies per month which depends on the number of available vacancies relative to the number of active searchers. That is, the greater the number of vacancies per searcher, the greater the rate at which each searcher finds and visits open vacancies. Suppose then that each searcher in labour market  $i$  visits  $c(V_{it}(U_{it} + a_{t it}E_{it}))^{\alpha_1}$  registered vacancies per month, where  $c$  is a constant and  $V_{it}$  is the number of registered vacancies. Then the total number of searches per month is given by  $c V_{it}^{\alpha_1} (U_{it} + a_{t it}E_{it})^{1-\alpha_1}$

and each vacancy receives visitors at the rate of  $v_{it}$  per month where

$$(6) \quad v_{it} = c \left( \frac{U_{it} + a_t E_{it}}{V_{it}} \right)^{1-\alpha_1}$$

Next we must specify a variable  $\pi_{it}$  which measures the probability that an individual searcher visiting a vacancy will both be offered and accept a job. We would expect the probability of receiving an offer to depend negatively on both the rate of arrival of visitors,  $v_{it}$ , and the extent of firing costs for reasons we have already discussed. As before, we shall attempt to capture the rise in firing costs with a time trend. The probability of accepting an offer will depend on the replacement ratio and hence we may specify  $\pi_{it}$  as

$$(7) \quad \pi_{it} = b R_t^{-\delta} v_{it}^{-\alpha_2} e^{-\gamma t}$$

where  $\delta$ ,  $\alpha_2$  and  $\gamma$  should all be positive. The rate at which registered vacancies are filled per month in the  $i^{th}$  labour market,  $\sigma_{it}$ , is then given by the product of the total number of searches per month and the probability of a search resulting in a job offer and acceptance. Thus we have

$$\begin{aligned} \sigma_{it} &= c v_{it}^{\alpha_1} (U_{it} + a_t E_{it})^{1-\alpha_1} \pi_{it} \\ &= c^{1-\alpha_2} b R_t^{-\delta} e^{-\gamma t} v_{it}^{\alpha_1+\alpha_2(1-\alpha_1)} (U_{it} + a_t E_{it})^{(1-\alpha_1)(1-\alpha_2)} \end{aligned}$$

Hence the total number of registered vacancies filled per month is given by

$$(8) \quad \sigma_t = \sum_i \sigma_{it} = c^{1-\alpha_2} b R_t^{-\delta} e^{-\gamma t} \sum_i v_{it}^{\alpha_1+\alpha_2(1-\alpha_1)} (U_{it} + a_t E_{it})^{(1-\alpha_1)(1-\alpha_2)}$$

or

$$(9) \quad \frac{\sigma_t}{V_t} = c_1 R_t^{-\delta} e^{-\gamma t} \left( \frac{V_t}{U_t + a_t E_t} \right)^{-\alpha} \sum_i \left( \frac{v_{it}}{V_t} \right)^{-\alpha} \left( \frac{U_{it} + a_t E_{it}}{U_t + a_t E_t} \right)^{\alpha}$$

where  $\alpha = (1-\alpha_1)(1-\alpha_2)$ ,  $c_1 = c^{1-\alpha_2} b$  and  $V_t$ ,  $U_t$ ,  $E_t$  are aggregate registered

vacancies, unemployment and employment respectively. Equation (9) thus indicates that the proportion of vacancies filled each month depends inversely on the replacement ratio, the ratio of vacancies to active searchers and the level of dismissal costs as proxied by a time trend. The last term on the right hand side of (8) can be viewed as being inversely related to the degree of mismatching between searchers and vacancies in the various labour markets. This follows from the fact that for a given set of proportions of job seekers in the various markets, this term achieves its maximum when the vacancy proportions are identical to the proportions of job seekers, that is when  $V_{it}/V_t = (U_{it} + a_t E_{it}) / (U_t + a_t E_t)$  for all  $i$  and mismatching is at a minimum. So finally, the proportion of vacancies filled is inversely related to the degree of mismatching.

Taking logs of (9) gives the simple log linear equation

$$(10) \quad \log(\sigma_t/V_t) = c_2 - \delta \log R_t - \gamma t - \alpha \log(V_t/U_t + a_t E_t) \\ + \log \sum_i \left( \frac{V_{it}}{V_t} \right)^{1-\alpha} \left( \frac{U_{it} + a_t E_{it}}{U_t + a_t E_t} \right)^\alpha$$

where the only problem as far as estimation is concerned lies with the final term. The equation is non-linear in  $\alpha$  but it was thought inadvisable to estimate  $\alpha$  from the final term because we have no real notion as to how to define the separate labour markets. So we have somewhat arbitrarily replaced the final term by a proxy of the form  $\log \sum_i \left( \frac{V_{it}}{V_t} \right) \left( \frac{U_{it} + a_t E_{it}}{U_t + a_t E_t} \right)$  where  $i$  refers to nine British regions. Unfortunately it was more or less impossible to subdivide by standard occupations because the system of occupational categories was changed dramatically half way through the sample period. So the final

equation to be estimated has the form

$$(11) \quad \log(\sigma_t/V_t) = c_2 - \delta \log R_t - \gamma t - \alpha \log(V_t/U_t + a_t E_t) \\ + \log \sum_i \left( \frac{V_{it}}{V_t} \right) \left( \frac{U_{it} + a_t E_{it}}{U_t + a_t E_t} \right)$$

All the variables in this equation are readily available although the computation of  $a_t$ , the proportion of the employed who are actively searching, must be spelled out.  $a_t$  is defined as

$$a_t = \frac{U_t}{E_t} \times \frac{\text{vacancies cancelled}}{\text{vacancies filled by the employment service}}$$

where vacancies cancelled refers to the vacancies which are registered with the employment service and then cancelled by the firms before the employment service has time to fill them. We are, thus, assuming that those vacancies which are cancelled are filled by individuals who are in employment.<sup>16</sup> In table 10 we present the parameter estimates of equation (11) which appears to fit the data well and to exhibit no sign of serial correlation in the residuals. The variables all have the correct sign and the time trend indicates that the probability of an individual receiving and accepting a job offer on visiting a vacancy has declined secularly at the rate of about 1.1 percent per quarter with two standard error bounds of 0.38 percent and 18.2 percent. This is consistent with the theoretical impact of rising firing costs which we discussed in the previous section and it is worth attempting to estimate the effect of both this and the secular reduction in the inflow into unemployment found in the results of table 9 on the equilibrium level of unemployment.

Table 10

Three monthly regressions (March, June, October, December) to explain  
the Proportion of Vacancies Filled Each Month in Britain  
March '70 - June '76

<u>Independent Variables</u>	<u>Dependent Variable: <math>\log (\sigma_t/V_t)</math></u>
constant	3.4 (1.3)
$\log R_t$	-0.72 (1.2)
t	-0.011 (3.1)
$\log (V_t/(U_t + a_t E_t))$	-0.49 (21.9)
$\log \sum_i \left( \frac{V_{it}}{V_t} \right) \left( \frac{U_{it} + a_t E_{it}}{U_t + a_t E_t} \right)$	0.77 (0.85)
D.W.	2.16
Box-Pierce statistic for random correlogram, $\chi^2(4)$	4.4
$R^2$	0.98

- Notes. 1) Number of observations = 26, t statistics in brackets.  
2) The data refer to both men and women because consequent on Sex Discrimination legislation, vacancy statistics ceased to be published by sex in 1975.  
3)  $V_t$ ,  $U_t$  are recorded vacancies and unemployment,  $V_{it}$ ,  $U_{it}$  are the same by nine regions,  $\sigma_t$  is the vacancy outflow, all taken from the D.E. Gazette as were the statistics on cancelled vacancies used to create  $a_t$ .  $R_t$  is taken from the same source as in Table 7.  
4) All the vacancy and unemployment variables are seasonally adjusted. When we used seasonally unadjusted variables, included seasonal dummies and corrected for 4th order serial correlation the equation was very similar with a time trend coefficient -0.011 (2.05).

In order to do this we may return to the discussion leading up to equation (6) and assume that the total number of vacancies searched per month by an unemployed individual,  $S$ , is given by

$$S = k(V/U + aE)^{\alpha_1}$$

where we now drop the separate labour markets. Then the average duration of an unemployment spell,  $m$ , is given by the reciprocal of the number of searches per month times the probability of a search being successful,  $\pi$ , hence

$$\begin{aligned} m &= (S\pi)^{-1} = k_1 (V/U + aE)^{-\alpha_2(1-\alpha_1)-\alpha_1} R^\delta e^{\gamma t} \\ &= k_1 (V/U + aE)^{\alpha-1} R^\delta e^{\gamma t}, \quad \alpha = (1-\alpha_1)(1-\alpha_2) \end{aligned}$$

using (5) and (7) and the definition of  $S$  given above.  $k_1$  is simply a constant and the subscripts  $t$  have been omitted because we are now referring to equilibrium values. So if  $i$  is the inflow into unemployment we have

$$U = im = k_1 i (V/U + aE)^{\alpha-1} R^\delta e^{\gamma t},$$

unemployment,  $U$ , being the product of the inflow and the mean duration. This then yields

$$\frac{UV^{1-\alpha}}{(U + aE)^{1-\alpha}} = k_1 i R^\delta e^{\gamma t}.$$

Now let us assume that the equilibrium level of unemployment,  $U^*$ , is given by  $U = KV$  where  $K$  is some constant independent of  $\pi$  and  $i$ . Thus we have

$$\frac{U^{*2-\alpha}}{(U^* + aE)^{1-\alpha}} = k_2 i R^\delta e^{\gamma t}$$



So the secular growth rate of  $U^*$ ,  $\frac{d \log U^*}{dt}$ , is given by

$$(2 - \alpha) \frac{d \log U^*}{dt} - \frac{(1-\alpha)U^*}{U^*aE} \frac{d \log U^*}{dt} = \frac{d \log i}{dt} + \delta \frac{d \log R}{dt} + \gamma .$$

But, from the results in table 10 we know that  $\alpha = 0.49$  and hence we have

$$\left\{ 1.51 - \frac{0.51U^*}{U^*+aE} \right\} \frac{d \log U^*}{dt} = \frac{d \log i}{dt} + \delta \frac{d \log R}{dt} + \gamma .$$

In order to proceed, we may note that the average value of  $a_t$  over the sample period is 0.02 and if we suppose that  $U^*$  lies between 400,000 and 800,000, this implies that  $U^*/U^* + aE$  lies between about 0.4 and 0.6. Hence we find

$$(12a) \quad \frac{d \log U^*}{dt} = \beta \left\{ \frac{d \log i}{dt} + \delta \frac{d \log R}{dt} + \gamma \right\}$$

where  $0.77 \leq \beta \leq 0.83$ . If we now take the results from the male equation of table 9 as our estimates of equation (5), we have that in equilibrium

$$(12b) \quad \frac{d \log i}{dt} = \frac{d \log e}{dt} - 0.4 \frac{d \log R}{dt} - 0.0018$$

where note first that  $e$  is total male employment and further that the lagged dependent variable coefficient in table 9 indicates that all coefficients must be divided by 0.52 to obtain long run equilibrium values. The output change and the vacancies to unemployment ratio will, of course, have zero rates of change in equilibrium. Since the point estimate of  $\gamma$  from table 10 is 0.011, equations (12a) and (12b) indicate that the equilibrium rate of unemployment has been increasing in recent years by 1.18 per cent per quarter via the secular reduction in the probability of unemployed individuals receiving and accepting job offers and has been decreasing by 0.188 per cent per quarter via the secular reduction in the inflow into unemployment. Taking the outer

limits of  $\beta$  presented above, this implies point estimates of an increase in unemployment of between 22.4 and 24.3 per cent due to the reduction in job offer probabilities and a decrease of between 3.4 and 3.6 per cent due to the reduction in the inflow during the six years from 1970 to 1975. These results are, of course, ceteris paribus on changes in the replacement ratio and, to a limited extent on changes in the degree of job mismatching. We have done some crude experimentation with job mismatch measures across 2 digit occupations which reveals a 3% increase since 1973 with little change prior to that date. This is not very satisfactory, however, and a finer breakdown by occupation may reveal something more definite.

The combination of the increase in equilibrium unemployment due to the secular fall in job offer and acceptance probabilities and the decrease due to the secular decline in inflows into unemployment leads to a median estimate of the increase in equilibrium unemployment from 1970 to 1975 for these reasons alone of some 19.8 per cent.<sup>17</sup> Taking account of the estimated standard errors, this figure has 5% confidence limits of about 6 and 38 per cent. In the light of this evidence we would tentatively conclude that at least some of this change is due to the increased difficulty experienced by firms in reducing their labour force although our inability to control accurately for changes in the degree of job mismatching makes it difficult to be any more precise particularly when we are picking up the impact of legislative changes using simple time trends.<sup>18</sup>

## II. Special Employment Subsidies

### Some examples of special employment measures of the wage subsidy type

In recent years a number of West European countries have introduced special measures to attempt to reduce unemployment without resorting to a general reflation. Among some of the more important and interesting have been the Temporary Employment Subsidy (TES) introduced in Britain in August 1975, the Small Firms Employment Subsidy (SFES) introduced in Britain in July 1977 and the Special Wage Subsidy (SWS) which ran for six months in Germany from December 1974 to June 1975. The TES entitled firms to £10 per week per worker for six months for any worker who would otherwise have been made redundant. The subsidy was increased to £20 per week per worker and the period to one year in April 1976 and each establishment had to claim for a minimum of ten workers to be eligible. The SFES entitled small manufacturing firms (< 50 employees) in Special Development Areas (in which some 12% of the labour force live) to a subsidy of £20 per week for 6 months for each additional full-time job which was created. The SWS gave firms a 60% wage subsidy for six months for each additional long-term unemployed worker (3 months unemployed) who was recruited in areas where unemployment was 0.5 percentage points higher than the national average. The interesting thing about these subsidies is that they are selective both in respect of the firms and the workers to whom they apply and they are temporary. In order to understand why such types of subsidy might be preferred to either across the board wage subsidies or general reflation, it is a good idea to consider the criteria by which such counter cyclical policies should be judged. The aim of the game is to choose a policy which provides the largest possible increase in output for any given inflationary impact, where output should take into account the value of the leisure of those both in and out of work and may

also have to be adjusted for distributional effects. In order to investigate the inflationary impact of any policy it is necessary, strictly speaking, to construct a model which determines the time path of wages and prices. Since this is bound to be contentious, we shall sidestep the issue by looking at things in the context of a fixed wage, fixed exchange rate world. One can then argue that any expansionary policy is liable to lead to inflationary pressure by reducing unemployment thereby leading to greater upward pressure on wages, by increasing the budget deficit leading to pressure on the money supply and by increasing the balance of payments deficit which may lead to devaluation producing a one-for-all price rise or an inflationary spiral if there is real wage resistance. Thus, in a fixed wage, fixed exchange rate world and if we assume an immutable relationship between employment and output, we can look at the budget deficit and balance of payments effect per unit increase in employment and if a policy is superior on both counts, then it may be safely preferred.

On this basis then, why might wage subsidies be preferred to, say, tax cuts? The following are some plausible hypotheses. First, for any given expenditure there are substitution effects as well as output effects, thereby obtaining a greater increase in employment per unit of expenditure. Second, a factor subsidy will lead to employment expansions in industries which operate in competitive world markets. This is essentially a supply effect which also, of course, increases exports and thereby improves the balance of payments. Third, wage subsidies can be made selective in the sense that only certain types of workers need be subsidised and if these types are in more than average excess supply, this will exert less pressure on wages.<sup>19</sup> Fourth, wage subsidies can be made marginal rather than average and all three examples given above have this

sort of aspect. The consequences of this are discussed at some length below. These, then, are the issues to be discussed and in the next section we attempt a detailed theoretical analysis.

### The impact of wage subsidies

The most general analysis of wage subsidies may be found in a very elegant article by Schweinberger (1978) and it is worth attempting an extension of his analysis just to provide a flavour of the difficulties involved in obtaining any general results. The essence of Schweinberger's model is that we have a number of commodities produced by a number of factors, some of which have fixed prices and are not fully employed. It is solely a supply side model because all the commodities are traded in competitive international markets at fixed prices. The analysis is concerned with the introduction of subsidies to the unemployed factors and it must be assumed that the structure of fully employed and unemployed factors remains unchanged throughout. In this model of an open economy, Schweinberger shows that proportional factor subsidies granted to unemployed factors will lead to an increase in the "aggregate" employment of these factors. What we shall do here is to see what can be said about this topic in a closed economy and to compare the results with those for an open economy. Following Schweinberger's notation we may describe the supply side of this world as follows.

$$(13) \quad \sum_{i=1}^n a_{ji} C_i = \bar{A}_j, \quad j = 1, \dots, n$$

$$(14) \quad \sum_{i=1}^n a_{ji} C_i = A_j, \quad j = n+1, \dots, n+m$$

$$(15) \quad \sum_{j=1}^n a_{ji} p_j + \sum_{j=n+1}^{n+m} a_{ji} p_j = q_i, \quad i = 1, \dots, n.$$

$q_i, i = 1 \dots n$ , prices of commodities

$p = [p_j], j = 1 \dots n$ , prices of the fully employed factors

$\bar{p} = [\bar{p}_j], j = n+1, \dots, n+m$ , prices of the unemployed factors (fixed)

$a_{ji} = a_{ji}(p, \bar{p})$ , the input coefficients derived from a set of linear homogeneous production functions

$\bar{A}_j, j = 1 \dots n$ , quantities of fully employed factors

$A_j, j = n+1, \dots, n+m$ , quantities employed of under employed factors

$C_i, i = 1 \dots n$ , supplies of the  $n$  commodities.

This sums up the supply side of the model and the equations are more or less self explanatory. Given  $q_i, \bar{p}_j, \bar{A}_j$ , the equations determine the commodity supplies  $C_i$ , the unemployed factor demands  $A_j$  and the fully employed factor prices,  $p_j$ . Since Schweinberger deals with an open economy in which the  $q_i$  are fixed, this is all he requires to analyse the effects of changes in  $\bar{p}_j$  on  $A_j$ . Before introducing the demand side it is worth following through some of his results because they will be useful. By taking the total derivatives of (13), (14), (15) and noting that perfect competition and cost minimisation will imply

$$(16) \quad \sum_{j=1}^n p_j da_{ji} + \sum_{j=n+1}^{n+m} \bar{p}_j da_{ji} = 0, \quad \text{all } i$$

he finds that

$$(17) \quad \sum_{i=1}^n q_i dC_i - \sum_{j=n+1}^{n+m} \bar{p}_j dA_j = 0.$$

This implies that the commodity supplies and factor demands derived from (13), (14), (15) are the solutions to the problem,

$$(18) \quad \max V = \sum_{i=1}^n q_i C_i - \sum_{j=n+1}^{n+m} \bar{p}_j A_j$$

for given  $q, \bar{p}$ . Furthermore he shows that, under certain weak conditions,  $C_i, A_j$  are constrained by a production possibility locus of the form

$$(19) \quad G(C_1, \dots, C_n, A_{n+1}, \dots, A_{n+m}) = 0$$

which is strictly concave.  $V$  is, of course, the value added by the scarce, fully employed factors and hence these results are hardly surprising. They are very useful, however, since the  $C_i, A_j$  are the solutions to (18) subject to (19) and various standard results can now be applied. From the standard theory of profit functions, we have that  $\max_{C_i, A_j} V = V(q, \bar{p})$  is convex and the duality

results

$$(20) \quad \frac{\partial V}{\partial q_i} = C_i, \quad \frac{\partial V}{\partial \bar{p}_j} = -A_j$$

Suppose the government now introduces a proportional subsidy which reduces all unemployed factor prices by  $d \bar{p}_j = \mu \bar{p}_j$ ,  $\mu < 0$ . Then the aggregate employment of unemployed factors may be defined as

$$A_0 = \sum_{i=n+1}^{n+m} \bar{p}_i A_i$$

and the consequent change in this value (evaluated at the original prices) is

$$(21) \quad dA_0 = \sum_{i=n+1}^{n+m} \sum_{j=n+1}^{n+m} \frac{\partial A_i}{\partial \bar{p}_j} \mu \bar{p}_j$$

$$= - \sum_{i=n+1}^{n+m} \sum_{j=n+1}^{n+m} \mu \bar{p}_i \bar{p}_j \frac{\partial^2 V}{\partial \bar{p}_i \partial \bar{p}_j} > 0$$

from (20) and the convexity of  $V$ . This is Schweinberger's open economy result. Suppose we now close the economy and introduce aggregate demand functions  $C_i^d(q, M)$  where we assume for simplicity that aggregate demands are a function of aggregate money income  $M$ , which the government maintains unchanged throughout. The system now determines the commodity prices,  $q_i$ , from the market equilibrium equations

$$(22) \quad C_i^d(q, M) = C_i(q, \bar{p})$$

and so a proportional subsidy will induce commodity price changes,  $dq_i$ , given by

$$(23) \quad \sum_j \left( \frac{\partial C_i^d}{\partial q_j} - \frac{\partial C_i}{\partial q_j} \right) dq_j = \mu \sum_k \bar{p}_k \frac{\partial C_i}{\partial \bar{p}_k}, \quad i = 1, \dots, n.$$

So the change in the aggregate value of employment in the closed economy is given by

$$\begin{aligned} (24) \quad dA_c &= \sum_{i=n+1}^{n+m} \bar{p}_i dA_i \\ &= \sum_{i=1}^n q_i dC_i \text{ from (17)} \\ &= \sum_i q_i \sum_j \frac{\partial C_i}{\partial q_j} dq_j + \mu \sum_i q_i \sum_k \frac{\partial C_i}{\partial \bar{p}_k} \bar{p}_k \end{aligned}$$

Then if we let matrix  $A = \begin{bmatrix} -\frac{\partial C_i^d}{\partial q_j} \end{bmatrix}$ , matrix  $B = \begin{bmatrix} \frac{\partial C_i}{\partial q_j} \end{bmatrix}$ ,

column vector  $q = [q_i]$  and column vector  $\sum_k \frac{\partial C_i}{\partial \bar{p}_k} \bar{p}_k = \begin{bmatrix} \sum_k \frac{\partial C_i}{\partial \bar{p}_k} \bar{p}_k \end{bmatrix}$ ,

we have from (23) and (24)

$$dA_c = \mu q' \sum_k \frac{\partial C_i}{\partial \bar{p}_k} \bar{p}_k - \mu q' B(A + B)^{-1} \sum_k \frac{\partial C_i}{\partial \bar{p}_k} \bar{p}_k$$



or

$$(25) \quad dA_C = dA_0 - \mu q' B(A + B)^{-1} \sum_k \frac{\partial C}{\partial \bar{p}_k} \bar{p}_k$$

using (17) to show that the first term on the right is, in fact,  $dA_0$ .

The structure of (25) is transparent particularly when it is recognised that  $B$  is positive definite from the convexity  $V$  and (20) and that  $A$  would also be positive definite if we could ignore income effects. There are no general results to be had here but if, for example, we had a single commodity, then both  $A$  and  $B$  would be positive scalars and hence  $0 < B(A + B)^{-1} < 1$ . So (25) becomes

$$(26) \quad dA_C = dA_0(1 - \lambda), \quad 0 < \lambda < 1$$

thus indicating that the employment effect of a wage subsidy in a closed economy is bound to be less than in an open economy although it is still positive. This result may be extended to the case where cross effects are small and  $A, B$  are close to diagonal, then so long as a ceteris paribus proportional increase in unemployed factor prices never increases the supply of a commodity, (26) will still hold. This is an important result because it gives us some clue as to both the countries and the industries where wage subsidies are likely to be most effective. But in order to say more about this we must obviously turn to something a little less general.

Consider first a competitive industry in a closed economy consisting of identical firms with identical potential entrants waiting on the sidelines. Suppose  $D(p)$  is industry output demand, each firm produces  $f(x)$  units of output by employing  $x$  units of labour and there are  $n$  firms operating in the industry. Suppose each firm has fixed costs,  $A$ , and a constant capital stock. If the

wage is  $w$ , suppose that a subsidy  $sw$  is introduced for all employees in excess of some base number  $\ell_0$ . Then industry equilibrium with  $n$  fixed may be described by the following.

$$(27) \quad D(p) = nf(\ell). \quad \text{Demand} = \text{output}$$

$$(28) \quad pf'(\ell) = w(1-s). \quad \text{Profit maximization.}$$

If  $n$  is allowed to vary, we have

$$(29) \quad pf(\ell) = A + w\ell - sw(\ell - \ell_0). \quad \text{Zero profits.}$$

If we suppose that the industry starts at a position of long run equilibrium with  $s = 0$ , then we have initially

$$(29') \quad pf(\ell) = A + w\ell$$

It is useful to consider the long run industry response to a change in  $s$  inspite of the fact that it is rather ludicrous to allow the number of firms in the industry to alter in response to a policy which is only temporary. It nevertheless serves as a useful bench mark for further analysis. Under the assumption that  $f(\ell) = F(\ell, \bar{K})$  where  $F$  has constant returns, we have the following results which are trivial to prove.

For an Average Employment Subsidy (AES) ( $\ell_0 = 0$ ):

$$\frac{d \log \ell}{ds} = \sigma, \quad \frac{d \log n}{ds} = \beta(|\epsilon_d| - \sigma)$$

which implies

$$(30) \quad \frac{d \log(\ell n)}{ds} = (1-\beta)\sigma + \beta|\epsilon_d|$$

where  $\beta = \frac{w\ell}{A + w\ell}$ ,  $\sigma$  = the elasticity of substitution and  $\epsilon_d$  = the elasticity of demand.

For a Marginal Employment Subsidy (MES) ( $\ell_0$  = initial  $\ell$ ):

$$\frac{d \log \ell}{ds} = \frac{\sigma}{1-\beta}, \quad \frac{d \log n}{ds} = \frac{-\beta\sigma}{1-\beta}$$

which implies

$$(31) \quad \frac{d \log(\ell n)}{ds} = \sigma$$

A number of points are worth noting. (30) is, of course, a special case of the familiar "Marshallian Rules" result. For AES, the number of firms is liable to rise and the expansion within each firm depends on the ex-post elasticity between capital and labour. For the MES, the outcome depends entirely on the ex-post substitution elasticity and the number of firms is bound to fall. Bearing these results in mind, we may now enquire as to what will happen if the number of firms is held constant. On the face of it, we obtain the following result for either the AES or the MES (note (27), (28) do not depend on  $\ell_0$ ).

$$(32) \quad \frac{d \log \ell}{ds} = \frac{|\epsilon_d| \sigma}{\beta\sigma + (1-\beta)|\epsilon_d|}$$

The problem is that under the MES, every firm in the industry is bound to be making losses, essentially because the subsidy induces a large increase in output and consequent fall in output price while providing very little money. This is why, of course, the number of firms contracts in the long run. Indeed, if  $\sigma$  is high enough, the AES can also lead to all firms making losses as well. The question then arises as to whether this will do as an adequate model of industry behaviour in response to a short term subsidy. On the face of it, the MES is marvellous because you may get an increase in employment for very little expenditure. This is something which it is hard to believe will come about in a closed economy. Let us, then, change the rules of the game slightly and

suppose that the firms in the industry are able to collude temporarily to avoid losses. So they forget individual profit maximization and impose (29). Under these circumstances we have

$$\text{AES: } \frac{d \log \ell}{ds} = |\epsilon_d|$$

$$\text{MES: } \frac{d \log \ell}{ds} = 0.$$

The marginal subsidy has no impact whatsoever and the impact of the average subsidy is unaffected by the elasticity of substitution. So, to summarise, if firms in a competitive industry in a closed economy collude, at least implicitly, to avoid making losses, a marginal employment subsidy will be useless and an average employment subsidy will have an effect which depends solely on the elasticity of industry demand for output except where the elasticity of substitution is small. In this case, the zero profit constraint will not bite and substitution possibilities will be advantageous (the RHS of (32) is increasing in  $\sigma$ ). Furthermore, only in this case will the employment subsidy hold any advantage in terms of expenditure per new job over a cut in taxes on output, say.

In a small open economy, the outlook is considerably brighter. In this case the output price is exogenous to the industry and equation (27) disappears. Under these circumstances it is easy to show, for a fixed number of firms, that

$$\frac{d \log \ell}{ds} = e_s / \epsilon_\ell$$

where  $e_s$  is the elasticity of supply and  $\epsilon_\ell$  is the elasticity of output with respect to employment. This result holds for both an MES and an AES and consequently it is in this case that the marginal employment subsidy really comes into its own. As a final point, (32) also holds for a monopoly irrespective of whether the subsidy is marginal or average.

To summarise this section, the crucial factor which determines the impact of a short term employment subsidy is the elasticity of demand for output and to a much lesser extent the elasticity of substitution. It follows from this that industries operating in a competitive world market should expand a lot, particularly, of course, if they have spare capacity. Furthermore, they only need a marginal subsidy which will dramatically reduce the expenditure per additional job. Such a subsidy would also do well on the balance of payments criterion. It must, however, be pointed out that in an international context this is rather a ruthless beggar-my-neighbour policy and any government introducing such a policy is courting the wrath of its trading partners. Having analysed what we might expect to happen in rather general terms it is perhaps worth commenting on how one might set about predicting the short run impact of a wage subsidy. If the wage subsidy is generally applied then an obvious approach is that taken in Hamermesh (1977) who breaks down the demand for labour into the substitution and output effects and uses estimates from the numerous available labour demand studies to compute the actual impact. For his middle range assumptions, he comes up with a total four quarter elasticity of labour demand with respect to the wage rate of 0.32 of which almost half (0.15) is due to the substitution between labour and other factors. In the light of our previous analysis, this estimate does seem rather high and perhaps it is worth looking a little more closely into how substitution elasticities are derived. Ignoring dynamics the standard procedure is to regress employment on output and relative prices over some time period. Since we know it to be the case that output per man rises in booms and falls in slumps and real wages and earnings tend to move pro-cyclically,<sup>20</sup> we know that employment relative to output will be low when real wages are high and vice-versa. This will, of course, imply a negative sign on the wage variable and this is then interpreted as reflecting the wage elasticity of demand for labour holding output constant. But it is not at

all clear that the time series regularity which produces the negative wage coefficient can possibly provide useful predictions about how the economy will behave in response to a wage subsidy. Apart from anything else, there is a fair amount of evidence, at least in the investment literature, that the putty-clay model is rather a good representation of reality.<sup>21</sup> If this is the case, there cannot possibly be much change in the capital-employment ratio in the short run. Hours may, of course, adjust but this is irrelevant to the issue at hand.

A further problem with this kind of methodology concerns the prediction of the output effect at least in that portion of the economy which operates in internationally competitive markets. The method used is to predict the effect of wage subsidies on output price, output price on output demand and output demand on employment. But in an internationally competitive market the output response is essentially a supply response and here one is concerned with the elasticity of output with respect to marginal cost. This is, of course, particularly important in open economies such as those of Western Europe. In the light of these problems, an alternative method of predicting the impact of temporary wage subsidies may be to ignore substitution effects entirely and concentrate on output effects separating the home market sector and the competitive foreign sector along the lines of Layard and Nickell (1978) in their discussion of the use of marginal employment subsidies in Britain.

#### The impact of the temporary employment subsidy

Having gone into the theory of short term wage subsidies at some length, we now return to see what happened in Britain after the temporary employment subsidy was introduced. To recapitulate, this subsidy was introduced in 1975

and by mid-1976 £20 per week was given to firms for a year for every worker who was kept on and who would otherwise have been made redundant. By the end of 1976 the numbers covered by the subsidy had risen to around 180,000 and has remained fairly stable since then.<sup>22</sup> The question may first be asked as to how many of these 180,000 represent additional employment. The first obvious problem is how does anyone know whether firms would have made employees redundant were the subsidy not available. Applications for the subsidy are rather carefully vetted and up to March 1977 some 20% of applications had been rejected. Nevertheless it seems likely that employment in subsidised establishments would not have fallen by the number of subsidised employees. The second problem concerns the number of jobs lost in firms in competition with subsidised firms who are not themselves in receipt of any subsidy. This is a question which is very difficult to answer. Since the subsidy is essentially of the marginal type, our theoretical discussion would lead us to expect most of the firms which take it up to be operating in internationally competitive markets. If this is the case then any jobs lost by competing firms are likely to be abroad. Remarkable confirmation of this prediction comes when we look at the industrial composition of TES recipients. This is set out in Table 11. Here we see that over 50% of the recipients are in only two industries, Textiles and Clothing and footwear, which are notorious for their international competitiveness and which employ less than 4% of the work force. In this respect TES has been rather too successful since the E.E.C. has recently forced Britain to modify the scheme as it became readily apparent that for some industries it was equivalent to a large export subsidy. In the light of our criteria, then, TES has been rather successful. In terms of budget deficit effects it has been very cheap to run for the subsidy per subsidised worker per year is £1,000 and even if only one half of these represent a true increase in employment, £2,000 per year is not a great deal more than the average annual cost of unemployment

TABLE 11

Temporary Employment Subsidy (August 18, 1975 - March 31, 1977)

Industry	Workers involved per period	Workers involved as % of total employment March 1977
Agriculture, forestry, fishing	1,492	.42
Mining and quarrying	1,861	.54
Food, drink, and tobacco	5,553	.80
Coal and petroleum products	230	.62
Chemicals and allied industries	2,681	.63
Metal manufacture	3,195	.67
Mechanical engineering	10,147	1.10
Instrument engineering	1,687	1.13
Electrical engineering	13,836	1.87
Shipbuilding & Marine engineering	4,064	2.32
Vehicles	5,116	.67
Metal goods	9,410	1.77
Textiles	52,864	10.92
Leather, leather goods, fur	3,473	8.47
Clothing, footwear	64,038	17.35
Bricks, pottery, glass, cement	4,904	1.89
Timber, furniture	7,164	2.74
Paper, printing, publishing	12,459	2.34
Other manufacturing industries	9,837	2.96
Construction	7,013	.57
Gas, electricity, water	20	.006
Transport, communication	1,443	.10
Distributive trades	5,832	.22
Insurance, banking, finance service	278	.03
Professional & scientific services	262	.007
Miscellaneous services	5,388	.24
	229,247	

Source: D.E. Gazette, March 1978, Table 103 and July 1977, p.293.



benefit plus the loss in taxes.<sup>23</sup> Furthermore, it has been extensively taken up in export and import competing industries so can hardly have failed to yield a boost for the balance of payments. Finally, being a flat rate policy, it was biased in favour of low wage workers (the average wage of the subsidised worker was £45 per week, well below the national average) and since these are heavily overrepresented among the unemployed, one would expect less wage pressure following a reduction in the level of unemployment of this particular group.

### Summary and Conclusions

We have been concerned, in this paper, with analysing certain changes in the relationship between the wages received by employees and firms' labour costs. In the first section we gave a theoretical analysis of the impact on employment patterns and unemployment of the recent increase in the difficulty and expense which firm's face if they wish to reduce their labour force. We concluded that for any given pattern of output demand, employment fluctuations would be reduced, hours fluctuations would increase, the inflow into unemployment would fall and the duration of unemployment spells and vacancies would rise. Empirical investigation revealed that the data is at least consistent with all these effects. We further discovered that, as a result of the ceteris paribus fall in the chances of an individual visiting a vacancy being offered and accepting a job, the equilibrium level of unemployment has risen by about 23 percent between 1970 and 1976 and that this has been offset by a reduction of some 3 per cent due to a ceteris paribus decline in the inflow into unemployment. This yields a net increase in equilibrium unemployment of about 20 per cent between 1970 and 1976 for the above reasons and at least some of this change can probably be attributed to increases in firing costs of one form or another.

In the second section we analysed the theory of short run employment policies which have a wage subsidy content. In particular we showed how their impact depends crucially on the extent to which industries in receipt of such subsidies operate in competitive international markets. This and other points were then illustrated in the context of the British Temporary Employment Subsidy which appears to have been rather successful in fulfilling its object.

### Footnotes

1. It is worth pointing out that in March 1978, some 2.4% of the Swedish work force was engaged in some form of subsidised training and that a further 1.2% was on relief work. These figures are far higher than in either West Germany or the United Kingdom.
2. These figures are taken from the Swedish Employers Confederation, SAF Document No. 160.
3. It is not clear why payroll taxes should affect the natural rate of unemployment except in so far as they are independent of hours worked. Under such circumstances it could be argued that there will be a tendency for individuals to work longer hours in work and take unemployment holidays.
4. See D.E. Gazette, June 1976, p.588.
5. Employers must also notify redundancies some considerable period in advance. For example 90 days notice is required for more than 100 redundancies and 60 days for more than 10.
6. Daniel and Stilgoe (1978), p.80, quote figures of between £500 and £1500 for legal costs.
7. The reason why this might be advantageous to both firms and workers has been discussed extensively in the literature on contract theory (Baily (1976) footnote 15 provides a bibliography). For our purposes it would not matter if this were not the case; the same essential result would ensue.
8. In Britain, firms' contributions to unemployment compensation are totally unrelated to their lay-off rate.
9. The following employer's quote from Daniel and Stilgoe (1978) p.72 gives the flavour of this argument. "Four years ago anyone with eyes and hands could walk in and get a job here. Now we are much more selective with aptitude tests, health tests, job references and so on. This has come about because of the difficulty of getting rid of unsuitable people."

10. To keep things simple we ignore the fact that  $D$  will itself depend on the hiring policy because any employee who is sacked in the future must be replaced using the same policy. This would clearly not affect our basic result.
11. This is, of course, a very partial result because the relative wages associated with different  $z$ 's will clearly change if there is some uniformity among employers concerning the relationship between characteristics and reliability. However, it is unlikely that relative wage changes will fully offset the effect.
12. The first two are taken from Hornstein and Tarling (1976), p. 6.
13. Details are, however, available from the author on request.
14. The conditions under which this is optimal are noted in Sims (1974), footnote 7.
15. The proportion of the flow into unemployment which is voluntary is only about 20%. See Metcalf and Nickell (1977), p.2, for details.
16. We also incorporated into  $a_t$  an adjustment for unregistered unemployment using the statistics published in the D.E. Gazette, July 1976, p. 714. Such an adjustment is feasible given the log linear form of (11) since a factor which multiplies  $U_t$  may be shifted to  $a_t$  with a consequent adjustment of the constant term.
17. There will of course be many other reasons why the equilibrium level of unemployment may have changed, for example, changes in labour force composition. These effects will then be additional to those estimated in the text.
18. We have not made any attempt to include in our equations dummy variables corresponding to the introduction of various pieces of legislation, partly

because there have been so many changes and partly because each new piece of legislation typically has an increasing impact over a very long period as individuals become aware of its significance. Indeed this combination of many legislative changes each having a gradually increasing effect will probably be most easily captured by using a simple time trend over the relevant period as we have in fact done.

19. With this sort of policy we must also, of course, take account of the fact that if we only subsidise the unskilled, say, the marginal relationship between output and employment will change. Baily and Tobin (1977) have a great deal to say about this type of policy.
20. The following quarterly regression for real basic wage rates  $(\frac{w}{p})$  regressed on output (y) was estimated for Britain ( 1956(1) - 1976(4) )  

$$\log(\frac{w}{p})_t = 0.54 + 0.079 \log y_t + 0.81 \log(\frac{w}{p})_{t-1} - 0.14 \log y_{t-1} + 0.0019 t$$

(1.02)                      (2.9)                      (1.8)                      (3.3)

indicating a weak impact elasticity of real wages with respect to output of 0.08. Real basic wage rates are not a very good measure of what is actually being paid, however, and the corresponding real earnings  $(\frac{e}{p})$  relationship is

$$\log(\frac{e}{p})_t = -0.001 + 0.39 \log y_t + 0.005t + u_t \quad (\text{serial correlation coefficient} = 0.28)$$

(7.9)                      (15.0)

demonstrating a very powerful positive impact elasticity. Real earnings are, however, naturally procyclically biased.
21. See, for example, Bischoff (1971) and Hausman (1972).
22. Information about the results of the TES is taken from the D.E. Gazette, July 1977 and March 1978. Layard (1978) has a rather more comprehensive discussion.
23. Although it should be borne in mind that nearly half of the subsidised workers are women and some married women are not entitled to unemployment compensation.

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