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Taxation and the Choice of Employment Policy

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Abstract: The costs of investment- and employment- subsidies as alternative job-creation policies for a small open economy with classical unemployment are compared, and the latter are shown to dominate in terms of the financing requirement as well as on standard efficiency grounds.

I INTRODUCTION

The cost-effectiveness of the IDA investment-subsidy programme has become the subject of widespread public comment in recent times, primarily as a result of the crisis in the public finances; explorations of this issue have inevitably tended, under present circumstances, to focus on comparisons with alternative policies also deemed capable of stimulating employment.

One such analysis, due to Hughes (1985, Chapter 2), concludes that a reduction in the employer PRSI contribution would in fact be a far more costly means of raising the demand for labour. A response by Fagan and Murphy (1986), however, noted amongst other things the difficulties inherent in carrying out a rigorous empirical comparison of these job-creation costs. A full treatment of the issue, they suggest, would require a model in which output, employment and the capital stock were jointly determined, a conclusion with which Hughes (1986) himself concurs.

*This paper presents some results that emerge from the larger research project outlined in Barry (1984) when the model is modified to accord more with Irish conditions and concerns. The helpful comments of this Journal's referees are gratefully acknowledged.

The present paper constructs a simplified two-period model of this type in order to bring forth some relevant theoretical insights into the choice of policy targets and the relative costs associated with the use of various instruments.[1] At this level of abstraction a comparison of the tax costs of employment creation through investment grants and payroll-tax reductions yields ambiguous results; the paper instead deals with a *marginal* employment subsidy, (MES), which is equivalent to a payroll-tax reduction for *new* jobs, as advocated by Layard and Nickell (1980) and Chiarella and Steinherr (1982).[2] This policy would appear to be the more appropriate one to compare with investment grants, which function as *marginal* capital subsidies.

The type of unemployment considered here is of the classical variety – it results from excessive labour costs (relative to productivity) rather than from aggregate demand deficiency.[3] Keynesian policies would be appropriate only under the latter circumstances [cf. Barry (1986)], under which the dominance of employment over investment subsidies is likely to be magnified, as argued in Barry (1987).

The modelling procedure followed here, in which the second-period wage is assumed to exceed its full-employment level, is designed to capture the effects of the emergence of "monopoly trade union" behaviour [cf. Oswald (1985)] or of the opening-up of labour mobility with a higher-wage economy, in which case emigration would take the place of unemployment.

The paper is organised as follows: the impact of the subsidy policies on a competitive firm's employment and investment decisions is analysed in the next section, and these results are then used to determine the optimal size of each subsidy from the standpoint of social efficiency. Section IV demonstrates the relative superiority of the marginal employment subsidy in terms both of the associated financing requirement and of the aggregate consumption stream available to the economy. The major points of the paper are summarised in the concluding section.

II BEHAVIOUR OF THE FIRM

It is necessary first to establish how the subsidies under consideration affect employment and investment decisions. Consider the two-period decision problem of a firm that produces and sells an internationally-traded good (which

1. The two-period model allows for intertemporal effects while affording greater analytical tractability than multi-period models. Razin (1984) includes an infinite-horizon extension of a two-period model of the type presented here to illustrate that the methods yield similar results.

2. Both sets of authors analyse the effects of an MES programme on economic behaviour, but ignore the efficiency issues which are central to the present discussion.

3. Bruno and Sachs (1985) and Coen and Hickman (1987) have found such "wage gaps" to be of importance in explaining the European unemployment experience of the 1970s and 1980s.

may also be used for investment purposes) at an internationally-determined price that, since it remains fixed throughout the analysis, may be normalised at a value of unity. As the paper is not concerned with Keynesian phenomena it is assumed that the firm can sell all it desires at this going price on world markets; this is the "one-sector small open economy" assumption.

The firm chooses levels of employment in each period, L_1 and L_2, and a second-period capital stock K_2 (where investment $I = K_2 - K_1$) in order to maximise P, the discounted stream of its profits:[4]

$$P = F(K_1,L_1) - I - \frac{bI^2}{K_1} - w_1L_1 + r[F(K_2,L_2) - w_2L_2]$$

$$+ rm[L_2 - \bar{L}_2] + g[I - \bar{I}] \qquad (1)$$

The firm's production function F(K,L) exhibits constant-returns-to-scale technology; r is the discount factor, which is one over one plus the world interest rate, because of international capital mobility, and the bI^2/K_1 term represents a rising marginal cost of adjusting the capital stock, as in Lucas (1967); this serves to make the level of the capital stock determinate.[5]

As is usually the case, labour is treated as an instantaneously variable factor while the capital stock may be changed only over time, through investment. In order to be able to rigorously compare the two policies therefore, first-period investment grants which affect the capital stock and the level of employment only in the second period will be compared with second-period employment subsidies. Accordingly, the current wage w_1 is assumed to be set at its full-employment level while a wage contract sets future wages w_2 at a level which in the absence of government intervention would generate unemployment in that period.[6]

The policies to be considered are a capital grant g per unit of investment above a benchmark level $\bar{I}$, this level being the amount of investment that would have occurred in the non-intervention case; and a grant m per worker employed in the second period above the non-intervention benchmark level

4. Allowing for depreciation of capital equipment simply clutters up the algebra without affecting any qualitative results.

5. The long-run capital stock would be determinate even in the absence of adjustment costs if the technology exhibited decreasing returns to scale.

6. The assumption that wages are unaffected by the introduction of subsidy programmes implies that their entire incidence falls on the firm. This would be the case, for example, if the elasticity of labour demand were constant and wages were set by a monopoly trade union. (See Bruno and Sachs, 1985, pp. 190-193.) It is shown in an appendix that the qualitative conclusions of this paper are unaffected by the adoption of a more complex wage specification which allows for some shifting of incidence.

$\bar{L}_2$. (Perfect foresight over these non-intervention levels is assumed.) The final two terms in (1) therefore represent the discounted value to the firm of the government subsidies.

The first-order conditions resulting from this maximisation problem are:

$$F_{L1} = w_1 \tag{2}$$

$$F_{L2} = w_2 - m \tag{3}$$

and

$$rF_{K2} = 1 + \frac{2bI}{K_1} - g \tag{4}$$

Equations (2) and (3) are the familiar equalities between the value of the marginal product of labour and the cost of labour in each period; the marginal employment subsidy, by reducing the cost of labour in the second period, raises the labour-intensity of production. Equation (4) represents the condition of equality between the marginal benefit and the marginal cost of investment, the latter of course being reduced by the investment grant. From this equation is derived the investment function:[7]

$$I = \frac{1}{2b}\left[rF_{K2} + g - 1\right]K_1 .$$

The following effects of the subsidies may be found from Equations (2)-(4) by taking into account the fact that under constant returns to scale the marginal products of labour and of capital, F_L and F_K, are functions only of the capital-labour ratio:

$$\frac{dK_2}{dm} = \frac{1}{2b} rL_1 \tag{5}$$

$$\frac{dL_2}{dm} = \frac{L_1}{K_1}\left(\frac{dK_2}{dm} + \frac{L_1}{F'_L}\right) \tag{6}$$

$$\frac{dK_2}{dg} = \frac{1}{2b} K_1 \tag{7}$$

$$\frac{dL_2}{dg} = \frac{dK_2}{dg}\,\frac{L_1}{K_1} \tag{8}$$

7. Investment behaviour in the presence of the capital-adjustment costs assumed here is exactly equivalent to that emerging from a "Tobin's-q" framework. [Cf. Bailey and Scarth (1980)].

where F'_L (> 0) is the derivative of the marginal product of labour with respect to the capital-labour ratio. The derivatives in Equations (5)-(8) express the changes between periods 1 and 2 that are attributable solely to policy.

The investment grant, it may be noted, does not affect the firm's capital-labour ratio; by raising investment it raises second-period employment. The wage subsidy lowers the capital-labour ratio, and by raising the marginal product of capital also stimulates investment.

It can immediately be derived that labour-subsidisation is the more tax-efficient means of stimulating employment. To see this, let $\tilde{g}$ and $\tilde{m}$ be subsidy levels that generate equal increases in employment: $\frac{dL}{dg}\tilde{g} = \frac{dL}{dm}\tilde{m}$. The (linearised) tax cost of $\tilde{g}$ is $\tilde{g}\left[\frac{dK}{dg}\tilde{g}\right] = \tilde{g}\frac{K}{L}\left[\frac{dL}{dg}\tilde{g}\right] = \tilde{g}\frac{K}{L}\left[\frac{dL}{dm}\tilde{m}\right]$ while the discounted tax cost of $\tilde{m}$ is $r\tilde{m}\ \frac{dL}{dm}\tilde{m}$. Therefore $\tilde{g}$ costs more in terms of taxation if $\tilde{g}\frac{K}{L}\left(= \frac{K}{L}\frac{dL}{dm}\tilde{m}/\frac{dL}{dg}\right) > r\tilde{m}$; i.e. if $\frac{K}{L}\frac{dL}{dm} > r\frac{dL}{dg}$. From Equations (5)-(8) this is clearly seen to be the case.

The implication of this result is illustrated in Figure 1, where the curves gg and mm depict the relationship between any level of employment and the taxation required to generate it through use of the policy instruments g and m, respectively. The result indicates that the curve associated with investment subsidisation is the more steeply sloped of the two.

III SOCIAL EFFICIENCY

The social welfare of the community is assumed to depend on consumption levels over both periods less the disutility of work:

$$C_1 - \gamma L_1 + r[C_2 - \gamma L_2]$$

where the constant term γ is the representative worker's valuation of the disutility associated with the work week (the number of hours in the work week is assumed constant across periods), and where the time preference rate has been assumed equal to the world interest rate. With the economy in full equilibrium in period 1, the disutility of labour is equal to the full employment wage w_1.

The distortionary effects of taxation have not yet been taken into account. Rather than deriving an unwieldy taxonomy of results which depend on the precise tax instruments used,[8] the general principles of the case can be seen

8. As a referee points out, all tax instruments should ideally be included; the optimal solution would then be to equalise the marginal distortion cost of each instrument employed.

most easily by noting that the overall efficiency loss (i.e., the area of the "Harberger triangle") will, in linear models of the type presented here, depend quadratically on the tax rate, t, required to finance the subsidy policies.[9] This tax rate in return will be an increasing function, t(T), of the discounted value of the amount to be spent under the various subsidy programmes.

With total consumption equal to total production less investment and adjustment costs, i.e.,

$$C_1 + rC_2 = F(K_1, L_1) + rF(K_2, L_2) - I - \frac{bI^2}{K_1}$$

the decision problem of the government is to maximise

$$U = F(K_1, L_1) - \gamma L_1 + r[F(K_2, L_2) - \gamma L_2] - I - \frac{bI^2}{K_1} - at(T) \qquad (9)$$

where a is a positive weighting factor, while

$$T = rm^* [L_2 (m^*) - \bar{L}_2] \equiv T_m \qquad (10)$$

for an employment subsidy scheme in which the subsidy is set at its optimal value m*, thereby generating an employment level L_2 (m*), and where

$$T = g^* [K_2 (g^*) - \bar{K}_2] \equiv T_g, \qquad (11)$$

for the investment subsidy policy.

The optimal level of the marginal employment subsidy is found by maximising social welfare (9) with respect to the policy instrument m, subject to the appropriate tax costs (10) and the relevant private sector reaction embodied in Equations (2)-(4). This procedure yields:

$$m^* = A(m^*)^{-1} [w_2 - w_1] \qquad (12)$$

where $A(m^*) = 1 + 4at(T_m)\, t'(T_m)$, and $t'(T) > 0$ is the first derivative of t(T).

Several points emerge from Equation (12): full employment is an appropriate target only when non-distortionary taxation is available, since in this case the loss function term *a* is zero and the optimal subsidy completely bridges the gap between the excessive wage agreement w_2 and the full employment wage w_1. The greater the distortionary effects of taxation, the lower the level

9. For an economy characterised by an upward-sloping supply function and a horizontal demand curve, for example, the area of the efficiency loss associated with taxation is $\eta_s t^2 Y/2p^*$ where η_s is the elasticity of supply, Y is initial output, p* the consumer price, and t the tax rate.

of employment that the government should attempt to create. In the extreme case, for very large values of *a*, intervention of this type is undesirable.[10]

If investment rather than employment is subsidised, social welfare must be maximised with respect to g, subject to Equations (2)-(4) and (11), which reveals that the optimal investment subsidy is:

$$g^* = A(g^*)^{-1} \; r\frac{L_1}{K_1}[w_2 - w_1] \tag{13}$$

where $A(g^*) = 1 + 4at(T_g)\, t'(T_g)$.

What can be determined about the levels of employment and investment generated when each policy instrument in turn is set at its optimal level? From Equations (12) and (13) it is clear that:

$$g^* A(g^*) = r\, L/K\, m^* A(m^*) \tag{14}$$

If g* were to equal r L/K m* it may easily be seen, by substituting in the values of T_g and T_m and noting from Equations (5) and (7) that g*dK/dg would in this case equal m*dK/dm, that A(m*) would exceed A(g*). Therefore g* must be greater than r L/K m* for Equation (14) to hold.

This reveals, therefore, that the amount of investment generated by an investment subsidy when set at its optimal level is greater than that generated by the optimal employment subsidy, while the amount of taxation which it is efficient to raise (and spend) is greater when it is employment that is being subsidised.

Since it has already been demonstrated at the end of Section II that the latter policy is more tax-efficient in job creation, this implies that if both subsidies were set at their optimal levels more employment would be stimulated under the marginal employment subsidy (MES) policy.

IV COMPARISON OF POLICIES

The welfare effects of the two policies can now be compared. The increase in social welfare resulting from the introduction of a marginal employment subsidy of size m* may be measured by the difference between the resulting welfare level U(m*) and the welfare level that would prevail in the absence of policy intervention, $\bar{U}$. Taking a Maclaurin series expansion and linearising, this difference is approximated by m* dU/dm where the derivative is measured at the initial point m=g=o.

10. Honohan and Irvine (1987) conclude that the marginal social cost of taxation in Ireland is extremely high, so *a* may be expected to be large. This strengthens the argument in favour of payroll-tax reductions as opposed to subsidies of either type, and further increases the desirability of altering the rules that allow union-employer bargaining to generate inefficient outcomes.

Employing Equations (2)-(6), (9), (10) and (12) we find

$$U(m^*) - \bar{U} = m^* \frac{dL_2}{dm} r[w_2 - w_1] \tag{15}$$

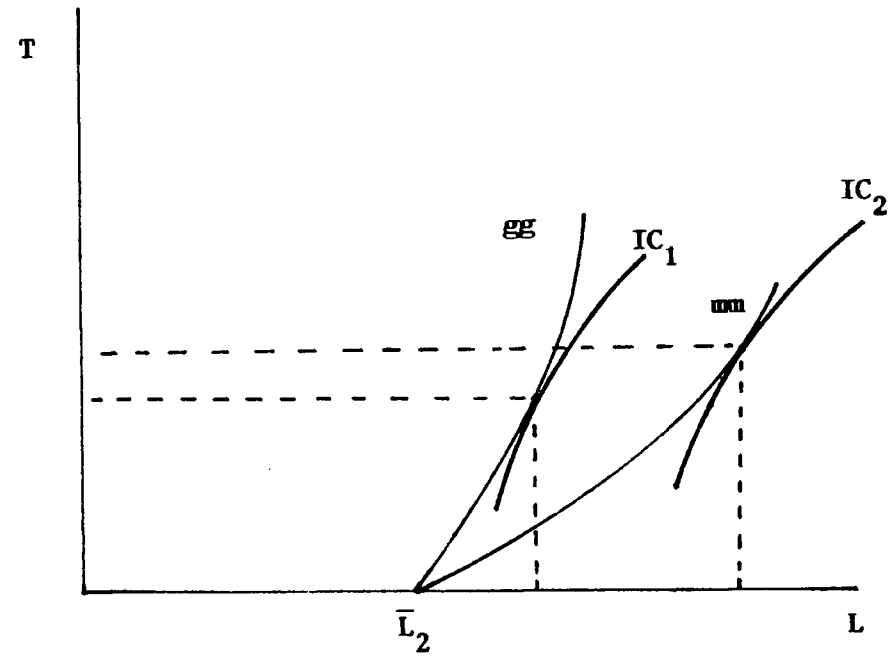
while the welfare effects of investment subsidies are found in an equivalent manner as

$$U(g^*) - \bar{U} = g^* \frac{dL_2}{dg} r[w_2 - w_1] \tag{16}$$

These equations reveal that the relative welfare effects of the two policy instruments depend only on the differential levels of employment generated when each subsidy is set at its optimal level. From the results of the previous section, it is clear that L(m*) is greater than L(g*) and the employment subsidy is therefore the more socially efficient of the two policies.

This result is summarised in Figure 1 where the tangency points between two social indifference curves and the feasibility curves discussed earlier are illustrated. Since there is a welfare trade-off between consumption and taxation, a greater level of taxation is acceptable when the more efficient policy instrument is used.

Figure 1: *The tax cost of employment creation under alternative policy instruments*



V CONCLUDING COMMENTS

In comparing the use of investment grants and marginal employment subsidies (MES) the following points have been made:

(i) The level of employment which it is optimal to generate depends on the policy instrument adopted.[11]

(ii) The optimal target level of employment is reduced when account is taken of the burden associated with financing the subsidy programmes.

(iii) For classical unemployment, the MES policy dominates the investment-grants programme in the following ways:

  (a) The increase in social welfare attainable with MES is greater than that associated with the alternative policy.

  (b) For any given level of tax revenue the MES is capable of generating a higher level of employment.

  (c) For any target level of employment creation the MES is less costly in terms both of the financing requirement and of aggregate consumption forgone.

Essentially what has been shown is that the implication of the standard theory of optimal intervention, i.e., that the optimal subsidy policy is that which treats the distortion at source, remains valid, as Corden (1974) speculated, in the "second-best" situation in which financing requirements must be taken into account.

It has been argued in an earlier paper, Barry (1987), that the dominance of labour subsidies over investment grants is even greater if unemployment is of the Keynesian type. This strengthens some of the arguments of Ruane (1987), for example, who adopts the Kennedy-Dowling (1975) "deficient-demand" interpretation of the 1950s recession in Ireland, while basing her discussion of employment- and investment-subsidies on non-Keynesian micro-foundations.

Finally, therefore, it is worthwhile to consider the influential view of those who hold that slow employment growth is the product of a weak industrial structure whose adjustment to external shocks is severely constrained by the existence of barriers to entry [cf. NESC (1982)]. This would imply that these are the major distortions to be tackled; investment grants are sub-optimal in this case also.

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11. Distributional issues have been ignored in the formulation of the social welfare function adopted in the text. Their inclusion would also presumably affect the government's target level of employment.

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APPENDIX

It is assumed in the text that wage demands are unaffected by the introduction and impact of the government subsidy programmes. It may be more realistic, however, to specify the second-period wage demand as an increasing

function of the level of employment. Under these circumstances, policies which increase the demand for labour also raise wages and the subsidies are shifted to some extent on to employees.

The purpose of this appendix is to explore the implications of this more complex specification.

The second-period wage now becomes

$w_2 = w_2 (L_2)$, with w', the first derivate of the wage function, > 0.

The equations in the text are amended in the following way:

$$F_{L2} = w_2 + L_2 w' - m \tag{3'}$$

$$dL_2/dm = B^{-1} \left[1 + F'_L \frac{1}{2b} r\right] \tag{6'}$$

$$dK_2/dg = B^{-1} \frac{1}{2b} K\left[2w' + \frac{K}{L}\frac{F'_L}{L}\right] \tag{7'}$$

$$dL_2/dg = C^{-1} F'_L/L \, dK_2/dg \tag{8'}$$

where $B = 2w' + \frac{K}{L}\frac{F'_L}{L} + \frac{1}{b} r w' F'_L$

$$C = 2w' + \frac{K}{L} F'_L/L$$

and $F'_L > 0$ is the first derivative of the marginal product of labour with respect to the capital-labour ratio.

The optimal level of the two policy instruments are:

$$m^* = A(m^*)^{-1} [w_2 + L_2 w' - w_1] \tag{12'}$$

and

$$g^* = A(g^*)^{-1} C^{-1} r\frac{F'_L}{L} [w_2 + L_2 w' - w_1] \tag{13'}$$

Using the methods employed in the text it is again clear that the labour subsidy generates more employment than the investment subsidy when each is set at its most efficient level, and that the former again dominates in terms of its ability to raise social welfare.

Allowing for the possibility of subsidy and tax-shifting between employers and employees does not therefore affect the policy hierarchy. The employment effects identified in the main text serve as a crude measure of employees' ability to reap wage increases in this fuller model in which lesser employment effects occur alongside wage gains.