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MACROECONOMIC POLICY WITH A FLOATING EXCHANGE RATE AND A UNIONISED NON-TRADED SECTOR

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This paper presents a model of a small open economy with a unionised non-traded sector. It provides an equilibrium in which there can be unemployment, and focuses on the effect of macroeconomic policy on the level of unemployment and social welfare. Most of open-economy macroeconomics has tended to concentrate on economies with perfectly competitive labour markets. Notable exceptions include models of fixed-price temporary equilibria (Dixit (1978), Neary (1980), and more recently Rankin (1987) *inter alia*).

Both of these approaches have limitations. The use of perfectly competitive models implies that there is no involuntary unemployment, and with a classical labour market there is a unique Natural Rate which ties down long-run output and employment. This Natural Rate property makes long-run policy analysis trivial. Fixed-price temporary equilibria allow for non-market-clearing, and hence in the Keynesian regime there may be unemployment. However, in fixed-price equilibria wages and prices are treated as exogenous parameters. No serious explanation is given of how wages and prices are determined, or why they might respond to policy changes. Since prices play a major role in determining the behaviour of individual agents and markets, there is a serious question as to what these models can explain.

The presence of an imperfectly competitive labour market serves three purposes. First, on the conceptual level it provides a framework in which wages are endogenous, determined explicitly by the microeconomic decisions of economic agents (in this case unions). Second, in so far as unions will seek to raise wages above the competitive level, imperfect competition provides an equilibrium solution in which there can be (long-run) unemployment. At the equilibrium real wage, there will be an excess supply of labour, with those households who are unemployed being worse off than those who are employed. In this sense, there is equilibrium involuntary (or 'union voluntary') unemployment. Third, at the empirical level, the assumption of perfectly competitive labour markets is inappropriate in many countries, where there are significant levels of unionisation. Whilst this paper adopts the other extreme with a fully unionised non-traded sector, it provides a useful counter-example to the usual competitive extreme.

The main results of the paper are as follows. First, we consider the case of direct government employment. Under a floating exchange rate, we assume

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that the exchange rate is determined so as to balance trade (implicitly there is no capital mobility). In this case, we find that the fiscal multiplier is unity, and money is neutral (Propositions 2 and 4). This reflects the fact that with fixed relative wages/prices and homothetic preferences, the balance of trade implies fixed consumption (and hence output) of non-traded goods. On the welfare side, the unit multiplier under the floating exchange rate leads to a fall in social welfare (Proposition 5).

With direct government expenditure on outputs, there is another channel of influence for macroeconomic policy: expenditure can alter the equilibrium real wage in the non-trade sector, which in turn will influence relative prices and the allocation of expenditure between traded and non-traded goods. Under a floating exchange rate, the relative price effect of an increase in government expenditure leads to crowding out, with a multiplier below unity (Proposition 6).

It should be stressed that the papers' results rest on the assumptions made: households have homothetic preferences with a constant disutility of labour, firms have constant returns to labour. However, by providing a rigorous imperfectly competitive microfoundation to our small open economy, we are able to provide a coherent account of equilibrium unemployment, explore policy effects absent from competitive models, and undertake a serious welfare analysis of policy.

I. THE MODEL

This paper considers an economy which consists of a traded-goods sector, a non-traded goods sector, and possibly a public sector. In the traded-goods sector there are perfectly competitive labour and product markets. In the non-traded goods sector there is a competitive product market with a unionised labour market, and the public sector employs households in public works. As is common in the literature (e.g. Neary, 1980), we will abstract from the distinction between traded goods which are net exports and net imports, and simply have a single traded good that can either be exported or consumed domestically.

Households have one unit of labour, and are allocated *ex ante* to either the traded or non-traded sector. Public-sector employees are recruited from those allocated to the non-trade sector. The number of households in the private sectors is assumed for simplicity to be the same, H. The immobility of labour between the traded and non-traded sectors is crucial for the model: with a competitive labour market in the traded sector (and perfect mobility) there might be no equilibrium unemployment.

Households have a fixed disutility of labour $-\theta$ in the non-traded sector, θ^T in the traded sector: for most of the paper we will simplify by assuming $\theta^T = 0$. Households derive utility from consuming the traded good and the non-traded good, and have preferences of the form:

$$[U(X^T, X)]^c \left(\frac{M}{P}\right)^{1-c} \quad 0 < c < 1. \tag{1}$$

Where M is nominal money balances, P is the true cost of living index for U; U is a homothetic subutility function defined over the consumption of the traded good X^T and the non-traded good X. Since preferences are homothetic we can aggregate over households, and we will deal with aggregates X^T, X, M, rather than first subscripting for households. Total household income consists of initial money balances M less aggregate lump-sum taxes T; employed households in the traded sector receive wage W^T; in the non-traded sector W; in public employment W^G; unemployed households receive nothing. The price of traded goods is p^T, non-traded goods p. The relevant budget constraints for households h are thus:

$$p^T X_h^T + pX_h + M \leqslant \begin{cases} W + M_h^o - T_h & (2a) \\ W^T + M_h^o - T_h & (2b) \\ W^G + M_h^o - T_h & (2c) \\ M_h^o - T_h & (2d) \end{cases}$$

where $(2a)$ applies to employed households in the non-traded sector, $(2b)$ to employed households in the traded sector, and $(2c)$ to those in public sector employment, $(2d)$ to the unemployed.

The true cost-of-living index P is taken from the expenditure function corresponding to the homothetic sub-utility function U: $e(p^T, p) = P(p^T, p)\, U$ (where utility is normalised so that if $p^T = p = p'$, then $P = p'$). Real wages are nominal wages deflated by P.

Firms in both sectors have a constant return to scale technology, with outputs normalised to be equal to employment:

$$X^{oT} = N^T \quad X = N \tag{3}$$

where N^T and N are employment in the traded and non-traded sectors, and X^{oT} is the output of the traded sector. Since output markets are both competitive, there are no profits, and prices equal wages:

$$p^T = W^T \quad p = W. \tag{4}$$

Government expenditure can take two forms: employment, or direct expenditure on the output of non-traded goods. In Section II we will deal with the former case, the latter in Section III. When the government spends money on employing people on public works, these are assumed to be worthless. Public employment is assumed to have the same disutility of labour as in the non-traded goods industry. For reasons of reality and convenience, government expenditure G is measured in *nominal* terms (see Dixon (1988*b*) for a discussion). The nominal wage the government pays its employees is w^G, so that total public employment g is:

$$g = G/w^G. \tag{5}$$

We will not specify the nature of public-sector pay determination: rather, we will assume that the public real wage is some mark-up over the disutility of labour. Whilst the mark-up can be set at any level, for notational convenience

we will assume that the public wage equals the *equilibrium* wage in the non-traded sector.[1]

A proportion τ of government expenditure is financed by a universal poll tax: $T = \tau G$. From the government's budget constraint, domestic money creation is given by $(1-\tau)G$. Under a floating exchange rate monetary expansion is:

$$M - M^{o} = (1-\tau)G. \tag{6}$$

Having outlined the basic assumptions, we will now specify the equilibrium in each sector. In the traded-goods sector, the price of the output is determined in international markets at p^* in foreign currency. The exchange rate is e, so that the law of one price dictates that the domestic price is:

$$p^{T} = ep^*. \tag{7}$$

Since the product market is competitive, with constant returns to scale, all income in the traded sector is labour income, so from (4) and (7):

$$W^{T} = ep^*. \tag{8}$$

On the assumption that there is no disutility of labour in the traded goods sector ($\theta^{T} = 0$), there will always be full employment: $N^{T} = H^{T}$. With disutility of labour ($\theta^{T} > 0$) there will be full employment for a range of parameter values: for most of the paper we concentrate on this case (see (17) below). Total output will be $X^{oT} = H^{T}$, of which X^{T} is consumed domestically, and $X^{oT} - X^{T}$ is exported. Total wage income for the traded goods sector is:

$$Hep^*. \tag{9}$$

To derive the equilibrium in the non-traded sector, we first solve for the demand for non-traded goods. If we define total nominal expenditure on non-traded goods K, and traded goods K^{T}, with homothetic preferences (1) we have:

$$K = \alpha c(Hep^* + K + G + M^{o} - T), \tag{10a}$$

$$K^{T} = (1-\alpha)\, c(Hep^* + K + G + M^{o} - T), \tag{10b}$$

where α is the proportion of expenditure spent on the non-traded sector, which of course depends on relative prices $\alpha = \alpha(p^{T}, p)$. The RHS bracket in (10) is total household income: initial money balances net of tax $M^{o} - T$; income from employment in the domestic sector $K+G$; income in the traded sector HeP^*. Noting that $T = \tau G$ we solve the income–expenditure system to obtain total expenditures:

$$K = \frac{\alpha c}{1-\alpha c}[Hep^* + G(1-\tau) + M^{o}] \tag{11a}$$

$$K^{T} = \frac{c(1-\alpha)}{1-\alpha c}[Hep^* + M^{o} + G(1-\tau)]. \tag{11b}$$

[1] This captures the notion of comparability, although a more realistic alternative in the UK context might be to set the public real wage at the disutility of labour.

Interpreting these equations, the marginal propensity to import is $c(1-\alpha)$ and the marginal propensity to consume non-tradeable output is αc. Thus (11 *a*, *b*) are standard income–expenditure equations.

Given total expenditure K, and wage W, employment in the non-traded industry is:

$$N = \frac{K}{W}, \tag{12}$$

assuming (as we will) that there is no binding employment constraint in the domestic sector as a whole: $N+g < H$.

In order to define equilibrium in the non-traded sector, we need to specify how wages are determined. Suppose that there are many identical industries in the non-traded sector, so that we can look at a 'representative' industry. We will adopt a 'Hartian' model of a unionised labour market (Hart, 1982). There are r unions $k = 1 \ldots r$ in each industry, who act as 'syndicates' controlling the supply of labour to that industry. These are private-sector unions, who do not see themselves as influencing wages or employment in the public sector. The disutility of work is θ, and the real wage is W/P: each union chooses its employment N_k to maximise the 'surplus' of its members:

$$N_k\left(\frac{W}{P}-\theta\right). \tag{13}$$

This objective function can be seen as arising from the union maximising the expected utility of its members if (1) is a Neuman–Morgenstern utility function with random layoffs. We further assume that the union treats the general price level P as exogenous, and faces the 'objective' demand curve (12):

$$W = K \Big/ \sum_{k=1}^{r} N_k. \tag{14}$$

Within each industry there is a Nash equilibrium between the unions. In a symmetric equilibrium, this yields the wage equation

$$\frac{W}{P} = \frac{r\epsilon}{r\epsilon - 1}\theta, \tag{15}$$

where ϵ is the elasticity of demand for labour which depends on prices:

$$\epsilon(p^T, p) = -\frac{p}{N}\frac{\partial N}{\partial p}, \tag{16}$$

where N is given by (12). Since preferences are homothetic, ϵ is homogeneous of degree zero (Hod 0) in p^T and p. Equation (15) says that the equilibrium real wage in the unionised non-traded sector is a 'mark-up' on the disutility of work, the mark-up $r\epsilon/(r\epsilon-1)$ being determined by the elasticity of demand ϵ and the number of unions r. We will also assume that there is a *unique* equilibrium defined by (15), which is true if U is Cobb–Douglas or CES.

We can now characterise the equilibrium in the non-traded sector using

(15). Under the assumption of homothetic preferences, the equilibrium nominal wage becomes 'pegged' to the domestic price of tradeables, and is not affected directly by the level of demand.

PROPOSITION 1. (*Pegging*). *Let* $\lambda > 0$. *Assume that for* ep^* *there exists a unique equilibrium nominal wage* w^* *in the non-traded sector. Then for* λep^*, λw^* *is an equilibrium.*

Proof. The cost of living index P is Hod 1 in prices (ep^*, w): ϵ is Hod 0. Hence both sides of (15) are Hod 0 in (ep^*, w), establishing the result. Q.E.D.

In effect, Proposition 1 states that the domestic nominal wage becomes 'pegged' to the domestic price of tradeables (ep^*); or, to put it another way, the ratio w^*/ep^* is fixed by (15).[2] The reason why the unionised wage becomes pegged in this way is the homotheticity of preferences, so that real wages and the elasticity of demand are determined only by relative prices, independently of output/income. The pegging result of Proposition 1 has implications which will play a crucial role in determining the effectiveness of macroeconomic policy. Since relative prices are fixed, the expenditure shares of tradeables and non-tradeables $(1-\alpha, \alpha)$ and elasticity ϵ are fixed.

Lastly, it will have been noted that we have ignored the labour market in the traded-goods sector. We have simply assumed that wages are determined by ep^* (7 and 8). If there is a strictly positive disutility of labour $(\theta^T > 0)$, there is also a participation constraint for the traded-sector households

$$\frac{ep^*}{P} \geqslant \theta^T. \tag{17}$$

The analysis is restricted to those cases where (17) is satisfied.

II. POLICY WITH A FLOATING EXCHANGE RATE AND PUBLIC EMPLOYMENT

Having considered the equilibrium values of domestic variables conditional upon the exchange rate, we will now introduce the external balance into the equilibrium. We assume that the government is completely passive in managing the exchange rate. Under the assumptions of the model, since money is the only asset and there is no capital market, the balance of payments reduces to the balance of trade, and the exchange rate varies so that trade balances. Since we have only one traded good, trade balances when domestic consumption equals domestic output. In nominal terms, the trade surplus S is:

$$S = Hep^* - K^T, \tag{18}$$

where Hep^* is total expenditure and income on the domestically produced

[2] Proposition 1 generalises the result of Dornbusch's real-wage resistance model (1980, pp. 71–4), which employs Cobb–Douglas preferences.

traded good, and K^T (defined in equation (11 *b*) above) is domestic expenditure thereon. From (18) and (11 *b*), trade balances at e^*:

$$e^* = \frac{c(1-\alpha)}{1-c}\frac{M^0+(1-\tau)G}{Hp^*}. \tag{19}$$

We assume that private-sector agents treat e as parametric, justified by the argument that they are 'small' relative to the whole economy. The government and foreign exchange markets, however, have perfect foresight, predicting the exchange rate resulting from any given macroeconomic policy. Schematically, we envisage the following sequence of events:

The Government chooses (G, M^0, τ) → Foreign Exchange markets determine e^* → Wages and prices are determined domestically given e^*.

With a floating exchange rate, e^* becomes endogenous and can be substituted out of the reduced-form equilibrium equations for employment and unionised wages. Government policy can influence wages and employment, not only through direct demand effects but also through its effect on the exchange rate e^*. Hence an increase in G or M^0, or a decrease in tax-finance τ, will lead to a devaluation (an increase in e). The equilibrium levels of wages, employment and real government expenditure under a floating rate are given by:

$$w^{T*} = e^*p^* = \frac{c(1-\alpha)}{1-c}\frac{M+G(1-\tau)}{H} \tag{20a}$$

$$w^* = \mu e p^* = \frac{\mu c(1-\alpha)}{1-c}\frac{M^0+G(1-\tau)}{H} \tag{20b}$$

$$N^* = \frac{\alpha c}{1-\alpha c}\frac{H}{\mu}+\frac{(1-c)H\alpha}{\mu(1-\alpha)(1-\alpha c)} \tag{20c}$$

$$g^* = \frac{G}{w^*} = \frac{(1-c)H}{\mu c(1-\alpha)}\frac{G}{M^0+G(1-\tau)}. \tag{21}$$

We are now in a position to determine the effectiveness of fiscal and monetary policy under a floating-exchange-rate regime, and then to evaluate the welfare implications of macroeconomic policy. Our first result concerns the real government expenditure multiplier.

PROPOSITION 2. *Let* $0 \leqslant \tau \leqslant 1$. *Under a floating exchange rate, the real fiscal multiplier is unity*:

$$\frac{dE}{dg} = 1.$$

Proof. Directly from (20*c*) and (21), since N^* is constant:

$$\frac{dE^*}{dG} = \frac{dg}{dG} = \frac{(1-c)H}{\mu c(-\alpha)}\frac{M^0}{[M^0+G(1-\tau)]^2}. \quad \text{Q.E.D.}$$

That the fiscal multiplier should be unity whatever the level of tax-finance τ is a very strong result: that the effect of an increase in government employment on the exchange rate causes sufficient devaluation and domestic inflation to lead to constant private consumption of the non-traded good. The intuition behind the result is quite simple once it is recognised that in equilibrium relative prices are fixed. With homothetic preferences, this means that expenditure shares are in effect fixed. Thus real domestic consumption of the traded and non-traded output rises together in fixed proportions. The balance of payments equilibrium ties down consumption of the non-traded good, and hence output and employment in the non-traded good sector (as is clear from (20c)). If domestic consumption/output of the non-traded good is fixed, there is neither crowding out nor a multiplier effect: hence the unit multiplier. The reason that taxation τ has no effect on the multiplier is that τ merely affects income (the relation between gross and net income), not the ratio of household expenditure and consumption across traded and non-traded goods (which depends only on relative prices).

Whilst the effect of tax-financing does not influence the size of the real fiscal multiplier, it does influence the level of equilibrium unemployment given (G, M^0).

PROPOSITION 3. *With a floating exchange rate, higher tax-finance increases employment.*

Proof. From (20c) and (21):

$$\frac{dE}{d\tau} = \frac{(1-c)H}{\mu c(1-\alpha)} \frac{\tau G}{[M^0+G(1-\tau)]^2} > 0. \quad \text{Q.E.D.}$$

The reason for this result is closely related to Proposition 2. A rise in τ given G yields lower domestic prices (the exchange rate appreciates); there is an increase in public employment. With a floating exchange rate, then, there is a very strict sense in which tax-cuts are equivalent to an expenditure increase.

Whilst the effects of fiscal policy are perhaps a little unorthodox, the effects of monetary policy are more familiar.

PROPOSITION 4. *Monetary policy under a floating exchange rate*

(i) *Let* $G = 0$. *Money is neutral,* $\dfrac{dN^*}{dM^0} = 0$.

(ii) *Let* $G > 0$. *Monetary expansion reduces employment.*

Proof. Directly from (20), (21). Q.E.D.

With no government expenditure money is neutral, as in a standard classical model. With positive government expenditure, an increase in the money supply 'crowds out' government expenditure, since it leads to a devaluation and domestic inflation, thus reducing public employment g, which has the same effect as in Proposition 2.

What are the welfare effects of fiscal policy? It turns out that since total household consumption of the traded and non-traded goods is fixed (by the

balance of payments equilibrium condition), there can be no Pareto-improving policy. In effect, the allocation of consumption becomes a zero-sum game: households who gain (those who become employed) must 'crowd out' the consumption of others (the employed, the unemployed). The crowding-out mechanism is a real balance effect (prices rise as the increase in government expenditure causes a devaluation) or a direct tax effect (as in Proposition 3, or Proposition 2 with $\tau > 0$). Even though the floating exchange regime rules out Pareto-improving macroeconomic policy, does the surplus earned by those becoming employed make policy effects desirable for other social welfare functions? If we limit our explicit analysis to an increase in government expenditure which is money-financed ($\tau = 0$), it is easy to see that from a Rawlesian perspective the expenditure reduces the welfare of the worst off (real balances fall as prices rise), so social welfare falls. What of a utilitarian government?

PROPOSITION 5. *Under a floating exchange rate, a money-financed increase in government expenditure reduces total utility in the economy.*

Proof. There are three elements constituting total utility: real balances, consumption, and the utility of leisure. Real balances fall, total consumption is fixed (20*c*), and the increase in output reduces leisure by θdg. Hence total utility falls. Q.E.D.

Even in the absence of crowding out, the fiscal expansion has no welfare-improving properties: indeed, for both Rawlesian and utilitarian governments social welfare is maximised with $G = 0$. This result stems from the combination of assuming no direct utility from government employment, and the balance of trade equilibrium, which ties down total consumption. The assumption of no direct utility of government expenditure is of course totally implausible: in the United Kingdom a large proportion of state expenditure is on health and education. However, Proposition 5 indicates that there is no *macroeconomic* motive for altering government expenditure: rather, the optimal level of expenditure should be chosen by microeconomic rationale.

III. FISCAL POLICY WITH DIRECT GOVERNMENT EXPENDITURE

In the previous section we assumed that government expenditure took the form of direct employment in the public sector. This is not unrealistic: most of central government expenditure goes on wages and salaries. However, in this section we will consider the case of direct expenditure on the output of non-tradeables. This allows government expenditure to influence the real wage in the unionised non-traded sector by altering the elasticity of demand for labour. Direct government expenditure can influence the relative price of traded and non-traded goods, and hence alter α, the share of expenditure given to non-traded goods. Since α underlies the income–expenditure multiplier which determines nominal national income, this influence of government expenditure can be very powerful. The analysis of this section is rather more complex than in Section II. As a result, over-analysis is in a rather less general framework:

we restrict our attention to the CES specifications of the subutility function. In this case:

$$U = [X^{T(\sigma-1)/\alpha} + X^{(\sigma-1)/\sigma}]^{\frac{\sigma}{\sigma-1}},$$
$$P = [\tfrac{1}{2}(ep^{*1-\sigma} + W^{1-\sigma})]^{\frac{1}{1-\sigma}},$$

where we treat σ as the elasticity of demand.[3]

If the government spends directly on the output of the non-traded sector, this alters the income–expenditure system. Total expenditure K on non-tradeables is now household plus government expenditure, so that (10a) becomes

$$K = G + \alpha c(K + Hep^* + M^o - \tau G) \tag{22}$$

and hence (11) becomes

$$K = \frac{G(1-\alpha c\tau)}{1-\alpha c} + \frac{\alpha c}{1-\alpha c}(Hep^* + M^o), \tag{23a}$$

$$K^T = \frac{c(1-\alpha)}{1-\alpha c}(Hep^* + M^o). \tag{23b}$$

The non-traded-sector unionised wage equation (15) still holds. However, the elasticity of demand ϵ is now influenced by the level and nature of government expenditure. The government allocates a fixed nominal sum to each industry in the non-traded sector (there are 'cash limits') so that government demand is unit-elastic.

The elasticity of demand in the typical non-unionised sector is an arithmetic average of government and private-sector demands, the weights being expenditure shares (see Rankin, 1987b). Total household expenditure is $K-G$, given by (23a): government expenditure is G. Thus the elasticity of industry demand in the non-unionised sector is:[4]

$$\epsilon = \frac{G}{K} + \frac{K-G}{K}\sigma. \tag{24}$$

We will assume $\sigma > 1$ (gross substitutability), so that an increase in government expenditure reduces the elasticity. We define the markup of unionised wages over the disutility of work θ as γ:

$$\gamma \equiv \frac{r\epsilon}{r\epsilon - 1}. \tag{25}$$

[3] See Blanchard and Kiyotaki (1987) for derivations. The treatment of σ as the elasticity of demand is an approximation. It is, however, fully justified here, as agents treat the general price level as given. σ can therefore be seen as the approximate or 'perceived' elasticity.

[4] The analysis of fiscal policy when the government directly purchases output from the private sector has been made under a particular assumption: government demand is unit-elastic, because of 'cash limits'. We have argued that although a special case, it is perhaps not unrealistic in the United Kingdom. Another possibility would be that the government is rather like a household – it chooses a total level of expenditure, but allocated across non-traded industries with CES preferences. Thus whether an increase in G will increase (decrease) the real wage in the non-traded sector will be determined by whether it is less (more) elastic than household demand.

From (24), γ is ultimately a function of G, M and σ,

$$\gamma = \gamma\underset{+}{(}\underset{+}{G}, \underset{-}{M^o}, \underset{-}{\sigma}\underset{-}{)}. \tag{26}$$

The signs of the derivatives are derived by substituting for ϵ in (25) using (24) with $\sigma > 1$.

The equilibrium real-wage equation (15) thus becomes:

$$\frac{w}{p} = \gamma\theta. \tag{27}$$

Using the CES cost-of-living index for P we have the equilibrium relative price of traded and non-traded goods μ:

$$\frac{w^*}{ep^*} \equiv \mu = \left(\frac{\gamma^{1-\sigma}\theta^{1-\sigma}}{2-\gamma^{1-\sigma}\theta^{1-\sigma}}\right)^{\frac{1}{1-\sigma}}. \tag{28}$$

Again, we will restrict ourselves to parameter values for which μ is defined (i.e. $2 > \gamma^{1-\sigma}\theta^{1-\sigma}$). It can be verified that μ is larger for larger γ: this reflects the fact that if non-unionised real wages are higher, the relative price of non-traded goods must be higher. Again, we can write μ as a function of its ultimate determinants:

$$\mu = \mu\underset{+}{(}\underset{+}{G}, \underset{-}{M^o}, \underset{-}{\sigma}\underset{-}{)}. \tag{29}$$

The budget share of non-traded goods α depends on the relative price μ:

$$\alpha = \alpha(\mu), \quad \alpha' < 0 \text{ for } \sigma > 1. \tag{30}$$

If goods are gross substitutes, a rise in μ leads to a fall in the expenditure share of non-traded output, and vice versa with gross complementarity. The ultimate effect of an increase in G on α can be determined by the chain-rule using (29) and (30):

$$\underset{- \; +}{\frac{d\alpha}{dG}} = \underset{- \; +}{\frac{d\alpha}{d\mu}\frac{d\mu}{dG}} \quad \sigma > 1. \tag{31}$$

Thus an increase in G reduces the expenditure share of non-tradeables. A rise in G makes demand less elastic, hence increasing γ and μ, which causes consumers to switch expenditure to the traded good.

Since there is no government employment, total employment in the non-traded sector is equal to private employment N. Combining the equilibrium nominal wage equation with expenditure equation yields equilibrium employment:

$$\begin{aligned} N^* &= K/w^* \\ &= \frac{\alpha c}{1-\alpha c}\frac{H}{\mu} + \frac{1}{1-\alpha c}\frac{\alpha c M^o + (1-\alpha c\tau)\,G}{\mu e p^*}, \end{aligned} \tag{32}$$

where α and μ are given by (29) and (30). However, if we treat α and μ as parameters note that:

$$\frac{\partial N^*}{\partial \alpha} > 0 > \frac{\partial N^*}{\partial \mu}. \tag{33}$$

Since the exchange rate is floating, the balance of payments constraint requires that consumption of tradeables equals its output H as in (23). The difference now is that α will no longer be constant: as G changes, the relative price of tradeables and non-tradeables will alter. As in (20c), the equilibrium level of domestic output of non-tradeables is in effect tied down by the balance of payments constraint. Given policy (G, M^0, τ), the relative price of traded and non-traded goods μ is determined, which in turn ties down the marginal propensity to import $(1-\alpha)$, and this ties down the level of output in the non-traded sector consistent with balance of payments. With direct government expenditure, (20c) becomes:

$$N^* = \frac{\alpha c}{1-\alpha c}\frac{H}{\mu} + \frac{(1-c)H}{\mu c(-\alpha)(1-\alpha c)}\left[\frac{\alpha c M^0 + (1-\alpha c\tau)S}{M^0 + G(1-\tau)}\right]. \tag{34}$$

An increase in nominal expenditure G has the following total effect:

$$\frac{dN^*}{dG} = \underset{+}{\frac{\partial N^*}{\partial \alpha}}\underset{-}{\frac{d\alpha}{d\mu}}\underset{+}{\frac{d\mu}{dG}} + \underset{-}{\frac{\partial N^*}{\partial \mu}}\underset{+}{\frac{d\mu}{dG}} + \underset{+}{\left.\frac{dN^*}{dG}\right|_{\mu}}. \tag{35}$$

The third r.h.s. term represents the effect of G holding μ (and hence α) constant, although nominal prices will vary (with the exchange rate e), which corresponds to the multiplier in Section III. We now have the two additional effects which reduce the multiplier. The rise in government expenditure raises the relative price of non-tradeables to tradeables μ, which tends to reduce N^*; the rise in μ also causes an increase in import penetration. It is not surprising, therefore, that the real expenditure multiplier is less than unity. This is most easily seen by showing directly that an increase in government expenditure reduces private consumption of the non-traded good. From (23):

$$K - G = \frac{\alpha}{1-\alpha}K^T,$$

where $K-G$ is private expenditure on the on-traded sector. Under a floating exchange rate, $K^T = HeP^*$, the level of real consumption X of non-tradeables being:

$$X = \frac{K-G}{\mu e P^*} = \frac{\alpha}{1-\alpha}\frac{H}{\mu}. \tag{36}$$

Hence with gross substitution, private consumption is decreasing in G:

$$\frac{dx}{dG} = \underset{(+)}{-\frac{x}{\mu}\frac{d\mu}{dG}} + \underset{(-)(+)\ (\sigma > 1)}{\frac{H}{\mu}\left(\frac{1}{1-\alpha^2}\right)\frac{d\alpha}{d\mu}\frac{d\mu}{dG}} < 0. \tag{37}$$

The change in total employment E is:

$$\frac{dE}{dG} = \frac{(dx/dG) + (dg/dG)}{dg/dG}. \tag{38}$$

Since $dx/dG < 0$, it follows that (38) is less than unity.

PROPOSITION 6. *If produced goods are gross substitutes, the real expenditure multiplier is less than unity.*

Since there is crowding-out due to a rise in the relative and absolute price of non-traded goods, whilst the total consumption of traded goods is fixed at H, similar arguments to those in Proposition 5 will lead to the conclusion that under any criterion, fiscal policy reduces social welfare (again, if we ignore the public benefits of government activity).

IV. CONCLUSION

There is a growing literature on the macroeconomic implications of imperfect competition in closed economies (Dixon, 1987; Blanchard and Kiyotaki, 1987, *inter alia*). This paper extends this approach to a small open economy. The motivation for this is to provide an equilibrium with endogenous wage and price determination in which there can be (involuntary) unemployment. The properties and analysis of the imperfectly competitive economy differ significantly from the Walrasian case. Most importantly, with imperfect competition the nature of government expenditure matters in a way that it does not in the Walrasian case. In the model presented, it matters whether the government expenditure takes the form of public employment or direct expenditure on firms' outputs. In the latter case, direct government expenditure can alter the equilibrium real wage in the unionised sector. In the corresponding Walrasian model, there would be no difference between the cases of public employment and direct expenditure.

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REFERENCES

Blanchard, O. and Kiyotaki, N. (1987). 'Monopolistic competition and aggregate demand externalities'. *American Economic Review*, vol. 77, pp. 647–61.

Dixit, A. (1978). 'The balance of trade in a model of temporary equilibrium with rationing.' *Review of Economic Studies*, vol. 45, pp. 393–404.

Dixon, H. (1987). 'A simple model of imperfect competition with Walrasian features.' *Oxford Economic Papers*, vol. 39, pp. 134–60.

—— (1988*a*). 'Nominal wage flexibility in a partly unionised economy.' Essex University Discussion Paper no. 335.

—— (1988*b*). 'Unions, oligopoly, and the natural range of employment.' ECONOMIC JOURNAL, vol. 98, pp. 1127–47.

—— (1989). 'Imperfect competition, unemployment benefit and the non-neutrality of money: an example.' Forthcoming, *Oxford Economic Papers*.

Dornbusch, R. (1980). *Open Economy Macroeconomics*. New York: Basic Books.

Hart, O. (1982). 'A simple model of imperfect competition with Keynesian features. *Quarterly Journal of Economics*, vol. 97, pp. 109–39.

Neary, P. (1980). 'Non-traded goods and the balance of trade in a neo-Keynesian temporary equilibrium' *Quarterly Journal of Economics*, vol. 95, pp. 109–39.

Rankin, N. (1987*a*). 'The price, output, exchange rate overshooting effect in a two country disequilibrium model.' QMC Discussion Paper no. 159.

—— (1987*b*). 'Monetary and fiscal policy in a Hartian model. Mimeo, QMC.