Employment Subsidies and the Behavior of the Firm

Bertil Holmlund

1. INTRODUCTION

The simultaneity of high rates of inflation and unemployment during the seventies has increased the interest in selective employment policies as means to reduce unemployment without increasing inflation. The experiences of large regional unemployment differentials have reinforced this interest. Numerous Western governments have undertaken various programmes of employment subsidization, e.g. the United States, Sweden, the United Kingdom, the Federal Republic of Germany, Belgium, France, the Netherlands and Norway. Among the programs considered are marginal employment subsidies (MES) in which subsidies are payed only for increases in employment.

Marginal employment subsidies may be constructed in a variety of ways. Distinctions can e.g. be made between temporary and permanent schemes as well as between programs focusing on net changes versus gross flows of employment. A large number of different subsidy bases might be used, e.g. the total increase in employment, the increase above a specific threshold or the increase in the firm's wage bill. The programs in operation are characterized by great differences concerning their main goals (preventing layoffs versus fostering hirings), the choice of subsidy base and employer and employee eligibility requirements. The British Temporary Employment Subsidy from 1975 is e.g. intended to be job preserving rather than job creating, whereas the Swedish recruitment subsidies introduced in 1978 are stimulating hirings.[1]

The purpose of the present paper is to elucidate how marginal employment subsidies will affect the behavior of a profit-maximizing firm. Capital and labor are not considered completely variable but adjustable at cost. Two different institutional settings are analyzed, a fixwage regime and a flexwage regime. The firm in the first regime is unable to control its wage and is facing nonwage recruitment costs only. The firm in the flexwage world, on the other hand, can influence the supply of labor to itself by its wage choice. An increase in hirings--or a decrease in quits--will thus be associated with adjustment costs in terms of wage increases. Section 2 contains an analysis of the fixwage regime, whereas section 3 deals with the case of dynamic monopsony. The interest is concentrated on employment subsidies; we are, however, also illuminating certain effects of investment subsidies ("marginal capital subsidies").

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[1] The references contain a list of earlier theoretical, empirical and policy-oriented investigations of employment subsidy schemes.

2. EMPLOYMENT SUBSIDIES UNDER A FIXWAGE REGIME

2.1 Basic Assumptions

Consider a competitive firm producing its output according to the production function $Q = f(K,N)$ homogeneous of degree one. Capital and labor are by assumption quasi-fixed factors; changes in the factors are thus associated with positive costs of adjustment. The analysis is confined to a case with purely external adjustment costs, implying that investment and recruitment of labor have no effects per se on the production activities of the firm. The adjustment cost functions have conventional convexity properties, i.e.

$$C_I > 0 \qquad C_{II} > 0 \tag{1}$$

$$C_A > 0 \qquad C_{AA} > 0, \tag{2}$$

where I is gross investment and A the number of new hires. The rationale for imposing costs associated with capital adjustment has been dealt with in investment literature and will not be discussed in this paper.[1] Current investment costs are in our formulation of two kinds: expenditures for buying capital goods, mI, where m is the (fixed) price of capital goods, and installation costs, C(I), independent in size of the price of the machines.

The assumption of rising marginal recruitment costs has intuitive appeal and might have different sources. In the first place, the costs associated with search for new workers are positive and

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[1] See e.g. Gould (1968).

probably rising at the margin due to the dispersion in space of job seekers. Secondly, the firm will have to provide each new employee with some firm-specific training and the marginal costs for this conversion of "raw" labor into "productive" labor is likely to rise with the number of hirings due to crowding.[1] The analysis will be confined to the behavior of the <u>recruiting</u> firm, thus disregarding layoffs. By assuming homogeneous labor, the possibility of simultaneous hirings and firings is ruled out. The variable A might, however, be reinterpreted as layoffs when $A<0$. Retaining the assumption of convex adjustment costs, the latter interpretation implies $C_A<0$ and $C_{AA}>0$. The realism of separation costs should be obvious; the rationale for their convexity seems perhaps more questionable. Somewhat tentatively, it might be argued that firing costs are rising at the margin due to increasing administrative burdens and overtime requirements within the personnel department.

The problem facing the firm is to maximize its discounted cash flow net of taxes (T) and subsidies (S_N, S_K), i.e.

$$\max\ V=\int_0^\infty e^{-rt}[pQ(K,N)-wN-C(A)-mI-C(I)-T+S_N+S_K]dt \tag{3}$$

subject to the constraints

$$\dot{N} = A - qN \tag{4}$$

$$\dot{K} = I - \delta K, \tag{5}$$

[1] In passing, it might be noted that Edmund Phelps assumes convex recruitment costs in his derivation of the Phillips curve. See Phelps (1971).

where q is the quit rate and δ the rate of depreciation, both exogenously given.

It is assumed that the profit tax is charged at the rate τ on gross income less pure wage costs, hiring costs and costs of installation of capital goods. Moreover, a fraction h of the depreciation $m\delta K$ is deductible. Employment and investment subsidies are included in the tax base. The tax function is

$$T = \tau[pQ - wN - C(A) - C(I) - hm\delta K + S_N + S_K] \qquad (6)$$

where S_N is the amount of employment subsidies and S_K the amount of investment subsidies. The analysis will be restricted to permanent subsidy schemes of the type $S=s\cdot B$, where S is the amount of the subsidy, s the subsidy rate and B the subsidy base. Programmes using net employment changes as base will be distinguished from schemes aimed at subsidizing gross employment changes. A mixed variant will include a threshold. The different possibilities are summarized in the formula

$$S_N = s_1[A-k_1N] = s_1[\dot{N} + (q-k_1)N] \qquad (7)$$

where k_1 is the threshold; $k_1=q$ implies net growth in employment as subsidy base. The subsidy is assumed symmetric, holding for both increases and decreases in employment. Employment reductions will thus be punished by lower subsidies or higher taxes.[1] The scheme described provides the policy-

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[1] Non-symmetric MES-programmes (i.e., $s_1 = 0$ for $\dot{N} < 0$) could be destabilizing as they might create incentives for employment speculation, i.e. exces-

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maker with two different instruments, the subsidy rate and the threshold. The investment subsidy--or investment tax--is analogously written as

$$S_K = s_2[I-k_2K] = s_2[\dot{K} + (\delta-k_2)K] \tag{8}$$

where s_2 is the subsidy rate and k_2 the capital threshold; $k_2=0$ implies e.g. subsidization of gross investment.

2.2 Properties of the optimal employment and investment policy

The firm has two control variables at its disposal, hirings (A) and investment (I). The Hamiltonian is:

$$H = e^{-rt}[pQ-wN-C(A)-mI-C(I)-T+S_N+S_K+\lambda_1\dot{N}+\lambda_2\dot{K}] \tag{9}$$

where λ_1 and λ_2 are costate variables interpretable as marginal revenues associated with increases in employment and capital. Necessary conditions for optimum are

$$\lambda_1 = (1-\tau)(C_A-s_1), \tag{10}$$

$$\lambda_2 = m + (1-\tau)(C_I-s_2). \tag{11}$$

Cont.

sive employment reductions in a recession in order to obtain eligibility for subsidies during a recovery. This observation would be one rationale for applying some kind of symmetric schemes, intended to shift the adjustment cost function for employment increases as well as employment reductions.

The interpretation of (10) is the following: Along an optimal path, the value of increases in employment should equal the (net) marginal hiring cost. This hiring cost is reduced by a higher employment subsidy and by a higher profit tax (since recruitment outlays are deductible). The interpretation of (11) is analogous; the value of increases in the stock of capital should equal the marginal investment cost, net of taxes and subsidies.

Additional necessary conditions for maximum are:

$$-\frac{\partial H}{\partial N} = e^{-rt}[\dot{\lambda}_1-\lambda_1 r], \tag{12}$$

$$-\frac{\partial H}{\partial K} = e^{-rt}[\dot{\lambda}_2-\lambda_2 r], \tag{13}$$

implying

$$\lambda_1(q+r)-\dot{\lambda}_1 = (1-\tau)(pQ_N-w-s_1k_1), \tag{14}$$

$$\lambda_2(\delta+r)-\dot{\lambda}_2 = (1-\tau)(pQ_K-s_2k_2)+\tau hm\delta. \tag{15}$$

Focusing on the stationary solution $(\dot{\lambda}_1=\dot{\lambda}_2=0)$ we have from Eq. (14) and Eq. (10)

$$\frac{(1-\tau)(pQ_N-w-s_1k_1)}{q+r} = (1-\tau)(C_A-s_1) \tag{16}$$

and from (15) and (11)

$$\frac{(1-\tau)(pQ_K-s_2k_2)+\tau hm\delta}{\delta+r} = (1-\tau)(C_I-s_2)+m. \tag{17}$$

The numerator in (16) is the net cash flow obtained by adding a new worker to the firm's labor force. In equilibrium the present value of increasing employment equals the marginal hiring cost. The L.H.S. of (16) expresses the expected capital value of hiring a worker with the quit-probability q. A higher marginal employment subsidy will decrease this present value (through the negative term s_1k_1). The reason is that the MES-scheme investigated is equivalent to a tax on a fraction of the firm's labor force as well as a hiring subsidy. Consider e.g. a pure net employment subsidy, i.e. $k_1 = q$. The product s_1k_1 $(=s_1q)$ is then interpretable as the expected quit tax.

Rearranging Eq. (16) and Eq. (17) gives the marginal productivity conditions for labor and capital:

$$pQ_N = w + s_1k_1 + [C_A - s_1][q+r], \tag{18}$$

$$pQ_K = \frac{m(\delta+r)}{1-\tau} - \frac{\tau hm\delta}{1-\tau} + s_2k_2 + [C_I - s_2][\delta+r] \tag{19}$$

The marginal revenue product is higher than the nominal wage, the difference consisting--in the first place--of the subsidy rate times the threshold (the "tax element" of the subsidy scheme). Secondly, the firm will recover a proportion q of the net hiring costs, thereby recovering 100 per cent in the long run for the average employee (whose expected length of employment is 1/q). Finally, the firm will recover imputed interest on its hiring investments, $r[C_A - s_1]$.

The R.H.S. of Eq. (18) --the implicit rental value of labor services-- will decrease with a higher subsidy, provided that the inequality $q+r-k_1>0$ holds; the effect is unambiguous in the pure net employment subsidy scheme $(q=k_1)$ and is reinforced by a higher rate of interest. Similar arguments hold for the rental value of capital services, the R.H.S. of Eq. (19). Capital costs are, however, also affected by the tax on profits.

2.3 Comparative Statics

Consider the stationary solution to the four differential equations (4), (5), (14) and (15). By differentiating the system the determinant

$$D = \begin{vmatrix} pQ_{NN} & pQ_{KN} & -(q+r)C_{AA} & 0 \\ (1-\tau)pQ_{KN} & (1-\tau)pQ_{KK} & 0 & -(1-\tau)(\delta+r)C_{II} \\ -q & 0 & 1 & 0 \\ 0 & -\delta & 0 & 1 \end{vmatrix} > 0 \qquad (20)$$

is obtained. The results of the comparative statics, pursued by solving the differentiated equations by Cramer's rule, are summarized in Table 1.

Table 1.

Parameter increased	Affected endogenous variable N	K	A	I
p	+	+	+	+
w	−	−	−	−
r	−	−	−	−
q	−	−	−	−
δ	−	−	−	−
m	−	−	−	−
τ	−	−	−	−
h	+	+	+	+
s_1	?	?	?	?
k_1	−	−	−	−
s_2	?	?	?	?
k_2	−	−	−	−

Some conclusions emerge from the exercises:

1. An increase in the product price (or a decreasing wage rate) will increase both capital and labor in stationary equilibrium.
2. A higher rate of interest will decrease the equilibrium size of the firm. The same result appears for increases in the quit rate (q), the rate of depreciation of capital (δ) and the price of capital goods (m).
3. A higher tax on profits will decrease the demand for both capital and labor in stationary equilibrium. This effect is due to the assumed tax treatment of "pure" investment outlays, mI (not deductible). More generous treatment of depreciation (a higher h) will, on the other hand, increase the stationary size of the firm (through the resulting decrease in the rental price of capital).
4. A higher employment subsidy threshold (k_1) will reduce the demand for labor but also the demand for capital. The scale effect swamps the substitution effect. A higher investment subsidy threshold (k_2) will, analogously, discourage capital formation but also, through the scale effect, reduce the demand for labor.

Now consider the marginal employment subsidy. We obtain

$$\frac{\partial N}{\partial s_1} = \frac{(q+r-k_1)(1-\tau)[\delta(\delta+r)C_{II}-pQ_{KK}]}{D} \tag{21}$$

$$\frac{\partial A}{\partial s_1} = \frac{(q+r-k_1)(1-\tau)[\delta(\delta+r)C_{II}-pQ_{KK}]q}{D} \tag{22}$$

$$\frac{\partial K}{\partial s_1} = \frac{(q+r-k_1)(1-\tau)pQ_{KN}}{D} \tag{23}$$

$$\frac{\partial I}{\partial s_1} = \frac{(q+r-k_1)(1-\tau)\delta pQ_{KN}}{D} \tag{24}$$

The signs hinge on the expression $(q+r-k_1)$. If the threshold is located at $\dot{N} = 0$ (i.e. $k_1 = q$), the signs are unambiguously positive.

A pure hiring subsidy $(k_1=0)$ will foster both employment and investment. It is interesting to note the existence of the special case $q<k_1<q+r$, where a higher subsidy will increase employment even if the threshold implies a tax in stationary equilibrium.

Consider, finally, the investment subsidy. We obtain

$$\frac{\partial N}{\partial s_2} = \frac{(\delta+r-k_2)(1-\tau)pQ_{KN}}{D} \tag{25}$$

$$\frac{\partial A}{\partial s_2} = \frac{(\delta+r-k_2)(1-\tau)qpQ_{KN}}{D} \tag{26}$$

$$\frac{\delta K}{\partial s_2} = \frac{(\delta+r-k_2)(1-\tau)\left[q(q+r)C_{AA}-pQ_{NN}\right]}{D} \tag{27}$$

$$\frac{\partial I}{\partial s_2} = \frac{(\delta+r-k_2)(1-\tau)\left[q(q+r)C_{AA}-pQ_{NN}\right]\delta}{D} \tag{28}$$

stating that a rising subsidy will increase employment provided that it increases the demand for capital, i.e. if the inequality $\delta+r-k_2>0$ holds.

The signs are unambiguous for a net investment subsidy $(k_2=\delta)$ and for a pure gross investment subsidy. Also in perfect symmetry with the employment subsidy, a special case appears when a rising investment "tax" increases the demand for capital (if $\delta<k_2<\delta+r$).

2.4 Comparative Dynamics

In the preceding section we have investigated how the stationary equilibrium of the firm will be affected by changes in different parameters. We now turn to the instantaneous effects of changes in the parameters, restricting ourselves to the employment subsidy rate and the threshold. Is it necessarily true that (e.g.) a lower threshold--implying a higher equilibrium level of employment --will produce an instantaneous increase in hirings irrespective of where on its path the firm is located? In order to simplify the analysis, the stock of capital is assumed to be fixed.

Consider a phase diagram in the (A,N)-space (Figure 1). The differential equation for hirings, obtained from (10) and (14), is

$$\dot{A} = \frac{C_A(q+r) - pQ_N + w + s_1(k_1-q-r)}{C_{AA}}. \tag{29}$$

Implicit differentiation of (29), conditional upon $\dot{A}=0$, establishes a negative slope for the $\dot{A}=0$ line.[1] By differentiating $\dot{N}=A-qN$ for $\dot{N}=0$ we find

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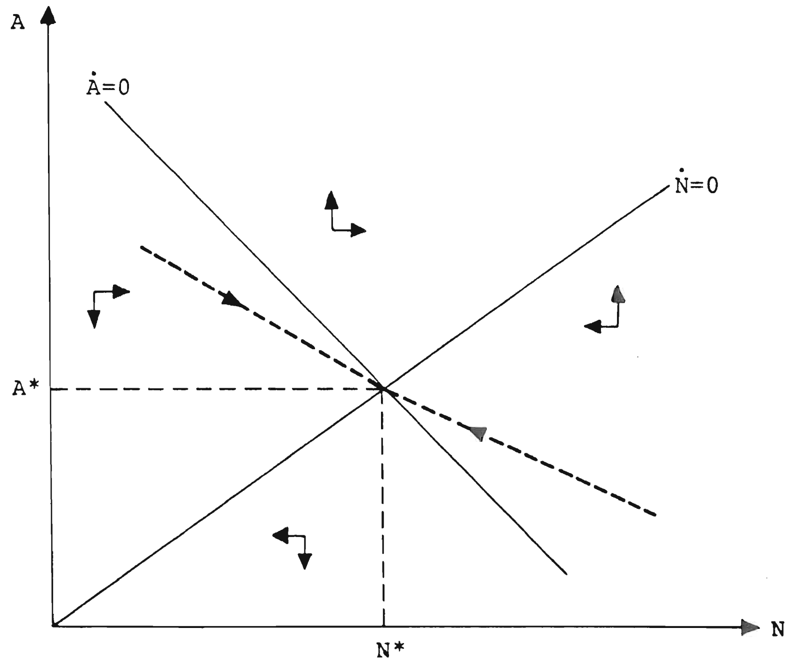
1 $$\left.\frac{\partial A}{\partial N}\right|_{\dot{A}=0} = \frac{pQ_{NN}}{C_{AA}(q+r)} < 0.$$

Figure 1.



a positive slope for the $\dot{N}=0$ line. The nonlinear system can be analyzed in a local region about the stationary solution (obtained as the intersection of the curves $\dot{A}=0$ and $\dot{N}=0$). It can be shown that the equilibrium is a saddle; hence there exists a unique optimal recruitment policy for the firm (the heavy arrows). Starting from an arbitrary point $N_0<N^*$ the firm will approach equilibrium by accessions which decrease over time. If employment reductions are called for, it is optimal to start with a low number of hirings and increase recruitments over time. The model thus implies "employment smoothing" as an optimal response to demand changes.

The slope of the optimal path is

$$y = \frac{\partial A}{\partial N} = \frac{\dot{A}}{\dot{N}} = \frac{C_A(q+r) - pQ_N + w + s_1(k_1-q-r)}{C_{AA}(A-qN)} \qquad (30)$$

If a change in a parameter is increasing the equilibrium employment level the instantaneous effect on hirings will also be positive, provided that the new path is everywhere above the old one. In a hypothetical point of intersection between the paths, the slope of the new path must be less steep than the slope of the old one (for $\dot{N} > 0$).

Differentiating (30) with respect to the subsidy rate and the threshold gives

$$\frac{\partial y}{\partial s_1} = \frac{k_1-q-r}{C_{AA}(A-qN)} \lesseqgtr 0 \text{ as } \dot{N} \gtrless 0 \text{ (if } q+r>k_1) \qquad (31)$$

$$\frac{\partial y}{\partial k_1} = \frac{s_1}{C_{AA}(A-qN)} \lesseqgtr 0 \text{ as } \dot{N} \gtrless 0. \qquad (32)$$

The slope of the optimal path is steeper for $\dot{N} > 0$ after an increase in the subsidy rate (if $k_1<q+r$ holds, implying a higher stationary level of employment). Thus no intersection occurs in that region. Likewise, no intersection between the paths can occur in the region $\dot{N} < 0$. It follows that a higher subsidy will induce an instantaneous increase in hirings (Figure 2) irrespective of the firm's actual employment level.[1] By similar arguments it can be shown that a higher threshold always will decrease hirings.

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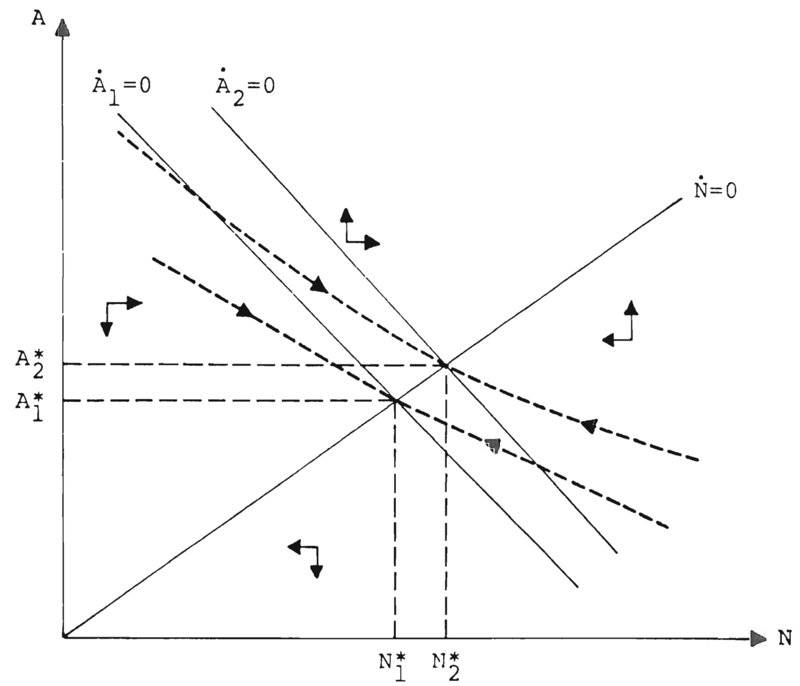
[1] Disregarding the case $k_1>q+r$.

Figure 2.



The special case appears when $q<k_1<q+r$; a higher subsidy will then produce an instantaneous increase in hirings and a switch to a new growth-path aiming at a higher stationary equilibrium with a higher employment tax; the negative subsidy is $S_N = s_1(q-k_1)N$ for $\dot{N} = 0$. This possibility--not easy to discover within a static framework--hinges on the fact that the firm is balancing two opposing forces: the subsidies (taxes) possible to get (avoid) during the adjustment process versus the employment tax in steady state.

3. EMPLOYMENT SUBSIDIES UNDER DYNAMIC MONOPSONY

3.1 Assumptions

The preceding model has treated the quit rate and the wage rate as exogenously given to the firm. We now relax these assumptions by making both quits and new hires dependent on the wage choice of the firm. The differential equation describing employment growth is

$$\dot{N} = [a(w)-q(w)]N, \tag{33}$$

where $a(w)$ is the new hire rate $(A=a(w)N)$.[1] The expected signs are $a_w>0$ and $q_w<0$. Furthermore, we impose "decreasing marginal returns" to the wage recruitment policy, i.e. $a_{ww}-q_{ww}<0$. Wage increases will thus increase employment at a decreasing rate. One argument underpinning the assumption is that quits are likely to reach a lower limit due to retirements, i.e. $q_{ww}>0$. Another argument relies on the dispersion in space of job seekers.

The problem facing the firm is

$$\max V = \int_0^\infty e^{-rt}[pQ-wN-mI-C(I)+S_N+S_K-T]dt, \tag{34}$$

where nonwage recruitment costs are abstracted from; the firm is assumed to be able to control

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[1] The number of hirings is thus homogeneous of degree one in employment. Job seekers are likely to contact large firms more often than small ones in order to increase the possibilities of finding vacancies.

the flow supply of labor to itself solely by its wage choice.[1]

3.2 Optimal Wage Policy

Differentiating the Hamiltonian corresponding to (34) with respect to the control variable (the wage rate) gives the first order condition

$$\lambda_1 = \frac{(1-\tau)(1-s_1 a_w)}{a_w - q_w}, \tag{35}$$

stating that the value of adding a worker to the firm's labor force should equal the net marginal cost of changing employment. The subsidy will decrease this adjustment cost, the effect being reinforced by a higher wage elasticity of labor supply.

By using $-\partial H/\partial N = \dot{\lambda}_1 - \lambda_1 r$ an additional necessary condition for maximum

$$\lambda_1[r-(a-q)] - \dot{\lambda}_1 = (1-\tau)[pQ_N - w + s_1(a-k_1)] \tag{36}$$

is obtained. Substituting (35) in (36) gives the steady state condition

$$\frac{[1-\tau][pQ_N - w + s_1(a-k_1)]}{r} = \frac{[1-\tau][1-s_1 a_w]}{a_w - q_w}. \tag{37}$$

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[1] The firm's optimal wage choice should of course be related to the average market wage; the latter is assumed constant in the analysis above. This assumption is not crucial; following e.g. Mortensen and Siven we can introduce wage inflation provided that wages and prices are expected to inflate at the same rate. We can thus interpret "higher wage" as higher wage increase relative to the average wage increase.

Rearranging Eq. (37) gives the marginal productivity condition

$$pQ_N = w - s_1(a-k_1) + r\left[\frac{1-s_1 a_w}{a_w-q_w}\right] \tag{38}$$

Labor costs are decreased by a higher subsidy rate provided that the inequality

$$a - k_1 + \frac{ra_w}{a_w-q_w} > 0 \tag{39}$$

holds. A reversal of the inequality requires a "high" threshold and accordingly a negative subsidy in equilibrium.

3.3 Comparative Statics

Consider now the properties of the stationary solution ($\dot{K} = \dot{N} = \dot{\lambda}_1 = \dot{\lambda}_2 = 0$). Differentiating the four equations under consideration gives

$$D = \begin{vmatrix} (a_w-q_w)pQ_{NN} & (a_w-q_w)pQ_{KN} & B & 0 \\ (1-\tau)pQ_{KN} & (1-\tau)pQ_{KK} & 0 & -(1-\tau)(\delta+r)C_{II} \\ 0 & 0 & a_w-q_w & 0 \\ 0 & -\delta & 0 & 1 \end{vmatrix} > 0 \tag{40}$$

where

$$B=-(a_w-q_w)(1-s_1a_w)+rs_1a_{ww}+[pQ_N-w+s_1(a-k_1)][a_{ww}-q_{ww}]<0$$

as determinant of the system. The comparative statics give results according to Table 2.

Table 2.

Parameter increased	Affected endogenous variable w	N	K	I
p	0	+	+	+
r	0	-	-	-
δ	0	-	-	-
m	0	-	-	-
τ	0	-	-	-
h	0	+	+	+
s_1	0	?	?	?
k_1	0	-	-	-
s_2	0	?	?	?
k_2	0	-	-	-

The results are similar to those obtained for the fixwage regime. Since the firm by assumption is able to control its relative employment growth by its wage choice, a larger number of hirings --corresponding to a higher level of employment-- does not *per se* require a higher wage rate. Changes in the parameters under consideration might have instantaneous effects on the wage choice of the firm; in the long run these effects will, however, disappear.

Our main interest is focussed upon the subsidy parameters. A rising employment (investment) threshold will decrease employment (the stock of capital) in steady state. Concerning the employment subsidy rate, we obtain

$$\frac{\partial N}{\partial s_1} = \frac{[(a_w-q_w)(a-k_1)+ra_w](a_w-q_w)(1-\tau)[\delta(\delta+r)C_{II}-pQ_{KK}]}{D} \tag{41}$$

$$\frac{\partial K}{\partial s_1} = \frac{[(a_w-q_w)(a-k_1)+ra_w](a_w-q_w)(1-\tau)pQ_{KN}}{D} \tag{42}$$

with positive signs provided that the inequality

$$a - k_1 + \frac{ra_w}{a_w-q_w} > 0 \tag{43}$$

holds. The effect is obviously unambiguous when the subsidy base is net increase in employment (k_1=q=a). The special case remains, where a higher subsidy will increase employment even if the subsidy is negative in steady state.

3.4 Comparative Dynamics

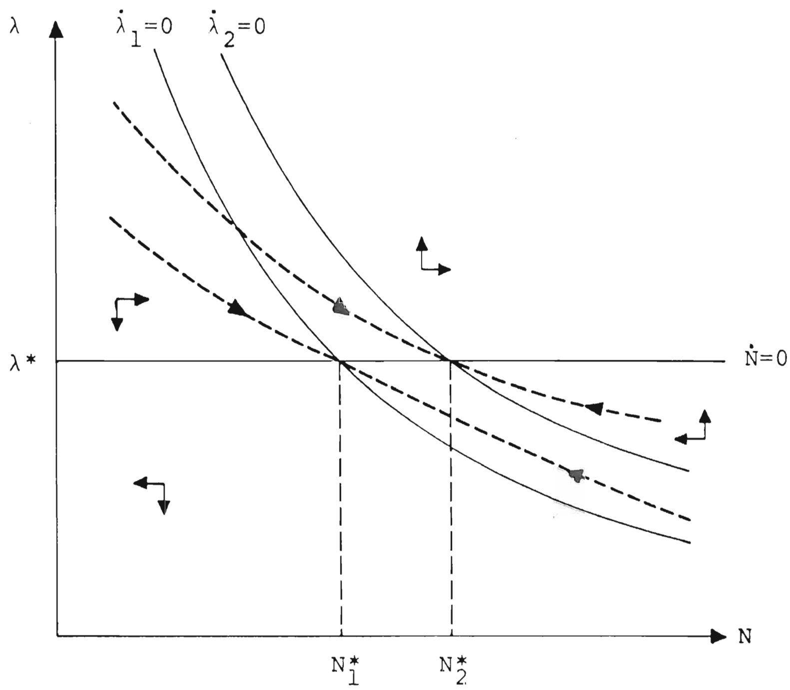
The instantaneous effects will now be explored. How will changes in the subsidy rate or in the threshold affect the wage choice when the firm is outside its stationary equilibrium? The (λ_1,N) phase diagram is illustrated in Figure 3. The differential equation is

$$\dot{\lambda}_1 = -\lambda_1[a-q-r] - (1-\tau)[pQ_N-w+s_1(a-k_1)]. \tag{44}$$

The curve for $\dot{N} = 0$ is horizontal; a higher employment level does not require a higher wage according to arguments already stated (and $\partial\lambda_1/\partial w>0$). By differentiating (44) we have

$$\left.\frac{\partial\lambda_1}{\partial N}\right|_{\dot{\lambda}=0} = \frac{-(1-\tau)pQ_{NN}}{a-q-r} \tag{45}$$

Figure 3.



with negative slope below and close to the $\dot{N} = 0$ curve; a positive slope appears when $a>q+r$. Differential equation (45) implies $\dot{N} > 0$ for points above $\dot{N} = 0$ and vice versa. Moreover, we have $\partial\dot{\lambda}_1/\partial N>0$ implying $\dot{\lambda}_1 < 0$ to the left of $\dot{\lambda}_1 = 0$ and vice versa. The optimal path for $\dot{N} = 0$ implies that hirings (quits) will decrease (increase) over time (since $\dot{\lambda}$ is increasing with $\dot{w}$). The opposite holds true for a contractive path ($\dot{N} < 0$).

The slope of the optimal path is

$$z = \frac{\partial\lambda_1}{\partial N} = \frac{\dot{\lambda}_1}{\dot{N}} \tag{46}$$

Differentiating z with respect to s_1 gives

$$\frac{\partial z}{\partial s_1} = \frac{[1-\tau][(a-q-r)\frac{a_w}{a_w-q_w} - (a-k_1)]}{(a-q)N} \tag{47}$$

with negative slope for $\dot{N} > 0$ in the neighborhood of $\dot{N} = 0$ if

$$a - k_1 + \frac{ra_w}{a_w-q_w} > 0 \tag{48}$$

holds.[1] This inequality has already been found to imply a higher stationary equilibrium. A higher subsidy will thus produce an instantaneous increase in wages and hirings and a similar decrease in the quit rate. Analogously, it is easily demonstrated that a lower threshold has the same effects; the relevant derivative is

$$\frac{\partial z}{\partial k_1} = \frac{-(1-\tau)s_1}{(a-q)N} \gtrless 0 \text{ as } \dot{N} \lessgtr 0. \tag{49}$$

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[1] Conversely, it holds that $\partial z/\partial s_1 > 0$ for $\dot{N} < 0$ close to $\dot{N} = 0$.

4. SUMMARY AND CONCLUDING REMARKS

The main purpose of this paper has been to investigate some microeconomic effects of marginal employment subsidies. We have, however, also compared employment subsidies with investment subsidies. The crucial point of departure from earlier investigations of MES-schemes has been the introduction of adjustment costs with respect to labor. Two different institutional settings have been considered, a fixwage regime and a flexwage regime.

In both cases the basic message that comes out of the analyses is: A rising subsidy leads to a higher equilibrium level of employment. A firm being on a growth-path towards a specific stationary equilibrium will--when the subsidy is increased--switch to a new path aiming at a higher equilibrium level. This change implies an instantaneous increase in hirings and--when wages are flexible--an instantaneous increase in wages. If the firm is on a contractive path, it will analogously switch to a less contractive path, provided that the scheme is taxing employment reductions in the same way as it is subsidizing employment growth. The employment creation is reinforced by the rate of interest and--in the flexwage regime--the wage elasticity of labor supply.

The analyses also illuminate how changes in subsidy thresholds affect equilibrium employment levels. A lower threshold has unambiguously positive employment effects. It might, however, be the case that a higher subsidy will reduce stationary employment, provided that the threshold is high enough.

A number of questions have been left out of focus of the present paper. Among them are: How are MES-schemes affecting the incentives for labor hoarding and inventory building? How are MES-schemes influencing price formation if we e.g. assume that the firm is acting as a temporary monopolist in the goods market as well as a temporary monopsonist in the labor market? Which are then the implications for inflation and unemployment in the aggregate?

Some heuristic remarks will be given to the last problem. A question to be answered could then be phrased like this: Assume that the natural rate hypothesis is valid -- would we then expect a MES-scheme to have any effect on the natural rate? Consider again the types of adjustment costs in focus of the present paper. We have analyzed them as polar cases, thus disregarding the probably more realistic case when the firm responds to a higher subsidy by adjusting its wage choice as well as its non-wage recruitment efforts. The latter response will mean increased search in the labor market, thereby enhancing the unemployed worker's probability of getting a wage offer. Job search models have, however, generally ambiguous implications for unemployment effects of increased production of information in the labor market. This inconclusiveness hinges upon the offsetting reservation wage effect resulting from increased job availability. The empirical studies, on the other hand, are more decisive in their messages; job availability seems to be the most important determinant of the duration of unemployment, whereas unexpected inflation plays a fairly marginal role.[1] Taking this empirical information into account, complete policy pessimism concerning MES-programmes seems unwarranted. A more reasonable standpoint would be to expect some effects on the natural rate, provided that the MES-schemes give rise to more intensive recruitment efforts on part of the firms. Accepting the notion of some "natural" rate of unemployment, consistent with stochastic equilibrium in the labor market, does not invalidate the case for selective employment policies.

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[1] Barron (1975), Axelsson and Löfgren (1977), and Björklund and Holmlund (1981).

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