Seminar Paper No. 238

EMPLOYMENT POLICIES AND CENTRALIZED WAGE SETTING

by

Lars Calmfors

and

Henrik Horn

INSTITUTE FOR INTERNATIONAL ECONOMIC STUDIES
Stockholm University

ISSN 0347-8769

Seminar Paper No. 238

EMPLOYMENT POLICIES AND CENTRALIZED WAGE SETTING

by

Lars Calmfors

and

Henrik Horn

Seminar Papers are preliminary material circulated
to stimulate discussion and critical comment.

May, 1983

Institute for International Economic Studies
S-106 91 Stockholm
Sweden

EMPLOYMENT POLICIES AND CENTRALIZED WAGE SETTING*

by

Lars Calmfors and Henrik Horn
Institute for International Economic Studies

There is an emerging consensus in the literature that the US and European unemployment problems have different origins.¹ It is commonplace to regard US unemployment as basically Keynesian, i.e. as resulting mainly from a deficiency of aggregate demand. The European unemployment problem is instead usually seen more as one of classical unemployment, i.e. a situation where the real wage is set above the market clearing level. The aim of this paper is to develop one possible explanation of this real wage problem that is relevant for the smaller European economies.

Usually the problem of too high real wages is seen in connection with the supply shocks of the 70's. For instance Bruno (1981) and Sachs (1979, 1982) stress that the actual real wage is sticky downwards and that it therefore did not respond to the reduction in the full-employment real wage rate that occurred because of the increase in the real cost of energy and increased competition from the NIC countries. Explanations of the inflexibility of real wages have also been set forth by e.g. Grossman and Hart (1981) and McDonald and Solow (1981).

However, as pointed out by e.g. Gordon (1982), the assumption of an inflexible real wage does not seem to be empirically true. The problem is rather that the real wage *moves* in a way that is not consistent with market clearing. There has been a long-run tendency for real labor costs to rise relative to output per head

in most European economies (cf. e.g. Sachs (1979) or Nickel (1982)). It thus appears that the European real wage problem is more fundamental than just a failure to adjust to the supply shocks of the 70's.

It is common to relate the tendency for real wages to rise in excess of productivity growth to gradually emerging expectations that government employment policies have reduced the need for moderation in wage settlements (cf. e.g. Sachs (1979) or Söderström and Viotti (1978)). The McCracken report (1977) formulates it in the following way: "During the course of the great post-war expansion those responsible for price setting and wage bargaining in many countries became so convinced that governments could, and would, maintain high levels of demand and employment that they increasingly behaved as if there was no way in which they could price themselves out of markets or out of jobs."

However, most of the theoretical analysis of the links between employment policies and wage (price) formation seems to stress the effects on the cyclical sensitivity of *money* wages and prices rather than on *real wage* developments.² Two basic assumptions have usually been that: (1) prices and wages are set in decentralized markets where the individual wage or price setter has no reason to expect his individual decision to trigger off policy responses from the government, and (2) that employment policies take the form of monetary or fiscal policies that increase aggregate demand in the goods market. This focus reflects U.S. conditions well, but it is less satisfactory for several of the smaller European economies such as the Scandinavian countries, the Netherlands and Austria where the real wage problems have been

most severe, as shown by Calmfors (1982). In these countries wages are set through centralized bargaining between economy-wide employer federations and trade unions that organize the majority of the labor force. Wage setters therefore have every reason to take into account that their decisions may trigger off policy reactions from the government. Moreover, employment policies in these countries have usually taken the form of direct increases in public sector employment or direct subsidization of private firms. These policies increase total labor demand at each given real wage and do not work by reducing the real wage through price inflation as is the case with policies increasing demand in the goods market. There is thus a direct link between employment policies and the expansion of the public sector in these countries as stressed by Söderström and Viotti (1978) and Calmfors (1982a).

Our analysis focuses specifically on these aspects of stabilization policy in the smaller European economies. We construct a model where the real wage is set unilaterally by *one* all encompassing trade union. The reason for not considering more complex institutional set-ups with several trade unions as in Oswald (1979) or with explicit bargaining between employers and trade unions as in McDonald and Solow (1981) is that we want to focus on the interaction between trade union and government behaviour in a system with centralized wage setting.³

The paper consists of *three* parts. The *first* part sets out the basic framework. The subsequent two parts discuss the links between real wage behaviour and employment policies under different assumptions. The *second* part discusses cases where the trade

union does not anticipate systematic employment policies and the *third* part shows how the results change when the trade union learns to anticipate such policies.

Since our analysis incorporates a rational expectations framework, it is natural to relate our results to those of the new classical economics as developed e.g. by Sargent and Wallace (1975, 1976). Their policy-ineffectiveness proposition will carry over to our analysis only under very special assumptions. In our model anticipated policies will in general have real effects. The reason is that we analyze fiscal policies that *shift* the labor demand schedule, whereas they analyze monetary policies, which can affect output and employment only causing movements *along* a given labor demand schedule.

The assumption of centralized wage setting makes it necessary to incorporate game aspects. The solutions in the second part can be interpreted as Nash equilibria and the solutions in the third part as Stackelberg equilibria. We thus distinguish between situations where the values of government policy parameters are correctly anticipated and situations where also the policy rule governing the values of these parameters are foreseen.

The idea of analyzing stabilization policy in game theoretic terms lies close to the rational expectations framework as stressed e.g. by Buiter (1980), Goldfeld (1982), and Kydland and Prescott (1977). In decentralized markets with many small private agents it is natural to regard these as non-dominant players (followers) and the government as the dominant player (leader). But in a centralized system this assignment is less

evident (cf. e.g. Faxén (1957) or Johansen (1977)). Indeed we analyze the opposite assignment with the trade union acting as the leader and the government as the follower with its hands tied by an automatic employment policy rule.

1. THE MODEL

Consider an economy with two sectors: a private sector producing a private good (manufactures) and a government sector producing a government good (services). Both sectors use labor, which is variable, homogeneous and mobile between the sectors. All other factors are fixed. There are two types of agents: capitalists and workers. Capitalists receive all profits in the private sector as their only income. Workers receive only labor income when employed and only a government-paid unemployment benefit when unemployed.

Since the analysis focuses on real variables, money is not introduced. The model may either be interpreted as a model of a small open economy or of a closed economy. In the former interpretation the government good corresponds to a non-traded good and the private good to a traded good, the price of which is exogeneously given from the world market.

1.1 *The Private Sector*

The private sector consists of perfectly competitive firms that maximize profits given the price of private goods (which is set at unity) and the wage rate w . In addition firms also have to take into account the productivity level α which varies around

a normal value α_N . This gives a simple representation of exogenous shocks that may motivate stabilization policy. Provided that firms maximize profits individually and thus do not collude, we have a labor demand function $N = N(w, \alpha)$, where $N_w < 0$ and $N_\alpha > 0$. For convenience we also assume $N_{ww} = N_{w\alpha} = 0$.

1.2 The Government Sector

The government sector produces services with a unitary input requirement of labor per unit of output.⁴ The number of government sector employees G hence refers both to the input and the output of the sector. Public services are distributed to all individuals in equal fixed quantities and at a zero price.

Workers in the government sector are paid the same wage as in the private sector. The government also pays out a fixed untaxed unemployment benefit b to those unemployed (the total number of workers M less those employed E), so total public sector expenditures S are⁵

$$S = G + [M - E(w, G, \alpha)] b = S(w, G, \alpha) \quad (1)$$

$$\text{where } E(w, G, \alpha) = N(w, \alpha) + G \quad (2)$$

is total demand for labor, i.e. the total number of employed workers.

Taxes are paid both by employed workers and capitalists. Capitalists together pay T^C . Each employed worker pays τ , which is composed of a fixed component τ_0 and a variable component that depends upon government expenditure per employed:⁶

$$\tau = \tau_0 + \mu \frac{S}{E} = T(\mu, w, G, \alpha) \quad 0 \leq \mu \leq 1 \quad (3)$$

The reason for choosing this specific form is that we want to have a simple representation where employed workers pay for a certain share μ of any increase in government expenditures.

We shall not in general specify whether there is budget balance or not. As long as we assume that no intertemporal considerations are made, it makes no difference whether a short-fall between government expenditure and taxes on workers is financed by a tax on capitalists or results in a government budget deficit. A government budget deficit or surplus must have a real counterpart in the goods market. Since all incomes are assumed to be consumed, total private consumption amounts to $Q + wG + (M - E)b - T^c - \tau E$, which will differ from output of the private good Q as soon as the government budget is not balanced.

There are two possible interpretations of this. If we regard our model as a model of a small open economy, the counterpart of a budget deficit will be a trade balance deficit, with net imports making up for any excess demand for domestic tradables. The government - as opposed to the private sector - is then assumed to have the opportunity of issuing debt abroad as in Helpman (1977) or Calmfors (1978).

The second interpretation is to regard our model as describing a closed economy. One then has to assume that the government runs

a buffer stock of private goods, which is decreased or increased depending upon whether the government budget shows a deficit or a surplus.

1.3 *The Individual Worker*

An individual worker derives utility from consumption of both private and government goods. We assume that the utility function is identical across individuals, and additively separable in the two goods. Labor in itself is not a source of utility or disutility. We take the number of hours each individual works as institutionally fixed, so that when employment (in hours) is below the market-clearing level, a worker is either employed or unemployed. Given the level of (un)employment the ones to be unemployed are singled out by a random draw. The probabilities of being employed and unemployed therefore equal the shares of employed and unemployed in the total labor force. A worker spends all his income on private consumption c . The private consumption of an employed worker therefore equals after-tax income $w - \tau$ and that of an unemployed worker the unemployment benefit b . The expected utility of an individual worker is then:⁷

$$U = \frac{E}{M} [V(w - \tau) + Z(G)] + \frac{M - E}{M} [V(b) + Z(G)] =$$

$$= U(w - \tau, G, E), \quad (4)$$

with $V_c > 0$, $V_{cc} < 0$, $Z_G > 0$, and $Z_{GG} < 0$.⁸

1.4 *The Trade Union*

All workers are members of the same trade union. Like Negishi (1979) and Oswald (1982a) we assume that the union

acts as a monopolist in the labor market, and sets the wage so as to maximize the unweighted sum of expected utilities of the workers, i.e. to maximize equation (4).⁹

The trade union's preferences can (given τ and G) be represented by a set of indifference curves in the wage-employment plane as in Fig. 1. We make the standard assumption that $w - \tau > b$ so that the utility of an employed worker is always larger than the utility of an unemployed worker; otherwise all workers would prefer to be unemployed. Then the indifference curves are negatively sloped and convex towards the origin, as shown by Oswald (1982a) and Calmfors (1982b).

Given G , we can also draw a labor-demand schedule EE in Fig. 1. The schedule is kinked at B , where the wage becomes so high that all demand for labor from the private sector disappears, and only the demand from the government sector remains. Employment will be demand-determined as long as the demand for labor is lower than the full-employment level M .

If the trade union takes τ and G as independent of its own actions it solves its maximization problem by equating the marginal rate of substitution between wage and employment with the slope of the labor demand curve. If indeed government demand for labor would remain unaffected by *any* wage increases, the trade union would obviously choose an infinitely high wage rate driving the private sector out of existence. We rule out this case and restrict the analysis to cases where both sectors are producing.¹⁰ In Fig. 1 the optimum is thus given by the tangency point A .¹¹

Figure 1

In general one cannot rule out the possibility that the trade union's optimization results in a wage that coincides with the full-employment wage (cf. Calmfors (1982b) or Oswald (1982a)). This may be either an interior or a corner solution. Since our aim is to analyze unemployment, we shall follow the literature and restrict the analysis to initial situations like A. As pointed out by Oswald (1982a), this is also the situation in which a trade union is likely to exist; if the trade union would set the market-clearing wage, there is in terms of the model no utility gain for workers from forming a trade union.

1.5 Government Employment Policies

In the following a specific time structure is imposed. It is assumed that the trade union has to set the wage for the next

period in advance on the basis of its expectations. The government always takes its decisions after the trade union. We assume that this advantage makes it possible for the government to act on the basis of perfect information.

One way of modelling government behavior is to postulate a utility function for the government and then to derive policy rules from explicit optimization (cf. e.g. Gylfason and Lindbeck (1983)). But our aim is *not* to explain government behavior but to analyze the consequences for trade union behaviour of certain government policies. We shall therefore instead directly postulate a government reaction function, which we find descriptive of post-war employment policies in most smaller European economies. We interpret these policies as unconditional in the sense that attempts have been made to achieve given employment goals more or less independently of the origins of unemployment problems.

The government is assumed to determine the level of government output and employment in the following two-step fashion. In a *first* step it determines a normal level for the size of the government sector, $\tilde{G}$. But government employment is held at this level only if the employment target $\tilde{E}$ of the government is achieved. If employment threatens to deviate from this target, government employment is in a *second step* expanded above or reduced below the normal level G . Following Calmfors (1982b) we assume a simple "leaning-against-the-wind" policy rule, according to which a certain fraction of the deviation from the employment target is eliminated, i.e:

$$G = \tilde{G} + \gamma(\tilde{E} - \underline{E}) \quad 0 \leq \gamma \leq 1 \quad (5)$$

$$\text{where } \underline{E} = E(w, \tilde{G}, \alpha) = N(w, \alpha) + \tilde{G} \quad (6)$$

is the employment level that would result without employment policies, when government employment is fixed at $\tilde{G}$.

The stipulated policy rule gives a simple representation of employment policies, where the parameter α measures the degree of "activism".

Using equations (2), (5) and (6), we get:

$$E = \gamma\tilde{E} + (1-\gamma)[N(w, \alpha) + \tilde{G}] = \gamma\tilde{E} + (1-\gamma)\underline{E}(w, \alpha, \tilde{G}) \quad (7)$$

The employment stabilization rule thus makes actual employment E as weighted average of the government employment goal $\tilde{E}$ and the employment $\underline{E}$ that would arise without government interventions.

The government policy rule is illustrated diagrammatically in Fig. 2. The EE -line represents the employment function with no government interventions. The policy rule pivots the employment schedule around the point at which $\underline{E} = \tilde{E}$. If $\gamma = 1$ all variations in employment are eliminated and actual employment is pegged at the target level $\tilde{E}$ (the vertical line).

1.6 Plan of the Analysis

The analysis below is devoted to the question of how the employment policy rule affects the normal equilibrium of the economy, i.e. the equilibrium when the productivity level is

Figure 2

at its normal value ($\alpha = \alpha_N$). We shall vary the assumptions about (1) trade union perceptions of the policy rule; (2) the employment goal of the government and (3) the response of the tax on workers to changes in government expenditure. Formally we shall consider an initial situation without active employment policies, i.e. when $\gamma = 0$ and thus $G = \tilde{G}$, and then study how an introduction of a policy rule changes the initial equilibrium.

2. NASH CASES

This section analyzes situations where the trade union does not perceive the government policy rule and instead regards the size of the public sector as exogenously given. In game-theoretic terminology this situation corresponds to

a Nash equilibrium. Formally, the trade union's general optimization problem then is to:¹²

$$\begin{aligned} \max_w \quad & U(w - \tau, G, E) \\ \text{s.t.} \quad & G = \text{const}, \\ & E = N(w) + G, \\ \text{and} \quad & \tau = T(\mu, w, G) \end{aligned} \tag{8}$$

The first order condition for an interior utility maximum then is¹³

$$\Omega(w, G, \mu) \equiv (1 - T_w)U_c + N_w U_E = 0. \tag{9}$$

Assume that the trade union considers a unit's wage increase. $(1 - T_w)$ measures the *after-tax* wage change, which is smaller than the before-tax wage increase (if $\mu > 0$ the per capita tax has to increase to compensate for the increased wage bill in the government sector, as well as for the loss of tax revenues and increased costs for unemployed benefits due to the fall in employment). We have to assume that $T_w < 1$ for an interior solution to exist. The first term in (9) then gives the utility gain from increased private consumption for those who remain employed. The second term captures the utility loss from the decrease in employment. In an optimum these two counter-acting effects must balance.

In order to analyze the effects of the employment policy rule we shall need to know how an exogenous change in the size of the public sector affects the wage rate and employment. To

see this, equation (9) is differentiated totally holding μ constant:

$$\frac{dw^*}{dG} = - \frac{\Omega_G}{\Omega_w} \quad (10)$$

where $\Omega_G = - (1 - T_w) T_G U_{cc} + (1 - \mu) U_{cE}$

Since we have assumed $T_w < 1$, it follows that $\Omega_G > 0$. It can easily be shown that $\Omega_w < 0$, which is also the second order condition for a maximum (cf. the appendix). An exogenous increase in the size of the public sector thus increases the wage.

The effect on total employment is obtained by differentiation of equation (2) and substituting in the expression for $\frac{dw^*}{dG}$ from equation (10):

$$\frac{dE^*}{dG} = \frac{\partial E}{\partial G} + \frac{\partial E}{\partial w} \cdot \frac{dw^*}{dG} = 1 - N_w \frac{\Omega_G}{\Omega_w} = \frac{1}{\Omega_w} (\Omega_w - N_w \Omega_G) \quad (11)$$

where $\Omega_w - N_w \Omega_G = (1 - T_w)(1 - T_w + N_w T_G) U_{cc} + (1 + \mu) N_w U_{cE} \geq 0$

An exogenous increase in the size of the government sector generally has an ambiguous effect on total employment. This is because the trade union might seek to compensate an increase in the tax due to a larger public sector by increasing the wage. This wage increase lowers private employment, and if it is large enough, total employment might fall.

To analyze the effect of the employment policy rule, we calculate $\frac{dw^*}{d\gamma}$ and $\frac{dE^*}{d\gamma}$. If the signs of these expressions are unambiguous for values $0 \leq \gamma \leq 1$, we also know unambiguously how

the equilibrium of the economy under a regime of systematic employment policies deviates from the equilibrium under a regime without employment policies, i.e. when $\gamma = 0$ and thus $G = \tilde{G}$.

In the Nash case it holds that

$$\frac{dw^*}{d\gamma} = \frac{dw^*}{dG} \frac{dG}{d\gamma} \quad (12)$$

From equation (5) we get when differentiating totally:

$$\frac{dG}{d\gamma} = (\tilde{E} - \underline{E}) - \gamma N_w \frac{dw^*}{d\gamma}. \quad (13)$$

Together with equation (12) this gives:

$$\frac{dG}{d\gamma} = \left(1 - \gamma N_w \frac{\Omega_G}{\Omega_w}\right)^{-1} (\tilde{E} - \underline{E}). \quad (14)$$

The effect on the wage and employment is now obtained using (10), (11), and (12):

$$\frac{dw^*}{d\gamma} = - \frac{\Omega_G}{\Omega_w - \gamma N_w \Omega_G} (\tilde{E} - \underline{E}), \quad (15)$$

where $\Omega_w - \gamma N_w \Omega_G = (1 - T_w)(1 - T_w + \gamma N_w T_G) U_{cc} +$

$$+ (2 - \gamma(1 - \mu)) N_w U_{cE} \geq 0,$$

$$\text{and } \frac{dE^*}{d\gamma} = (\Omega_w - \gamma N_w \Omega_G)^{-1} (\Omega_w - N_w \Omega_G) (\tilde{E} - \underline{E}). \quad (16)$$

In the subsections below we will show how the effects of the policy rule under Nash assumptions depend upon how the government employment target is set and on whether wage earners have to pay for increased government expenditure or not.

2.1 Government and Trade Union Employment Goals Coinciding

We start with the case where the initial employment level that would occur without a policy rule ($\gamma = 0$) coincides with the government employment target, i.e. $\underline{E} = \tilde{E}$. This is a situation when the government accepts that the trade union uses its monopoly position to set a wage rate that results in unemployment.

$\underline{E} = \tilde{E}$ gives directly from equations (15) and (16) that $\frac{dw^*}{d\gamma} = \frac{d\underline{E}^*}{d\gamma} = 0$. The policy rule will thus in this case have no effect on the normal equilibrium of the economy.

This case is most easily illustrated diagrammatically if we assume a constant tax, i.e. $\mu = 0$. In Fig 3. A represents the

Figure 3

initial equilibrium without a policy rule. The introduction of the policy rule pivots the actual employment curve clockwise around the initial equilibrium point. But if the trade union does not perceive this, it has no incentive to change its actions. Nor has the government, since its employment target is fulfilled if the trade union does not change its wage decision. The point A therefore represents a Nash equilibrium in which the trade union correctly anticipates the level of government employment, even though it does not know the government policy rule.

The Nash equilibrium can also be illustrated with the help of reaction functions as in Fig.4. Equation (10) gives the slope of the trade union reaction function, which is positive (cf. above). The government's reaction function is also positively sloped, since a higher wage triggers off an expansion of the government sector. Differentiation of equation (5) shows that the slope is $\left(\frac{dw}{dG}\right)_G = -\frac{1}{\gamma_N^w}$. If the tax is constant, it can easily be shown that the trade union reaction function is steeper (cf. the appendix). If the wage rate chosen by the trade union in the absence of a policy rule (when $G = \tilde{G}$) results in an employment level that coincides with the employment target of the government, the two reaction functions intersect at A along the horizontal $\tilde{G}$ -line. Consequently the initial equilibrium will not be disturbed by the introduction of the policy rule.

The employment stabilization rule enters the picture only when the economy is exposed to a shock. Assume for instance that

Figure 4

the trade union anticipates a productivity increase (which would shift the labor demand schedule to the right) that does not come about. It therefore sets the wage w_2 in Fig 3, a wage that *ex post* proves too high. Without the employment stabilization rule employment would fall to E_2 . But with the policy rule, government employment is expanded and employment falls only to

E_3 . In the same way the policy rule reduces employment variations also when actual (unanticipated or anticipated) productivity shocks take place.

Under the assumptions in this subsection the employment policy rule thus works as a pure stabilization policy that reduces employment variations in the case of shocks but that does not affect the normal equilibrium of the economy.

2.2 Different Employment Targets, a Fixed Tax

Next we consider the case where the government aims for a higher employment level than the initial one, i.e. $\tilde{E} > \underline{E}$. We also assume that the per capita tax on workers remains unaffected, i.e. that $\mu = 0$. Equation (15) and (16), then simplify to:

$$\frac{dw^*}{d\gamma} = - \frac{U_{cE}}{(U_{cc} + (2 - \gamma)N_w U_{cE})} (\tilde{E} - \underline{E}) > 0 \quad (17)$$

$$\frac{dE^*}{d\gamma} = \frac{U_{cc} + N_w U_{cE}}{U_{cc} + (2 - \gamma)N_w U_{cE}} (\tilde{E} - \underline{E}) > 0 \quad (18)$$

The employment rule thus has real effects in this case. Both the wage rate and employment increases.

This case is illustrated in Fig 5. An introduction of the policy rule both shifts the actual employment curve to the right and steepens it.¹⁴ But this is not perceived by the trade union. What the trade union perceives is that if it as before sets the wage rate at w_1 , the government will employ $(\tilde{E} - E_1)$ additional workers in the government sector. If the trade union takes this new level of government employment as given, it

Figure 5

"perceives" only a parallel shift to the right of the initial employment curve. It will therefore choose a new higher wage w_2 . This induces a further expansion of government employment. A Nash equilibrium emerges in a point like C at the intersection of the actual and a new perceived employment curve (along which the same level of government employment as in C is taken as exogenous by the trade union).

The new equilibrium can also be illustrated by help of the reaction functions in Fig 6. The trade union reaction function

Figure 6

as before passes through A. But if the employment target of the government is not reached at the initial wage w_1 , the government will at this wage increase government employment to a level $G_1 > \tilde{G}$. Since the government reaction function is flatter than the trade union reaction function when the tax is fixed, the two reaction functions must intersect in a point like C with both a higher wage and a larger government sector than in A.

We shall not discuss how the transition to this new Nash equilibrium takes place. We merely note that if the trade union has static expectations, i.e. takes the level of government employment prevailing in one period to prevail also in the next, the adjustment process is stable as shown in the diagram.

2.3 *Different Employment Targets, an Endogenous Tax*

Third we consider the case when the government again aims for a higher employment level than the initial one but where also the tax on workers is affected.

In this general case equations (15) and (16) show that the signs of both $\frac{dw^*}{d\gamma}$ and $\frac{dE^*}{d\gamma}$ are ambiguous. The sign of $\frac{dw^*}{d\gamma}$ depends upon the size of γ . For small values of γ the numerator of equation (14) is negative, implying $\frac{dw^*}{d\gamma} > 0$, but for large values it may be the case that $\frac{dw^*}{d\gamma} < 0$. Consequently, we cannot directly infer whether the policy rule drives up the wage rate or not.

Rearranging equation (15) slightly, we find that the sign of $\frac{dw^*}{d\gamma}$ is that of $\frac{1}{\gamma N_w} - \frac{\Omega_G}{\Omega_w}$. But $-\frac{1}{\gamma N_w}$ and $-\frac{\Omega_G}{\Omega_w}$ are the slopes of respectively the government's and the trade union's reaction functions. Hence, as long as the government reaction function is flatter than the trade union reaction function, the new equilibrium will as in Fig 6 be to the north-east of A. But if γ is so large that the government reaction function becomes steeper than the trade union function, the two curves will intersect to the south-west of A as shown in Fig 7. But this equilibrium will be an unstable one in the sense that if the trade union has static

expectations, there will be an explosive adjustment path.

Figure 7

In the stable case it holds that $\frac{dw^*}{dy} > 0$. In this case it is not clear whether the wage rises by more or less than in the case with a constant τ in subsection 2.2. On the one hand the trade union knows that wage increases will increase the tax on workers, which makes it less profitable to drive up the wage (the T_w - term). On the other hand the tax increases that result from the expansion of the government sector reduce the after-tax wage and thus increase the marginal utility of consumption, which tends to drive up the wage (the T_G - term). If the

trade union would not perceive the effect of its own wage decision on the tax, the first effect disappears and the wage would clearly rise by more than in the constant tax case. If the tax effects add an additional push to the wage rate, the wage increase may be so large as to cause total employment to fall.

2.4 *Conclusions on the Nash Case*

Although the trade union does not perceive the policy rule determining government behavior, it will have correct expectations about the *values* of government policy variables once a Nash equilibrium is reached. All the same the government policy rule has real effects on the normal equilibrium of the economy as soon as the government employment target deviates from the initial employment level. With a more ambitious employment target the employment policy rule raises both the wage and total employment in the case with a constant tax. With an endogenous tax the wage may even rise so much that total employment is reduced.

The policy-ineffectiveness proposition of the new classical macroeconomics does thus not go through in the above analysis except in the special case when the government and trade union employment targets coincide. The reason is that we have a set-up where demand policies are fiscal and shift the labor demand schedule instead of just causing movements along a given labor demand curve as the monetary policies analyzed in most rational expectations models do.

3. STACKELBERG CASES

In the Nash case the trade union was not aware of the employment policy rule. In this section we instead consider cases where the union perceives the policy rule. In game theoretic terminology the union behaves as a Stackelberg leader.

Formally the trade union's decision problem in this case is to

$$\begin{aligned}
 & \max_w \quad U(w - \tau, G, E) \\
 & \text{s.t.} \quad \tau = T(\mu, w, G), \\
 & \quad \quad G = \tilde{G} + \gamma(\tilde{E} - \underline{E}), \\
 & \text{and} \quad \underline{E} = N(w) + \tilde{G}.
 \end{aligned} \tag{19}$$

The first-order condition for an optimum now becomes:

$$\Lambda(w, \gamma, \mu) \equiv (1 - T_w)U_c + N_w U_E - \gamma N_w (U_G + U_E - T_G U_c) = 0 \tag{20}$$

The first two terms are the same as in the Nash case. What is new here is the third term. To interpret this term it is helpful to differentiate the trade union utility function (4) with respect to government employment for a given wage:

$$\left. \frac{dU}{dG} \right|_{dw=0} = U_G + U_E - T_G U_c \tag{21}$$

$U_G + U_E - T_G U_c$ thus measures the effect on trade union utility of one unit's change of government employment. U_G and U_E respectively measure the utility gains from the increased consumption of the government good and the higher employment. $T_G U_c$ measures the utility loss caused by the reduction of the

after-tax wage that arises if the increase in government employment causes a tax increase. γN_w in equation (20) gives the change in government employment that is triggered off by a unit's wage change. The third term in equation (20) hence gives the *total* utility effect of the change in the size of the public sector that is triggered off by a unit's wage change.

The sign of the expression (21) depends on the initial size of the government sector. If the size of the government sector is optimal from the point of view of the trade union given the wage rate and the tax function, $\left. \frac{dU}{dG} \right|_{dw=0} = 0$. If it is less than optimal, $\left. \frac{dU}{dG} \right|_{dw=0} > 0$ and vice versa.

To analyze the effects of the policy rule, we follow the same procedure as before and differentiate equation (20) with respect to w and γ :

$$\frac{dw^*}{d\gamma} = - \frac{\Lambda_Y}{\Lambda_w} = \frac{N_w}{\Lambda_w} (U_G + U_E - T_G U_C) - \frac{A}{\Lambda_w} (E - \underline{E}) \stackrel{?}{<} 0, \quad (22)$$

where $A \equiv - (1 - T_w + \gamma N_w T_G) T_G U_{CC} - \gamma N_w U_{GG} + (1 - \mu) U_{cE}$.

As can be seen $\frac{dw^*}{d\gamma}$ now consists of two effects. The second one looks very much like the original Nash effect and indeed coincides with this when $\gamma = 0$. The first one will be labelled the Stackelberg effect. The sign of $dw^*/d\gamma$ equals that of Λ_γ , since the second-order condition for a maximum requires that $\Lambda_w < 0$ (cf. appendix).

We also obtain:

$$\begin{aligned} \frac{dE^*}{d\gamma} &= (1 - \gamma) \frac{N_w^2}{\Lambda_w} (U_G + U_E - T_G U_C) + \\ &+ \left[1 - (1 - \gamma) \frac{N_w A}{\Lambda_w} \right] (E - \bar{E}) \begin{matrix} \geq \\ < \end{matrix} 0 \end{aligned} \quad (23)$$

We shall again investigate how the policy rule affects the economy under different assumptions about the government employment target and tax policies.

3.1 Government and Trade Union Employment Goals Coinciding, Constant Tax Rate

First we consider the case where the government employment target coincides with the initial employment level, i.e. $\tilde{E} = \bar{E}$, and where the per capita tax on workers is held constant, i.e. $\mu = 0$. Then only the Stackelberg effects remain in equations (22) and (23) which now reduce to:

$$\frac{dw^*}{d\gamma} = \frac{N_w}{\Lambda_w} (U_G + U_E) > 0, \quad (24)$$

$$\text{and } \frac{dE^*}{d\gamma} = (1 - \gamma) \frac{N_w^2}{\Lambda_w} (U_G + U_E) < 0. \quad (25)$$

Therefore, the introduction of the employment policy rule increases the wage and - somewhat surprisingly - *reduces* employment.¹⁵

The reason for the negative employment effect is that by reducing the opportunity cost of wage increases in terms of lost employment, the policy rule induces the trade union to raise the wage. Since government employment makes up for only

a fraction of the employment loss in the private sector, the result must be a fall in total employment. To avoid this, the government would have to even out all variations of employment from its target $\tilde{E}$, i.e. set $\gamma = 1$. But this is an unfeasible solution, since the rational behavior of the trade union would then be to raise the wage rate without limit.

The Stackelberg case is easily illustrated in a reaction function diagram if we plot the trade union's indifference curves (cf. Fig 8). As shown in the appendix, the indifference curves

Figure 8

are convex downwards and a higher indifference curve represents a higher level of utility. The trade union will achieve the highest utility level if it chooses a wage rate that makes the government's reaction function a tangent to an indifference curve. In Fig 8 this situation is shown by B with both a higher wage and a larger government sector than in the case without employment policies.

The results can also be demonstrated in the wage-employment diagram (Fig 9). In this diagram the trade union now optimizes

Figure 9

against the steeper employment curve EE, which takes the endogenous responses of the government into account. When drawing the indifference curves we now also have to take into account that the level of government output no longer is regarded as given by the trade union but instead as depending upon the wage rate it chooses. We can therefore draw a new set of indifference curves taking the response of government output into account. They must be flatter than the indifference curves drawn for a given level of government output. The reason is that since a higher wage rate triggers off an increase in government production, a larger decline in employment is now consistent with unchanged utility. Both the steepening of the labor demand curve and the flattening of the indifference curves tend to raise the wage rate. The economy will end up in B.

3.2 Different Employment Targets, Fixed Tax

Now consider a case where the tax on workers is still held constant, i.e. $\mu = 0$, but where the government aims at a higher employment than the initial level, i.e. $\tilde{E} > E$. Then we have from equations (22) and (23) that

$$\frac{dw^*}{d\gamma} = \frac{N_w}{\Lambda_w} (U_G + U_E) - \frac{A}{\Lambda_w} (\tilde{E} - E) \stackrel{>}{<} 0, \quad (26)$$

$$\begin{aligned} \text{and } \frac{dE^*}{d\gamma} &= (1 - \gamma) \frac{N_w^2}{\Lambda_w} (U_G + U_E) + \\ &+ \left[1 - (1 - \gamma) \frac{N_w A}{\Lambda_w} \right] (\tilde{E} - E) \stackrel{>}{<} 0 \end{aligned} \quad (27)$$

$$\text{where } A = U_{cE} - \gamma N_w U_{GG} \stackrel{>}{<} 0, \quad (27a)$$

$$\text{and } 1 - (1 - \gamma) \frac{N_w A}{\Lambda_w} = \frac{1}{\Lambda_w} \left[U_{cc} + (1 - \gamma) N_w U_{cE} + \gamma N_w^2 U_{GG} \right] > 0. \quad (27b)$$

If $\gamma > 0$ the sign of $\frac{dw^*}{d\gamma}$ is ambiguous. The first term in (26) is positive. But the sign of the second term is ambiguous, since the first term U_{cE} in the expression for A is positive, while the second $-\gamma N_w U_{GG}$ is negative. This second term captures the following. If γ is positive, the trade union takes into account that a wage rise increases consumption of government goods. An increase in γ implies more consumption of government goods given the wage. Hence the marginal utility of consumption of government goods is reduced. This creates an incentive to lower the wage rate. The smaller is γ and U_{GG} , the smaller is this effect. Indeed $\gamma = 0$ or $U_{GG} = 0$ are sufficient conditions for this effect to vanish, in which case $\frac{dw^*}{d\gamma} > 0$ unambiguously. The effect on employment is, however, still indeterminate, since the two terms in the square bracket in expression (25) still have opposite signs.

The effects in this case are easily illustrated in Fig 10, where we assume that $U_{GG} = 0$ and $\gamma = 0$. The first term in expressions (26) and (27) measures the Stackelberg effect and can be illustrated as the effect of a steepened labor demand schedule (cf. subsection 3.1 above). This effect tends just as

Figure 10

before to increase the wage and decrease total employment (the movement from A to D).

The second term is a Nash effect that can be illustrated as the effect of a parallel rightward shift of the labor demand schedule. This effect tends both to increase the wage and total employment (the movement from D to E or E'). The two effects - which in this case are exactly analogous to ordinary substitution and income effects - reinforce each other with respect to

employment. Hence the wage must rise, whereas employment may rise or fall.

3.3 Government and Trade Union Goals Coinciding, Endogenous Tax

Finally we consider the case when the government employment target again coincides with the initial employment level, i.e. $\tilde{E} = \underline{E}$ but where workers have to bear part of the tax burden of increased government expenditure, i.e. $\mu > 0$. We are then again looking at the pure Stackelberg effect. Equations (22) and (23) then reduce to:

$$\frac{dw^*}{d\gamma} = \frac{N}{\Lambda} \frac{w}{w} (U_G + U_E - T_G U_C) \begin{matrix} \geq \\ < \end{matrix} 0, \quad (28)$$

$$\text{and } \frac{dE^*}{d\gamma} = (1 - \gamma) \frac{N^2}{\Lambda} \frac{w}{w} (U_G + U_E - T_G U_C) \begin{matrix} \geq \\ < \end{matrix} 0. \quad (29)$$

The signs of both $\frac{dw^*}{d\gamma}$ and $\frac{dE^*}{d\gamma}$ are determined by the sign of

$$U_G + U_E - T_G U_C = \left. \frac{dU}{dG} \right|_{dw=0}. \text{ Consequently the effect on both}$$

the wage and employment depends upon the initial size $\tilde{G}$ of the government sector. If it is smaller than what is optimal for the trade union, $\left. \frac{dU}{dG} \right|_{dw=0} > 0$, and there will be a wage increase and a fall in employment. The reason is that by increasing the wage, the trade union makes a utility gain from the increase in the size of the government sector that is triggered off through the policy rule. If the initial size of the public sector is larger than optimal for the trade union, the opposite result holds.

By comparing equation (28) in the variable tax case with equation (26) in the constant tax case, it is obvious that when

the government and the trade union targets coincide, a variable tax will always have a dampening effect on the wage (the $-T_{GC}^U$ term in equation (28)). The reason is that a variable tax in this case confronts the trade union also with a cost when a wage increase triggers off an expansion of the government sector.

3.4 Conclusions in the Stackelberg Case

As soon as the trade union perceives the employment policy rule an additional Stackelberg effect is added to the Nash effect. This Stackelberg effect occurs because the trade union considers how its wage decision affects the size of the government sector. If the initial size of the government sector is regarded as lower than optimal by the trade union, the policy rule gives an incentive for wage increases that in fact reduce employment.¹⁶ Clearly this must happen if the trade union is not faced with any immediate tax increases when the government sector expands and does not consider any future costs. In this case employment policies thus have unambiguously counter-productive effects. If the government aims for a higher level of employment than would result without the policy rule, the effects on employment become ambiguous in the constant-tax case, but the wage rises even more and the private sector contracts even more.

3.5 Intertemporal Considerations

In the analysis above we have not specified how changes in government expenditures not covered by taxes on workers are financed. We have left it open whether they cause a govern-

ment budget deficit or if they are financed through taxes on capitalists. As long as the trade union is myopic this does not matter. But it will, as soon as intertemporal considerations are introduced.

Consider e.g. the case when a government budget deficit today is financed through future tax increases for workers or future reductions of the normal level of government employment. Then the trade union can no longer make the same simple atemporal optimization as above. It must in addition take into account the future welfare losses that are incurred if it sets the wage in such a way that the employment policy rule is triggered off. This case can be analyzed within a two-period framework with an additively separable intertemporal utility function where the constraint is that the government budget has to balance over the two periods. It is straightforward to show that a sufficient condition for the policy rule to raise the wage rate in both periods, if the government and trade union employment goals coincide ($\tilde{E} = \underline{E}$), is that the normal level of government employment $\tilde{G}$ is less than optimal for the trade union in both periods (the mathematics is not reported here).

As long as there are no investments in the model, taxes on capitalists have no future effects. But if a link between capitalists' income and the future capital stock is introduced, the trade union would have to take into account the effects on investment that arise if taxes on capitalists are raised to finance an expansion of the government sector.

The probability that the introduction of a policy rule increases the wage also in an intertemporal framework is, of course, large if the trade union underestimates the future costs of present government expenditures, or believes that these costs can be shifted over to future generations.

4. SUMMARY

One should in general expect systematic employment policies in the form of fiscal policies that shift the labor demand curve to have real effects on the normal equilibrium of the economy.

Such policies thus do not only reduce variations in macroeconomic variables but also affect the average values around which these variations take place.

We have shown a menu of cases which differ with respect to the assumptions on (1) how ambitious employment policies are; (2) how changes in government expenditure are financed and (3) trade union perceptions about the policy rule.

Employment policies are purely stabilizing when the government accepts the employment level that results from the trade union's wage decision and when the trade union does not perceive the policy rule. But if the government aims for a higher level of employment and/or the trade union perceives the policy rule, the wage rate is likely to be driven up and the government sector to expand at the expense of the private sector. It is quite possible that the economy ends up in a stagflationary situation where also total employment is lowered.

Tax changes for workers due to changes in government expenditure may have quite different effects under different assumptions about trade union perceptions. If the trade union does not perceive the policy rule, a tax increase on workers to finance an expansion of the government sector tends to increase the wage. But when the policy rule is anticipated, the wage may increase for exactly the opposite reason, namely because the trade union is *not* confronted with increased tax costs when wage increases trigger off an expansion of the government sector.

Our analysis suggests a possible interpretation of the macro-economic developments in the smaller European economies with centralized wage setting. The Nash cases without anticipations of employment policies could be regarded as applicable to the earlier post-war period, when trade unions had not yet learnt to take employment policies into account. A Stackelberg case where wage earners drive up wages in anticipation of government policy responses would seem to catch important aspects of the combined stagflation and expansion of the government sector in the seventies in these economies. This Stackelberg effect is a consequence of centralized wage setting and could arise in a decentralized system like in the U.S. only if employment policies are selective and thus directed towards the individual industry.

Obviously the analysis here represents only a first step. Several extensions suggest themselves: (1) to examine cooperative as well as non-cooperative solutions, which would make it necessary to introduce a well specified utility function for the

government, (2) to introduce several trade unions and discuss the possibility of Prisoner's Dilemma situations and (3) to introduce the employer side as an active agent in the wage setting process and analyze explicit wage bargaining situations.

FOOTNOTES

* We are grateful for comments from participants in the Institute for International Economic Studies Summer Workshop 1982 and from participants in a seminar at the Stockholm School of Economics as well as from Gene Grossman, Thorvaldur Gylfason, Assar Lindbeck, Paul Marginson, Andrew Oswald, Mats Persson, Torsten Persson and Assaf Razin. The research has been financed by grants from Bankforskningsinstitutet, the Nordic Economic Research Council and the Swedish Central Bank Tercentenary Foundation.

1. Cf. e.g. Malinvaud (1982) or Sachs (1982).
2. Cf. e.g. Fellner (1980), Phelps (1978) or Sachs (1980).
3. The model here thus is a theory for the real wage that would be desired by wage earners when acting as a collective. It remains to be shown that the actual bargained real wage in a more complex model moves in the same direction.
4. The analysis would not be qualitatively different if the marginal productivity of labor was diminishing.
5. M and b are henceforth suppressed under the function sign.
6. Partial derivatives are given in the appendix.
7. V_c and V_{cc} should always be evaluated at the consumption level $w - \tau$.

8. Partial derivatives are given in the appendix.

9. Cf. also Layard (1982). Alternatively we could, like Grossman (1981) use a median voter approach. But the results would be basically the same, as long as the size of the trade union cannot change endogenously. Note also that our general formulation of the trade union utility function covers the special case when the trade union maximizes the wage bill. It has been shown by Oswald (1982b) that the trade union utility maximization problem then boils down to maximization of the wage bill in the case when the trade union runs its own internal unemployment insurance scheme without any government-paid unemployment benefits.

10. Implicitly we thus impose a restriction on the government's willingness to accommodate wage increases in the government sector.

11. An implicit assumption above is that the choice of which workers will be unemployed is both random *and* repeated frequently. If e.g. the same individuals were to be unemployed period after period, it is hard to see why they would remain in the trade union and refrain from bidding down the wage rate.

12. α is henceforth suppressed under the function signs since we focus on cases where $\alpha = \alpha_N$.

13. As noted above there exists the possibility that such an interior solution does not exist. If it is the case that

$(1 - T_w)U_c + N_w U_E < 0$ for all $0 \leq E \leq M$, the trade union obtains maximum utility by setting the wage at the full-employment level. For the reasons given above we do, however, focus on interior solutions.

14. It also "renumbers" the indifference curves, but because of the separability assumption on the trade union utility function it will not change their slopes.

15. Cf. also Calmfors (1982b) where the same result is derived.

16. Since no utility function for the government has been specified, the model does not indicate whether $\tilde{G}$ is likely to be larger or smaller than what is optimal for the trade union. But it does not seem farfetched to conceive of situations where the government takes into account the interests of both capitalists and workers, and where capitalists obtain a proportionately smaller share of the benefits of an increased government sector than what they pay for through taxes (note that the capitalists get utility only from the output of the government sector but not from public employment). Then one would expect the government to choose a lower $\tilde{G}$ than the trade union desires.

APPENDIX

Partial Derivatives of the Tax Function

$$T_w = \frac{1}{E} [\mu(G - bN_w) - N_w(\tau - a)] > 0$$

$$T_{ww} = -\frac{2}{E} N_w T_w > 0$$

$$T_G = \frac{1}{E} [\mu(w - b) - (\tau - a)] > 0$$

$$T_{GG} = -\frac{2}{E} T_G < 0$$

$$T_{Gw} = \frac{1}{E} (1 - T_w - N_w T_G) - \frac{(1 - \mu)}{E} > 0$$

Partial Derivatives of the Utility Function

Set without loss of generality the size of the union's membership to unity, and let $c \equiv w - \tau$. Then

$$U_c = EV_c > 0; \quad U_{cc} = EV_{cc} < 0; \quad U_G = MZ'_G > 0;$$

$$U_{GG} = MZ_{GG} < 0; \quad U_E = V(c) - V(b) > 0 \quad \text{with } c > b;$$

$$U_{EE} = U_{cG} = U_{GE} = 0; \quad \text{and } U_{cE} = V'_c > 0.$$

Second-Order Condition in the Nash Case

$$\Omega_w = (1 - T_w)^2 U_{cc} + 2N_w U_{cE} < 0 \quad \text{always.}$$

*Shape of Indifference Curves in Reaction Function Diagram with
a Constant Tax*

$$u = U(w - \tau, G, N(w) + G) \quad \text{and} \quad u = 0 \Rightarrow$$

$$\left. \frac{dG}{dw} \right|_{du=0} = - \frac{U_c + N_w U_E}{U_G + U_E}.$$

Therefore

$$\begin{aligned} \frac{d}{dw} \left| \frac{dG}{dw} \right|_{du=0} &= - \frac{1}{(U_G + U_E)} \left[U_{cc} + 2 \frac{(N_w U_G - U_c)}{(U_G + U_E)} U_{cE} + \right. \\ &\quad \left. + \left(\left. \frac{dG}{dw} \right|_{du=0} \right)^2 U_{GG} \right] > 0 \end{aligned}$$