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An Imperfectly Competitive Open Economy with Sequential Bargaining in the Labour Market

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ABSTRACT. – We consider a three sector small open economy with a monopolistic non traded sector, a competitive traded good sector, and a capital good sector. In both the consumer good sectors, there are enterprise unions that bargain sequentially over wages and employment as in MANNING [1987]. This approach encompasses the standard monopoly union, right-to-manage and efficient bargain bargaining models. We consider first the effects of bargaining strengths at each stage on overall macroeconomic equilibrium. Here we find strong general equilibrium spillover effects: bargaining strength in one sector affecting the other sectors. Second, we consider the influence of the bargaining process on the welfare analysis of fiscal policy.

Une économie ouverte et imparfaitement concurrentielle avec négotiations séquentielles sur le marché du travail

RÉSUMÉ. – Cet article analyse une économie ouverte avec concurrence imparfaite sur les marchés des biens et du travail. Suivant MANNING [1987], chaque entreprise produisant des biens pour la consommation négocie séquentiellement le salaire nominal et le niveau de l'emploi avec un syndicat d'entreprise. On analyse tout d'abord l'influence sur l'équilibre macroéconomique du pouvoir des syndicats à chaque stade des négociations. Finalement on étudie les propriétés normatives de la politique fiscale.

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1 Introduction

There have recently been several papers that explore the macroeconomic implications of imperfect competition in output and labour markets in open economies (CALMFORS [1982], ANDERSEN [1991], DE LA CROIX [1993], DIXON [1990], ELLIS and FENDER [1987], FENDER and YIP [1994], see DIXON [1994] for a survey). These in turn build on closed economy models (see SILVESTRE [1993] and DIXON and RANKIN [1994] for surveys). The previous papers have adopted specific models of the bargaining process in the labour market (either monopoly union, efficient bargain, or the right-to-manage model). In this paper we adopt a more general sequential bargaining framework developed by MANNING [1987], which encompasses the three approaches adopted so far. By adopting a more general bargaining model, we are able to explore in more detail the influence of the bargaining structure on both the macroeconomic equilibrium and the effects of policy.

There are two sectors producing consumer goods: a competitive traded sector and a monopolistic non traded sector selling only to home consumers. Both outputs use labour as an input. The non traded sector is subject to increasing returns to scale and also employs an intermediate good (overhead capital) produced by labour. The labour market in the traded and non traded sectors are unionized, and there is firm-union bargaining at the firm level. Using Manning's model, firms and unions bargain over first wage and then employment. The bargaining strengths may differ at each stage.

Our results are two fold. First, we are able to explore in detail how the bargaining process in each sector influences the outcome in the whole economy. Here we find important spillover effects: what is happening in one sector influences what happens in the other. Second, we are able to analyze the welfare effects of fiscal policy. Again, the magnitude of the effects depends upon the bargaining process in both sectors. In particular, we find that there is a marked contrast to the welfare effects of fiscal policy in the short and long-run. In the short-run, we find that there is a crowding-in multiplier effect which can lead to an increase in welfare even if government expenditure is waste. In the long-run, however, the balanced-trade condition ties down private sector consumption, and government expenditure simply increases employment, hence reducing welfare. If we allow for government expenditure directly in the welfare function, we find that the marginal increase in welfare is less when there are less perfect markets.

2 The Model

There is a small open economy composed of a capital good sector, a non traded and a traded sector. The non traded sector has DIXIT-STIGLITZ

[1977] monopolistic competitors, each producing its own brand of the non-traded good under increasing returns. The traded sector output market is perfectly competitive, with firms producing under decreasing returns to labour a single and homogenous good, which they supply to foreign and domestic consumers at a fixed international market price. In both unionized sectors, firms bargain sequentially over wages and employment with enterprise unions. In the perfectly competitive capital good sector, there is one representative firm, producing under constant returns to labour and selling capital goods to firms in the non traded sector. There is a single economy wide labour market with perfect labour mobility. Money is the only asset and there is no capital mobility. The exchange rate is fixed. Balanced trade will be obtained via endogenous adjustments in the domestic money supply.

2.1. **Households**

There is a continuum of H identical households indexed by $h \in [0,\, H]$. They derive utility from consumption of domestic sector output c_h^{NT} (an index defined below), traded sector output c_h^T, and from real money balances M_h/P, where M_h are end-of-period money balances and P is the consumer price index, defined below. We assume that real money balances enter the household utility function either as a proxy for future consumption (*i.e.* "savings") or as a nonproduced good which provides liquidity services to households. Households offer one unit of labour with a fixed disutility θ, thus making a binary choice, to work or not to work. Households can be employed in any sector or they can be unemployed. Assuming homothetic preferences over consumption and money balances allows us to consider an aggregate household, whose preferences take the form:

$$U = u\left(c^{NT},\, c^T\right)^c \left[\frac{M}{P\left(P^{NT},\, P^T\right)}\right]^{1-c} - \theta n \tag{1}$$

where n is total employment, P^{NT} the non traded sector price index, P^T the traded sector price index (see below). Furthermore, we suppose that u is Cobb-Douglas and the sub-utility of consumption in the non traded sector is CES:

$$\begin{aligned} u(c^{NT}\left(c_j^{NT}\right),\, c^T) =& [c^{NT}\left(c_j^{NT}\right)]^{1-m}\left(c^T\right)^m \\ & \times [m^m\left(1-m\right)^{1-m}c\left(1-c\right)^{\frac{1-c}{c}}]^{-1} \end{aligned} \tag{2}$$

$$c^{NT}\left(c_j^{NT}\right) = r^{\frac{(\rho-1)}{\rho}}\left[\sum_{j=1}^{r}\left(c_j^{NT}\right)^{\rho}\right]^{\frac{1}{\rho}} \tag{3}$$

$$P^{NT} = \left[r^{-1}\sum_{j=1}^{r}\left(P_j^{NT}\right)^{\frac{\rho}{(\rho-1)}}\right]^{\frac{(\rho-1)}{\rho}} \tag{4}$$

(5) $$P = (P^{NT})^{1-m}\,(P^{T})^{m}$$

In (2) the constant term is a useful normalization; we shall interpret $0 < c < 1$ as the marginal propensity to consume, and $0 < m < 1$ as the marginal propensity to import out of disposable income. (3) is a CES consumption index of the non traded sector brands c_j^{NT} and we assume $0 < \rho < 1$ (gross substitution and elastic demand); all goods enter the sub-utility function symmetrically and we neutralize the household's "love of variety" using the $r^{(\rho-1)/\rho}$ term, thereby marginal utility is constant [1]. Equations (4) and (5) represent the price indices for the non traded sector and the whole economy. The latter is a weighted geometric average of prices in the non traded and traded sectors. (The weights being the expenditure shares on total consumption by home households.) The aggregate household's disposable income consists of aggregate initial nominal money balances M^0, plus aggregate nominal profits Π (all profits are distributed), plus aggregate labour income Wn, minus aggregate nominal lump-sum taxes T. It then maximizes utility (2.1) subject to the budget constraint:

(6) $$\sum_{j=1}^{r} P_j^{NT}\,c_j^{NT} + P^T c^T + M \leq Y + M^0 - T$$

where $Y = Wn + \Pi$ is the flow component of the household disposable income and:

(7) $$Wn = \sum_{j=1}^{r} W_j^{NT}\,n_j^{NT} + \sum_{i=1}^{\nu} W_i^{T}\,n_i^{T} + W^K n^K$$

is the total wage bill, *i.e.* the sum of the wage bill from employment in the non traded sector NT, in the traded sector T (v corresponds to the number of firms) and in the capital good sector K, where W and n denote nominal wages and employment.

Given Y, we can solve the household's problem adopting a three-stage budgeting procedure [2], which yields the Marshallian demands for money balances, aggregate consumption in the traded and non traded sectors and for each brand:

(8) $$\frac{M}{P} = (1-c)\left[\frac{Y + M^0 - T}{P}\right]$$

(9) $$P^T c^T = mc\,[Y + M^0 - T]$$

1. In this we follow BLANCHARD and KIYOTAKI [1987]. Notice that the summatory sign in (3) implies an integer constraint on the number of brands available on the marketplace; HELPMAN and KRUGMAN ([1985], chap. 6) provide a general treatment of the CES function on continuous space.
2. See DEATON and MUELLBAUER ([1988], chap. 5) on multistage budgeting decisions with weakly separable preferences.

$$P^{NT} c^{NT} = (1-m)\, c\, [Y + M^0 - T] \tag{10}$$

$$c_j^{NT} = \left(\frac{P_j^{NT}}{P^{NT}} \right)^{-\sigma} \left[\frac{(1-m)\, c\, [Y + M^0 - T)}{r P^{NT}} \right] \tag{11}$$

where P^{NT} is the price index defined in (4); and $\sigma \equiv 1/(1-\rho)$ denotes the constant price elasticity of demand, corresponding to the elasticity of substitution between brands in (3). Note that using the quantity and price indices defined above (3, 4), we can treat the output of the monopolistic sector as a single commodity.

The aggregate household's labour-supply decision coincides with the participation decision. If the real wage exceeds the disutility of labour θ, the aggregate household wishes to supply H units of labour; if the real wage is equal to the marginal disutility of employment, the household is indifferent between work and leisure; if it is less than θ, the household will not choose to participate in the labour market.

2.2. The Government

The government allocates total nominal expenditure G in the non traded sector, and raises nominal lump-sum taxes T in order to balance its budget. We ignore public benefits of public activity (*i.e.* government expenditure is "waste"), which, except for Section 6 below, allows us to concentrate on the purely macroeconomic effects of fiscal policy only. We assume that the government has the same preferences [3] and faces the same prices as the household, yielding demand for each brand j:

$$g_j = \left(\frac{P_j^{NT}}{P^{NT}} \right)^{-\sigma} \left[\frac{G}{r P^{NT}} \right] \tag{12}$$

where P^{NT} is given by (4). The real government expenditure g is equal to nominal expenditure G deflated by the non traded sector price index, *i.e.* $g = G/P^{NT}$.

2.3. The Non Traded Sector

In the product market of the non traded sector, there are $j = 1, \ldots, r$ monopolistically competitive firms. Before production can take place, each firm must install $f \geq 0$ units of capital, which is the source of

3. This assumption is purely for simplicity. We could in principle allow for a different elasticity of government demand. However, since we are not interested in the resultant *composition* effect (see DIXON and RANKIN [1994], p. 189), we have not done so. Alternatively, we could adopt the approach of FAGNART *et al.* [1994], pp. 5-9: the monopolistic sector produces intermediate goods, which are used as inputs by competitive firms in the production of one final non traded-good.

internal increasing-returns-to-scale when $f > 0$. We assume that there are r enterprise unions, one for each firm, and that the nominal wage and employment are determined at the firm level in a sequential bargaining framework, as in MANNING [1987]. In the first stage, each firm and union bargain over the nominal wage, and in the second over employment (and hence output and prices). Furthermore, since demands are symmetric across firms, technologies identical, and bargaining units alike we consider the solution for the typical monopolistic firm and its typical enterprise union [4]. In this section, we treat the number of firms as fixed: the results do not depend on this, and we shall briefly consider the effect of free entry in Section 7.

The typical firm produces x_j^{NT} units of output with n_j^{NT} units of labour, provided it has f units of overhead capital. Its profit function is therefore:

$$\Pi_j^{NT} = P_j^{NT} n_j^{NT} - (W_j^{NT} n_j^{NT} + P^K f) \tag{13}$$

where $P^k f$ are the overhead costs of production. Each firm faces a downwards sloping market demand curve, which is the sum of the household and government demands. From (10)-(12) and since equilibrium in the typical product market implies $c_j^{NT} + g_j = n_j^{NT}$, we obtain:

$$n_j^{NT} = \left(\frac{P_j^{NT}}{P^{NT}}\right)^{-\sigma} \left[\frac{c^{NT} + g}{r}\right] \tag{14}$$

The typical union maximizes the "surplus" of its members:

$$s_j^{NT} = \left[\frac{W_j^{NT}}{P} - \theta\right] n_j^{NT} \tag{15}$$

We can interpret (15) as a Benthamite welfare function, with risk-neutral households and random layoffs (see e.g. OSWALD [1982]) [5].

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4. Models of monopolistic competition and wage bargaining in closed economies include LAYARD and NICKELL [1990] and LICANDRO [1992]. ARNSPERGER and DE LA CROIX [1990] consider the efficient bargain solution as well.

5. This interpretation requires that households are ex ante allocated to firms, that θ, P and membership are exogenous to the union and that employment falls short of membership, see e.g. OSWALD [1985]. This approach is consistent with the household's utility function (1), where the zero real wage elasticity of labour supply means risk neutrality (the marginal utility of income is constant at 1/P). For a criticism of equation (15), see PENCAVEL [1991], pp. 59-65.

2.3.1. ***The Bargaining Solution***

In Manning's sequential bargaining model, the union may have a differential bargaining power over wages and employment. This "differential control" may emerge from differences in attitude toward risk, time preferences or asymmetries of information between parties. Here we treat the union's bargaining strength over the contract variables as parametric [6]. In the first stage, the firm and the union negotiate over the nominal wage rate; in the second stage, they choose employment, given the optimal wage. The equilibrium wage-employment pair is subgame perfect. This solution nests as special cases the well known monopoly union, right-to-manage, and efficient bargain models (see PENCAVEL [1991] for a survey). Notice that although the parties negotiate both over wages and employment, the solution can deviate from the efficient bargain since the variables are not chosen simultaneously and bargaining strength may differ [7].

The bargaining takes the asymmetric Nash solution, maximizing the weighted product of the parties' payoffs net of opportunity costs. We interpret the fall-back levels as the payoffs attained during the process of bargaining; at each stage we normalize the union's fall-back to zero [8], and the firm's to $-P^K f$. Therefore, in the second stage of bargaining, the typical bargaining unit chooses employment as the solution to the program:

$$\begin{aligned} &\underset{n_j^{NT}}{\mathrm{MAX}}\ \Omega^{NT} = (s_j^{NT})^L \left[\frac{\Pi_j^{NT} + P^k f}{P}\right]^{1-L} \\ &s.t.\,(14), \quad S_j^{NT} \geq 0, \quad \Pi_j^{NT} \geq 0 \end{aligned} \tag{16}$$

where $0 \leq L \leq 1$. Note that the contractors consider the price index of the monopolistic sector P^{NT} and the general price index P as exogenous, as seems appropriate since each firm is small relative to its sector and the economy (see BLANCHARD and KIYOTAKI [1987] and DIXON [1991]). Furthermore, the wage rate is taken as given, being determined in the former negotiation round. Substituting the market product demand constraint (14)

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6. MANNING [1987] discusses these cases. BINMORE *et al.* [1986] show that in a two-person negotiation the power parameter of an actor is positively related to its speed in responding to the offer of the rival and negatively related to its estimate of the probability of a breakdown. These may be different for wage and employment.

7. The wage-employment sequential bargain yields the efficient simultaneous bargain only if the bargaining strength over wage and employment are the *same* at each stage, see MANNING [1987], Proposition 1 (ii).

8. If the union is utilitarian, this corresponds to normalize its fall-back to $z\theta$, where z is total membership. The solution concept in a cooperative framework is due to NASH [1950]. BINMORE *et al.* [1986] give a strategic content to the asymmetric solution. It corresponds to the limit of a game featured by offers and counteroffers as the period between the successive offer reduces to zero. SVEJNAR [1986] derives it from an axiomatic framework, which includes the notions of exogenous bargaining power and fear of disagreement.

into the NASH product, the employment choice can be turned into a price choice program. Solving for the first-order condition and rearranging yields:

$$\frac{P_j^{NT} - W_j^{NT}}{P_j^{NT}} = \frac{(1-L)}{\sigma} \equiv \mu\,(1-L) \tag{17}$$

(17) represents the standard equation for the Lerner index of monopoly, augmented by L, the union's influence over employment; when $L = 1$, we have the perfectly competitive outcome, when $L = 0$, the monopoly rule. Turning to the first stage, the parties select the nominal wage rate, anticipating their optimal choice in the second stage. In doing this, they recognize the dependence of employment upon the nominal wage rate, *i.e.* $n_j^{NT} = n_j^{NT}\left(P_j^{NT}\left(W_j^{NT}\right)\right)$. The negotiators solve then the program:

$$\begin{aligned} & \underset{W_j^{NT}}{MAX}\ \Omega^{NT} = (s_j^{NT})^b \left[\frac{\Pi_j^{NT} + P^K f}{P}\right]^{1-b} \\ & s.t.\ (17), \quad S_j^{NT} \geq 0, \quad \Pi_j^{NT} \geq 0 \end{aligned} \tag{18}$$

where $0 \leq b \leq 1$. Solving (17) in (18) yields:

$$\frac{W_j^{NT}}{P} = \theta \left[\frac{\sigma - (1-b)}{\sigma - 1}\right] \tag{19}$$

The real wage is a mark-up over the disutility of labour. The mark-up is decreasing in σ (the wage elasticity of employment demand) and increasing in b (the union power over wages), as we expect. Notice that (19) corresponds to the competitive wage for $b = 0$ (*i.e.* no union power and the zero utility constraint binds) and to the monopoly union wage for $b = 1$. Moreover, the wage contract is independent of L (the union power over employment), which influences the employment contract stage only. Substituting (19) back into (17) yields:

$$\frac{P_j^{NT}}{P} = \theta \left[\frac{\sigma}{\sigma - 1}\right] \left[\frac{\sigma - (1-b)}{\sigma - (1-L)}\right] \tag{20}$$

The real output price is a mark-up over the disutility of labour. The mark-up is decreasing in σ (the price elasticity of product demand) and L, and increasing in b [9]. The sequential bargaining solution nests as special cases

9. Turning back to equation (17), DOWRICK [1989] (with conjectural variations) and ARNSPENGER and DE LA CROIX [1990] (with monopolistic competition) derive a similar result but under the efficient bargain regime, so that the wage and price mark-ups must move in opposite directions as a result of an increase in union power, which is not necessarily the case in the present framework. Rearranging (17), we obtain the optimal allocation rule, $W_j^{NT} = (1-L)(1-\mu)P_j^{NT} + LP_j^{NT}$: employment is chosen as if equating the wage rate to a weighted arithmetic average of the marginal revenue product of labour and the product price, the weights being the firm's and union's power coefficients. This rule is the counterpart of the Mc DONALD and SOLOW ([1981], p. 905) "power locus", derived under a symmetric Nash solution.

the right-to-manage (when $L = 0$ and $0 \leq b \leq 1$) and the monopoly union solutions (when $L = 0$, $b = 1$). The efficient bargain solution occurs when $b = L$, with the two polar cases of the competitive labour market ($b = L = 0$) and the "producer cooperative" ($b = L = 1$, see WARD [1958]). In these efficient cases, price and employment are chosen at their profit maximizing level, with wages determining the distribution of surplus (see e.g. DE MENIL [1971]). In the symmetric partial equilibrium, prices and wages are the same for each bargaining unit and they all choose the same level of employment. Hence: $P_J^{NT} = P^{NT}$; $rn_j^{NT} = n^{NT}$; $W_J^{NT} = W^{NT}$.

2.4. The Capital Good Sector

In the capital good sector, workers are paid their reservation wage and one representative firm produces and sells a good to the Dixit-Stiglitz monopolies. We interpret this as capital, although it could as well be considered as any good which is needed for setting up firms (e.g. plants, buildings, managerial labour) in the non traded sector. The market demand for capital goods is determined by the number of firms operating in the non traded sector, and assuming that one unit of labour produces one unit of capital good, we define the equilibrium aggregate output-employment as $n^K = rf$, where r is the given number of monopolistically competitive firms of the non traded sector, and f is overhead capital per firm. In equilibrium, the representative firm makes no profits, thus:

$$P^K = W^K = \theta P \tag{21}$$

2.5. The Traded Sector

In the traded sector, there are v identical firms and enterprise unions. Firms use symmetric decreasing returns to labour technologies and supply a single and homogeneous good, whose foreign currency price P^* is determined in international market. By the law of one price, the domestic currency price is:

$$P^T = EP^* \tag{22}$$

where E is the exchange rate, *i.e.* the quantity of domestic currency necessary to buy one unit of foreign currency. Aggregating over firms, we can consider a representative firm and a representative union, whose preferences are:

$$\Pi^T = P^T x^T - W^T n^T \tag{23}$$

$$s^T = \left[\frac{W^T}{P} - \theta\right] n^T \tag{24}$$
$$n^T = vn_i^T$$

where the relation between sectoral employment n^T and output x^T is:

$$x^T = (n^T)^{\alpha} \qquad \alpha < 1 \tag{25}$$

Normalizing fall-backs to zero, in the second stage of the bargaining process the contractors solve the program:

$$\underset{n^T}{\mathrm{MAX}}\ \Omega^T = (s^T)^{\gamma} \left(\frac{\Pi^T}{P}\right)^{1-\gamma} \tag{26}$$
$$s.t. \qquad s^T \geq 0, \quad \Pi^T \geq 0, \quad (25)$$

where $0 \leq \gamma \leq 1$. Recalling that the cost-of-living index P is exogenous to both parties, the solution to (26), using (22) and rearranging, gives equilibrium employment:

$$n^T = \left[\frac{EP^*}{W^T}\left(\alpha\left(1-\gamma\right)+\gamma\right)\right]^{\frac{1}{1-\alpha}} \tag{27}$$

In the first stage, the parties choose wages anticipating their optimal employment decision, thereby solving the program:

$$\underset{W^T}{\mathrm{MAX}}\ \Omega^T = (s^T)^{\beta} \left(\frac{\Pi^T}{P}\right)^{1-\beta} \tag{28}$$
$$s.t. \qquad (27), \quad s^T \geq 0,\ \Pi^T \geq 0$$

where $0 \leq \beta \leq 1$. Substituting (27) into (28), the solution to the first-order condition yields:

$$\frac{W^T}{P} = \theta\left[\frac{\alpha\left(1-\beta\right)+\beta}{\alpha}\right] \tag{29}$$

The interpretation of equation (29) is analogous to that of (19). The contract wage does not depend upon the union influence over employment γ and is a parametric function of the household's preferences (θ), the technology (α) and the parties' influence over wages (β and $1-\beta$). Moreover, the real wage is increasing in β. Using (5), (29) in (27) and collecting terms yields the optimal employment level as a function of both γ and β:

$$n^T = \left[\left(\frac{EP^*}{P^{NT}}\right)^{1-m}\frac{\alpha}{\theta}\left(\frac{\alpha\left(1-\gamma\right)+\gamma}{\alpha\left(1-\beta\right)+\beta}\right)\right]^{\frac{1}{1-\alpha}} \tag{30}$$

Traded sector employment and thus output are increasing in γ and decreasing in β. Furthermore, if the union has a differential control $[(\beta/\gamma) > 1]$, employment is below the market clearing level, *ceteris paribus* [10].

2.6. **Balance of Payments and Nominal Income**

Since capital is immobile, the balance of payments consists of the trade account only. Net exports A are the accounting definition of the difference between the value of total output in the traded sector and the value of total expenditure from home households:

$$A \equiv P^T x^T - P^T c^T = EP^* x^T - mc\,(Y + M^0 - T) \tag{31}$$

Using (9)-(10) and solving for the equilibrium level of nominal national income yields:

$$Y = \frac{(1-m)\,c\,(M^0 - T) + G + EP^* x^T}{1 - (1-m)\,c} \tag{32}$$

When trade balances, $A \equiv 0$ and (32) reduces to the income-expenditure equilibrium:

$$Y = \frac{c\,(M^0 - T) + G}{1 - c} \tag{33}$$

Lastly, we define the equation for the expansion in the domestic money supply from the various agents budget constraint:

$$M - M^0 = A + (G - T) \tag{34}$$

which says that the sum of the private, public and foreign deficit must equal zero. Therefore, monetary expansion is equal to the balance of trade surplus plus the government deficit.

3 Macroeconomic Equilibrium

In this section, we consider the macroeconomic equilibrium in the "short run", without imposing balance of payments equilibrium. In Section 5, we shall consider the long-run balanced trade equilibrium through the adjustment of the domestic money supply. In this section, the exchange

10. Note that the above results reflect the analysis of MANNING ([1987], pp. 129-131). However, by adopting a general equilibrium method, we can evaluate the macroeconomic content of these imperfections in the traded sector, via their spillovers in other sectors.

rate E is treated as fixed and government fiscal policy instruments (G, T) are considered as exogenous. The model presented above may be solved in order to determine equilibrium prices, wages, employment and output. Combining (5), (19), (20) and (22) yields the wage and price equations:

$$P^{NT} = EP^* \left[\left(\frac{\sigma}{\sigma - 1} \right) \left(\frac{\sigma - (1-b)}{\sigma - (1-L)} \right) \theta \right]^{\frac{1}{m}} \tag{35}$$

$$W^{NT} = EP^* \left[\left(\frac{\sigma}{\sigma - 1} \right) \left(\frac{\sigma - (1-b)}{\sigma - (1-L)} \right) \theta \right]^{\frac{1}{m}} \left(\frac{\sigma - (1-L)}{\sigma} \right) \tag{36}$$

Using (29), the solution for wages in the traded sector is:

$$W^T = EP^* \left[\left(\frac{\sigma}{\sigma - 1} \right) \left(\frac{\sigma - (1-b)}{\sigma - (1-L)} \right) \right]^{\frac{1-m}{m}} \left[\frac{\alpha (1-\beta) + \beta}{\alpha} \right] \theta^{\frac{1}{m}} \tag{37}$$

Using (21), the solution for prices in the capital good sector is:

$$P^K = EP^* \left[\left(\frac{\sigma}{\sigma - 1} \right) \left(\frac{\sigma - (1-b)}{\sigma - (1-L)} \right) \right]^{\frac{1-m}{m}} \theta^{\frac{1}{m}} \tag{38}$$

As is clear from (35)-(38), the domestic nominal prices and wages become "pegged" to the domestic value of world prices. Hence for $\eta > 0$, if W^{NT*}, P^{NT*}, W^{T*}, P^{K*} is an equilibrium given EP^*, then ηW^{NT*}, ηP^{NT*}, ηW^{T*}, ηp^{K*} is an equilibrium given ηEP^*. This result develops DIXON ([1990], p. 83) and Dornbusch's real-wage resistance model ([1980], pp. 71-74). From Section 2, all the partial equilibrium equations determine prices relative to the consumer price index $P\left(P^{NT}, P^T\right)$, which is homogeneous to degree one in P^{NT} and P^T; however, in so far as the price of tradeable is fixed at $P^T = EP^*$, it follows that $\left(W^{NT}, P^{NT}, W^T, P^K\right)$ are determined relative to P^T, *i.e.* (19)-(21) and (29) are HOD0 in P^T, W^T, P^{NT}, W^{NT}, P^K.

Solving for equilibrium output and employment in the traded sector by combining (25), (30) and (35) yields:

$$x^T = \left[\alpha \left[\left(\frac{\sigma}{\sigma - 1} \right) \left(\frac{\sigma - (1-b)}{\sigma - (1-L)} \right) \right]^{\frac{m-1}{m}} \times \left(\frac{\alpha (1-\gamma) + \gamma}{\alpha (1-\beta) + \beta} \right) \theta^{-\frac{1}{m}} \right]^{\frac{\alpha}{1-\alpha}} \tag{39}$$

The traded sector output (and employment) is determined by parameters only: the technology (α), preferences (m, θ), the degree of competition in the non traded and traded sectors (σ, b, L; β, γ). There are obvious "own sector" effects of β and γ on x^T: higher union power over wages β leads to lower output, higher union power over employment γ yields higher output (what ultimately matters is the differential control β/γ). However, there are also general equilibrium "cross-sector spillover" effects. Imperfect competition in the non traded sector output market (σ) and labour market ($b,\ L$) both influences x^T. This operates via the cost-of-living: a higher price for non traded output leads to higher nominal wages in the traded sector. Substituting (39) into (32) yields equilibrium nominal national income Y, as a function of parameters and government policy instruments only. Turning to equilibrium employment-output in the non traded sector, as each bargaining unit chooses the same employment-output level n_j^{NT} and the same price $P_j^{NT} = P^{NT}$, from (10)-(12) total sectoral output-employment is:

$$n^{NT} = rn_j^{NT} = c^{NT} + g = \left[\frac{(1-m)\,c\,[Y + M^0 - T] + G}{P^{NT}}\right] \tag{40}$$

Equilibrium total employment is the sum of sectoral employment:

$$n = n^{NT} + n^T + n^k \tag{41}$$

where the capital good sector employment n^K is constant, from (21) and the fact that there is no free entry in the non traded sector. In the analysis which follows, we shall assume that total equilibrium employment falls short of total labour supply H (*i.e.* employment is demand determined). Furthermore, there is involuntary unemployment for households who stay unemployed in the *unionized* sectors, as the real wage can be above the disutility of labour. Clearly, the assumption of underemployment is only valid for certain parameters values and not for others. In the case where the full employment constraint is binding, the analysis is classical (see e.g. DIXON [1992], pp. 302-303 for a partly-unionized economy under full employment).

The analysis above confirms that in a general equilibrium framework the imperfections in one market can spill over to affect other markets. In this case, the market imperfections in the traded sector spillover and can or not lower output in the non traded sector, whilst they directly affect Y. Moreover, imperfections in the non traded sector spill over in the traded sector and influence equilibrium nominal national income through this.

4 Macroeconomic Policy with Unbalanced Trade

In this section, we examine the effects of government policy on real variables and its desirability in terms of Welfare analysis in the short-run, where we do not impose balance of payments equilibrium. We assume that the social welfare function is the indirect utility function of the aggregate household augmented by the domestic value of foreign reserves.

The inclusion of foreign currency reserves in the objective function of the government is needed to take account of the option value which the government has of importing goods. Substituting (8)-(10) in (1-5) and given total employment (41), social welfare is:

$$V = \left[\frac{Y + M^0 - T}{P\left(P^{NT},\, P^T\right)}\right] - \theta n + \lambda R \tag{42}$$

The first RHS term represents the indirect utility from consumption and real balances; the second is the disutility of labour; the third term is the domestic value of foreign currency reserves, with λ being the shadow price and R foreign currency reserves (in foreign currency). We shall assume for simplicity that $\lambda = E/P$: foreign currency reserves are valued at their "real" value in domestic currency.

4.1. **Fiscal Policy: A Tax-Cut**

We consider the effects of an across-the-board cut in taxes firstly. Note that such a policy is equivalent here to "helicopter drop" monetary policy, money being the only asset in the model. The results derived below can then be interpreted as referring to an increase in money supply rather than to tax cuts, via the government budget constraint. Since nominal wages and prices are constant as long as the exchange rate is fixed from (35)-(38), a tax-cut has real effects on output and employment in the non traded sector, whilst n^T and n^K are fixed in equilibrium. From (9)-(11), a reduction in lump-sum taxes of the aggregate household raises real consumption for both c^T and c^{NT}, since prices are fixed from (22) and (35). Hence, employment-output in the non traded sector raises (see (40)). An across-the-board cut in taxes has real effects in the short-run.

What about its welfare effects? On the one hand, if n^{NT} increases, the disutility of labour θn clearly raises, but households earn a surplus both in the terms of profits (the number of firms is fixed) and wages, because of market power. On the other hand, the increase in real consumption in the traded sector has a two fold impact on Welfare: a positive direct effect and a negative effect, via the deterioration in the current account and thus the reduction in the stock of foreign reserves. However, the overall effect on Welfare is unambiguously positive, and is influenced by the nature of bargaining (b, L) and the firm's monopoly power (σ) in the non traded sector.

PROPOSITION 1: Under unbalanced trade, a cut in taxes –T/P leads to a welfare improving increase in output and employment. The welfare improvement is increasing in the union power over wages b, decreasing in the product demand elasticity σ and in the union power over employment L in the non traded sector.

Proof: See Appendix.

The reason behind this result is that, in the non traded sector, the real price exceeds the real wage and the latter is higher than the disutility of labour. Given that a tax-cut policy increases output, first enterprise unions assure a

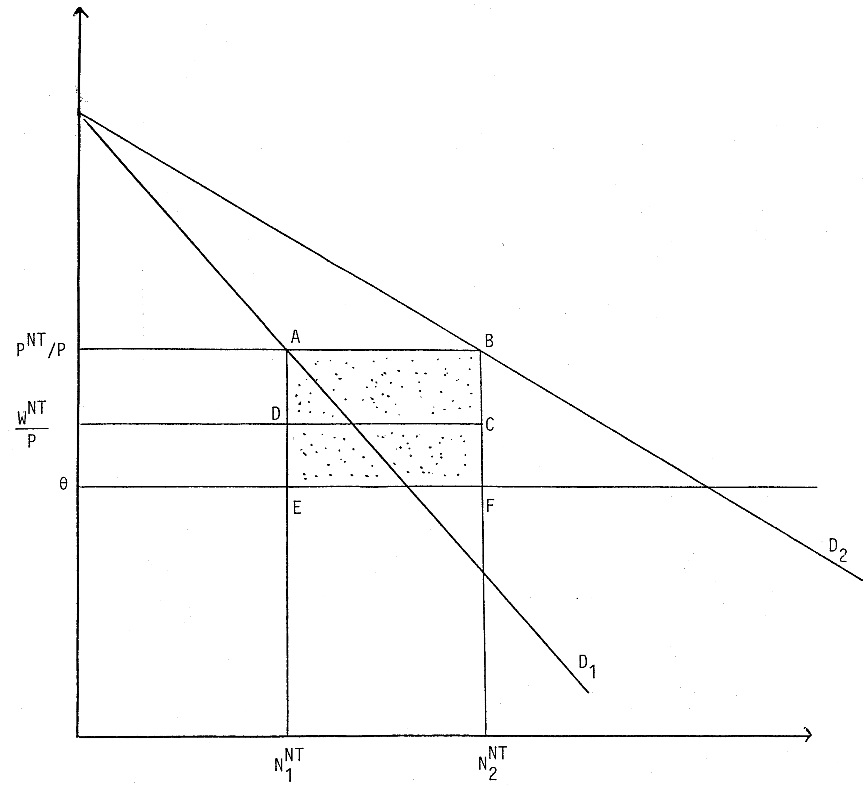

FIGURE 1

Imperfect Competition and the Increase in Surplus.

surplus to the employed above the competitive wage; second the real price is marked-up over the real wage and shareholders earn a surplus as well. This is depicted in Figure 1. The area ABCD represents the increase in the surplus of shareholders, and CDEF the increase in the surplus of workers.

Another straightforward implication is that, given product market conditions, the welfare gain is higher under monopoly union (*i.e.* $b = 1$, $L = 0$) than under efficient bargain (*i.e.* $b = L$), in so far as in the latter regime both the union wage rent for the new employed is lower, and employment is initially higher than in the former. Lastly, we note that the increase in domestic consumption of the traded good has a welfare cost in terms of reduction in the stock of foreign currency reserves only, since n^T and thus the disutility of labour is constant.

4.2. **Fiscal Policy: An Increase in Government Expenditure**

Turning to government expenditure, we firstly consider the effects of a money-financed increase in expenditure both on real aggregates and on Welfare. Since the exchange rate e and thus nominal prices are fixed, the real government expenditure multipliers are positive and the employment multiplier is always greater than one. This "crowding-in" effect of fiscal policy implies that an increase in nominal government expenditure raises nominal national income and therefore real private expenditure c^{NT} and c^T. Welfare effects are however ambiguous.

PROPOSITION 2: Under unbalanced trade and for a given lump-sum tax T, the real government expenditure multipliers are:

$$\left.\frac{dc^{NT}}{dg}\right|_T = \frac{(1-m)\,c}{1-(1-m)\,c}$$

$$\left.\frac{dN^{NT}}{dg}\right|_T = \frac{1}{1-(1-m)\,c}$$

A money-financed increase in G/P increases welfare if $1-cm > [(\sigma-1)/\sigma][\sigma-(1-L)]/[\sigma-(1-b)]$. The welfare improvement (reduction) is increasing (decreasing) in the union power over wages b, decreasing (increasing) in the product demand elasticity σ and the union power over employment L in the non traded sector.

Proof: See Appendix.

The ambiguity for this result is due to the welfare effect of the trade deficit via the foreign exchange reserves. If we set the shadow price of reserves $\lambda = 0$, there would always be a welfare improvement (as in DIXON [1994], Proposition 2). Note that the increase (decrease) in welfare is smaller (larger) with government expenditure as opposed to a tax-cut in Proposition 1 above. This is because the same increase in private consumption is associated with a larger increase in work required to supply government purchases. With more competitive markets (*i.e.* $\sigma \to \infty$, $L = b = 0$), welfare is reduced for any $\lambda > 0$.

Turning to the effect of a tax-financed increase in nominal expenditure with $G = T$, we note that the balanced-budget multiplier is unity and reduces welfare. On the one hand, this means that private consumption and thus the trade account are unaffected by the government expenditure. On the other hand, in so far as this expenditure is "waste", an increase in G reduces total Welfare, since it increases employment and thus the disutility of labour.

PROPOSITION 3: Under unbalanced trade, a tax financed increase in nominal expenditure has a multiplier of unity and reduces welfare.

Proof: See Appendix.

Summing-up this section, fiscal policy has real effects and the balanced-budget multiplier is unity. These short-run results mimic those in standard Keynesian fixed-price models. Nevertheless, in this analysis government policy has a welfare content: when it succeeds in increasing consumption, there might be a welfare improvement. The welfare improvement is increasing in the firm's monopoly power in the product market $1/\sigma$ and in the union power over wages b, and decreasing in the union power over employment L in the non traded sector.

5 Macroeconomic Policy with Balanced Trade

In this section, we examine the "long-run" equilibrium of the economy, with balanced trade. Trade can be balanced either by a floating rate, or with a fixed rate by adjustments in the domestic money supply. We assume the latter, so that in the long run treating E as exogenous, from (31) and (33) we have the long-run equilibrium money supply, denoted $M^{0\wedge}$:

$$M^{0\wedge} = \frac{1-c}{mc}\left(EP^{*}x^{T}\right) - (G-T) \tag{43}$$

We can now add equation (43) to the other equilibrium equations (35)-(41). Note first that x^T is not affected by $M^{0\wedge}$. Given x^T, we can solve for c^{NT} and c^T:

$$c^{T} = x^{T} \tag{44}$$

$$c^{NT} = x^{T}\,\frac{1-m}{m}\left[\left(\frac{\sigma}{\sigma-1}\right)\left(\frac{\sigma-(1-b)}{\sigma-(1-L)}\right)\theta\right]^{\frac{-1}{m}} \tag{45}$$

The consumption of both c^T and c^{NT} are proportionate to x^T, and vary with the parameters that affect x^T (*i.e.* α, m, θ, σ, b, L, β, γ). However, the ratio of c^T to c^{NT} is influenced only by the terms in the square bracket of (45). Hence c^T/c^{NT} is decreasing in σ and L, and increasing in b. The reason for this is that the terms in the square bracket influence the *relative* price P^{NT}/P^T:

$$\frac{P^{NT}}{P^{T}} = \left[\left(\frac{\sigma}{\sigma-1}\right)\left(\frac{\sigma-(1-b)}{\sigma-(1-L)}\right)\theta\right]^{\frac{1}{m}} \tag{46}$$

As σ and L increase, and b decreases, P^{NT}/P^T falls. With homothetic preferences, the ratio c^T/c^{NT} is fixed given P^{NT}/P^T, yielding an income-expansion path which is linear from the origin, as depicted in Figure 2.

Given that exports are fixed at x^T, c^{NT} is determined by the intersection of $c^T = x^T$ and the income-expansion path. Again, it is most important to note that there are complex general equilibrium interactions across sectors: imperfect competition in one sector can influence the equilibrium in the other.

What of the effects of policy in the long-run? A change in the level of real government expenditure is equivalent to a cut in taxes, if nominal expenditures and taxes are fully indexed (*i.e.* $T = G = gP^{NT}$), which yields Proposition 4.

PROPOSITION 4: Under balanced trade, the real fiscal multiplier is unity and real government expenditure reduces welfare.

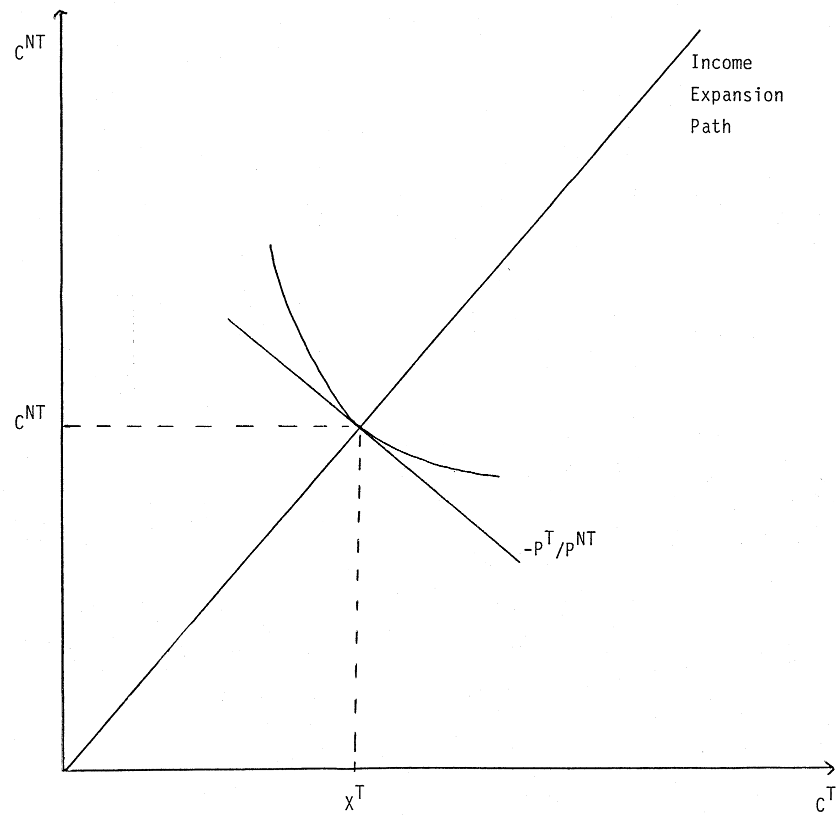

FIGURE 2

Balanced Trade.

Proof: See Appendix.

This result is similar to DIXON ([1990], Proposition 2) and holds for much the same reason.

It is worthy noticing the marked contrast between fiscal policy in the short and long-run. In the short-run, fiscal policy might increase welfare, because of a crowding-in multiplier effect. In the long run, it necessarily reduces total welfare, in so far as private sector consumption is fixed through the balance of payments equilibrium condition and government expenditure is waste.

6 Introducing Government Expenditure in the Utility Function

The Welfare analysis of fiscal policy up to now has been made under the assumption that government expenditure yields no utility, that it is waste. In Proposition 2, we showed that a (money financed) increase in expenditure might lead to a welfare-improvement despite no direct utility from government expenditure, due to the crowding-in effects inherent in the multiplier effects under a fixed exchange rate without balanced trade. However, under balanced trade, Proposition 4 showed that private consumption is unaffected by change in government expenditure, and hence there is a *reduction* in welfare. In this section, we briefly consider the welfare effects of fiscal policy when government expenditure enters the household utility. Following BENASSY [1991, 1992], we assume that total household utility U is log linear in private utility V' (where V' is the indirect utility function (42) net of the domestic value of foreign reserves- we ignore R since we are focusing on the comparative statics of the balanced trade case) [11] and government expenditure:

$$U = \delta_1 \log V' + \delta_2 \log g \tag{47}$$

The first-order condition for maximizing total utility U is:

$$\frac{dU}{dg} = \frac{\delta_1}{V'} \frac{dV'}{dg} + \frac{\delta_2}{g} = 0 \tag{48}$$

Under balanced trade, the only effect of dg is to increase employment [since c^{NT} and c^T are unaffected by g, see (44, 45)]; hence:

$$\frac{dV'}{dg} = -\theta \tag{49}$$

The optimal level of expenditure yields:

$$g^* = \frac{\delta_2}{\delta_1 \theta} V' \tag{50}$$

Since [from (49)] U is concave, it follows that Welfare is *increasing* in g up to g^*, and decreasing thereafter. This raises the question of how imperfect competition affects the welfare impact of dg. From (48):

$$\frac{d^2U}{dg\, dV'} = \frac{\delta_1 \theta}{(V')^2} > 0$$

The marginal welfare of government expenditure is $increasing$ in private utility. However, private utility is decreasing in the market power of firms $(1/\sigma)$ and the bargaining power of unions over wages (b), and increasing in L (see Appendix). Hence, the marginal welfare increase is less when σ and L are smaller and b is larger, the opposite of the short-run result (Propositions 1, 2). The reason for this contrast is that in the short-run the crowding-in effect of fiscal policy leads to an increase in surplus as depicted in Figure 1. However, in the long-run, there is no increase in surplus, since the balanced-trade condition fixes private consumption.

11. A full dynamic analysis would of course require us to take into account change in R as trade move towards balance.

There is also an interesting contrast with Benassy's results [1991, 1992]. In these papers, the optimal level of government expenditure is maybe increasing in the degree of imperfect competition in labour and product markets. In our model, the real-wage is unaffected by the level of employment, whilst Benassy allows for the real wage to be related to the level of employment. In so far as government expenditure increases (lowers) employment, it may reduce (increase) the gap between the real-wage and the disutility of labour, hence leading to higher (lower) optimal expenditure. This effect is absent here.

7 Free Entry in the Non Traded Sector

In this section, we briefly outline the effect of introducing free-entry in the non traded sector into the long-run balanced trade equilibrium of Section 5. Imposing the zero-profit condition in (13) and aggregating over firms, yields:

$$(51) \qquad r = \frac{n^{NT}}{F}\left[\left(\frac{1-L}{\sigma-1}\right)\left(\frac{\sigma-1+b}{\sigma-1+L}\right)\right]$$

From (51), it is clear that as total employment (output) in the non traded sector raises, more firms will want to enter the market (provided $L < 1$). Government will induce entry, because the long-run employment multiplier is positive and greater than one, *i.e.* using (41) and (51) yields:

$$(52) \qquad \left.\frac{dn}{dg}\right|_{A=0} = 1 + \frac{dr}{dg}F = 1 + \left(\frac{1-L}{\sigma-1}\right)\left(\frac{\sigma-1+b}{\sigma-1+L}\right)$$

In so far as price and wage mark-ups are unaffected by entry and the increase in the number of brands leaves welfare unaffected as well [*i.e.* we have eliminated the "love of variety" in (3)], entry will just increase total disutility of labour, raising employment in the non traded and capital good sectors.

8 Conclusion

In this paper, we have considered a model of imperfect competition in a multisectoral small open economy, focusing on the implications of the bargaining structure for the positive and welfare effects of fiscal policies, and using Manning's model of trade unions [1987]. In Section 3, we have considered direct and spillovers effects of bargaining power. In each sector higher union power over wages leads to lower output, higher union power over employment yields higher output, and what ultimately matters is the union differential control over the two contract variables. Spillovers operates via the cost-of-living index, since a higher price for output in one union sector leads to higher nominal wages in other sectors. In Section 4, we have analyzed the "short-run" effects of government fiscal policy, with unbalanced trade. We have found that government policies are able to influence real variables in the non traded sector only. An across-the-board cut in taxes is effective and its welfare-improving impact is the higher, the higher the typical enterprise union's power over wages and the lower its power over employment and the elasticity of demand for output in the monopolistic non traded sector (Proposition 1). A money-financed increase in government expenditure may increase or reduce welfare, depending on model parameters. However, the increase (decrease) in welfare is larger (smaller) the more the union power over wages and the less the elasticity of demand for output and the union power over employment (Proposition 2). The balanced-budget multiplier is unity and reduces welfare (Proposition 3).

In Section 5, we have imposed balanced trade via a specie-flow mechanism. The balanced trade condition and the assumption of homothetic preferences tie down the level of total domestic consumption, so that fiscal policy, when effective, reduces welfare (Proposition 4). In Section 6, we have introduced government expenditure into the household utility function and considered the normative implications for government expenditure. Again, balanced trade implies that the optimal level of government expenditure is decreasing in the degree of imperfect competition. Finally, in Section 7 we have allowed for free entry in the non traded sector with zero-profits. Since consumption is constant under balanced trade and price and wage mark-ups are unaffected by entry, government expenditure will increase the number of firms and employment, but will reduce welfare.

Proof of Proposition 1:

Totally differentiating (42) and noting that P^{NT} and P^{T} are constant yields:

$$(A.1a) \qquad -\frac{dV}{dT/P} = -\left[\left(\frac{dY/P}{dT/P}\right) - 1 - \theta\,\frac{dn}{dT/P} + \frac{E}{P}\,\frac{dR}{dT/P}\right]$$

From (31), (32) and (40) with n^T, n^K constant clearly yields:

$$(A.1b) \qquad \begin{aligned} \frac{dY}{dT} &= -\frac{(1-m)\,c}{1-(1-m)\,c} \\ \frac{dn}{dT/P} &= (1-m)\,c\left(\frac{dY}{dT}-1\right)\frac{P}{P^{NT}} \\ \frac{dR}{dT/P} &= -mc\left(\frac{dY}{dT}-1\right)\frac{P}{E} \end{aligned}$$

Substituting (A.1*b*) back into (A.1*a*) and using (20) to eliminate θ, we obtain:

$$(A.1c) \qquad \begin{aligned} -\frac{dV}{dT/P} &= \frac{1}{1-(1-m)\,c}\left[1 - c\phi - cm\,(1-\phi)\right] \\ \phi &= \left(\frac{\sigma-1}{\sigma}\right)\left(\frac{\sigma-1+L}{\sigma-1+b}\right) \le 1 \end{aligned}$$

which is positive, decreasing in σ and L and increasing in b.

Proof of Proposition 2:

Totally differentiating (40) and (32), and using (12) yields:

$$(A.2a) \qquad \begin{aligned} \left.\frac{dn}{dg}\right|_T &= \left.\frac{dn^{NT}}{dG}\right|_T \frac{dG}{dg} = (1-m)\,c\left.\frac{dY}{dT}\right|_T + 1 \\ \left.\frac{dY}{dG}\right|_T &= \frac{1}{1-(1-m)\,c} \end{aligned}$$

Totally differentiating (40) again:

$$(A.2b) \qquad \left.\frac{dc^{NT}}{dg}\right|_T = \left.\frac{dn^{NT}}{dg}\right|_T - 1 = \frac{(1-m)\,c}{1-(1-m)\,c}$$

Totally differentiating (31), (40), (42) and using (20) to eliminate θ yields:

$$(A.2c) \qquad \left.\frac{dV}{dG/P}\right|_T = \left[\frac{1-cm-\phi}{(1-m)\,c}\right]$$

where ϕ is given by (A.1c), which is positive for $1-cm>\phi$, decreasing in σ and L and increasing in b. Note that for $\lambda=0$ the numerator of (A.2c) reduces to $1-\phi\geq 0$. When $\phi=1$, $[dV/dG/P]|_T<0$ for any $\lambda>0$.

Proof of Proposition 3:

Totally differentiating (32), yields:

$$(A.3a) \qquad \left.\frac{dY}{dG}\right|_{T=G}=1$$

Totally differentiating (42), yields:

$$(A.3b) \quad \left.\frac{dV}{dG}\right|_{T=G}\left(\frac{1-mc}{P}\right)\left(\left.\frac{dY}{dG}\right|_{T=G}-1\right)-\theta\left.\frac{dn}{dG}\right|_{T=G}=-\frac{\theta}{P^{NT}}$$

which is clearly negative.

Proof of Proposition 4:

Directly from (41) with c^{NT} constant:

$$(A.4a) \qquad \left.\frac{dn}{dg}\right|_{A=0}=1$$

From (5), (35), (22) yields:

$$P=EP^{*}\left[\left(\frac{\sigma}{\sigma-1}\right)\left(\frac{\sigma-1+b}{\sigma-1+L}\right)\theta\right]^{\frac{1-m}{m}}$$

Using (43) and (33), the social welfare function (42) writes now:

$$(A.4b) \qquad V=\left(\frac{x^T}{mc}+\frac{R}{P^{*}}\right)\left[\left(\frac{\sigma}{\sigma-1}\right)\left(\frac{\sigma-1+b}{\sigma-1+L}\right)\theta\right]^{1-\frac{1}{m}}-\theta n$$

where x^T is fixed from (39) establishing the result.

Proof Section 6:

Using (39), (41), (45) in (A.4b), with $\lambda R=0$, and rearranging yields:

$$(A.5a) \quad V'Q^{-1}=(\phi)^{\frac{1-m}{m\,(1-\alpha)}}\left[1-\alpha mcd^T-(1-m)\,c\phi\right]-\theta\left(g+n^K\right)$$

where $Q=(\alpha d^T)^{[\alpha/(1-\alpha)]}\theta^{\{1-1/[m\,(1-\alpha)]\}}>0$ and $d^T=[\alpha\,(1-\gamma)+\gamma]/[\alpha\,(1-\beta)+\beta]$. Note that parameters values are such that the square bracket in (A.5*a*) is positive. Differentiating (A.5*a*) with respect to Z, where $Z = \sigma,\ b,\ L$ yields:

$$(A.5b) \qquad \frac{dV}{dZ} = H\left(\frac{d\phi}{dZ}\right)\left(\frac{1 - \alpha mcd^T - c(1-\alpha m)\,\phi}{m\,(1-a)\,\phi}\right)$$

A sufficient condition for the square bracket to be positive is $d^T \leq 1$, or $\gamma \leq \beta$: in the traded sector, the union has at least as much power over wages (β) as over employment (γ). Thus, V' decreases with *b* and increases with σ and L. The optimal level of government expenditure reads (use (50)-(A.5*a*)]:

$$(A.5c) \qquad g^* = \frac{\delta_2}{\delta_1 + \delta_2}\,\frac{1}{\theta}\,(J - n^K)$$

where J is a constant directly derived from (A.5*a*).

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