labour demand (price-setting) schedule: since it is based on the equality between the marginal revenue product of labour and the real wage, its being positively or negatively sloped depends, under imperfect competition, not only on labour marginal productivity, but also on the behaviour of demand elasticity along the firms' product demand function. This latter effect may actually dominate the technological one, inducing an effect of 'slope reversal' (Gali, 1994b, p.749). In this framework, the same conditions on structural parameters, which guarantee that a fiscal expansion increases or decreases the elasticity of demand, may generate a reversal of the slope of the labour demand schedule, in the direction required for the policy to be expansionary

Our discussion is organized as follows. In section 2 we develop our basic model. Section 3 is devoted to the analysis of the effectiveness of fiscal policy through the transmission mechanism based on elasticity and the composition of demand. We provide also a quantitative and qualitative evaluation of the behaviour of the fiscal multiplier derived in this set-up. In section 4 some possible extensions of the analysis are considered, while brief remarks and conclusions are gathered in section 5.

2 The basic set-up

We consider a simple monetary economy where households, firms and the government interact in the goods, labour and money market. The labour market is assumed to be competitive, while firms are monopolistic competitors in the goods market. Output is a composite good, made of n varieties. Each variety is supplied by a single firm, by means of labour only. We adopt a short run perspective, by taking the number of firms (varieties) as given. Both households and the government demand output, though the public and private demands faced by any firm are characterized by different demand elasticities.

2.1 The Households' Behaviour

We assume that the economy is populated by a large number of identical households, so that their aggregate behaviour can be formalized in terms of a single representative competitive household. Its objective function U is defined over consumption of the composite good, C, real money balances, M/P, and labour supply, L. We shall refer to a convenient, explicit, formulation of this utility function, which satisfies the usual concavity and differentiability properties: in order to rule out any income effect on labour supply, we assume that U is additively separable with respect to labour, and homogeneous of degree one in consumption and real money balances. Moreover, we assume that utility is linear in labour and that aggregate consumption is a CES function of the consumption of n varieties of output, C_i , $i = 1, 2, ..., n$:

$$U\left(C, \frac{M}{P}, L\right) = C^{\beta}\left(\frac{M}{P}\right)^{1-\beta} - \theta L, \qquad 0 < \beta < 1 \tag{1}$$

$$C = n^{\frac{1}{1-\rho}}\left[\sum_{i=1}^{n} C_i^{\frac{\rho-1}{\rho}}\right]^{\frac{\rho}{\rho-1}}, \qquad \rho > 1 \tag{2}$$

where θ is the constant marginal disutility of labour, and ρ is the household's elasticity of substitution between any two varieties. The price P of the consumption bundle (output) is given, consistently with the structure of the household's preferences, by the following function of the prices of the n varieties:

$$P = \left[\frac{1}{n} \sum_{i=1}^{n} P_i^{(1-\rho)} \right]^{\frac{1}{1-\rho}}. \tag{3}$$

The household maximizes (1) subject to the budget constraint:

$$\sum_{i=1}^{n} P_i C_i + M = WL + \Pi - Z + \overline{M},$$

where WL is nominal labour income, Π denotes nominal profits, Z taxes in nominal terms and $\overline{M}$ the initial endowment of money.

Given the definitions (2) and (3), the solution to the household's maximization problem generates the following demand for variety i:

$$C_i = \left(\frac{P_i}{P} \right)^{-\rho} \frac{C}{n}, \tag{4}$$

and optimal values for C, M, and L, which satisfy:

$$PC = \beta \left(WL + \Pi - Z + \overline{M} \right), \tag{5}$$

$$M = (1-\beta) \left(WL + \Pi - Z + \overline{M} \right), \tag{6}$$

$$\frac{W}{P} = \frac{\theta}{\beta^{\beta} (1-\beta)^{(1-\beta)}} \equiv \nu, \qquad if \quad L < \overline{L} \tag{7}$$

$$L = \overline{L}, \qquad if \quad \frac{W}{P} > \frac{\theta}{\beta^{\beta} (1-\beta)^{(1-\beta)}}, \tag{7 bis}$$

where $\overline{L}$ is the total endowment of labour time. Notice that the labour supply function takes a reversed L shape, being horizontal at the reservation wage ν, for $L < \overline{L}$.

2.2 The Government

The n goods produced in the economy are demanded not only by the private sector, but also by the government, which entirely finances its expenditure with lump-sum taxation. In modelling the government behaviour, we follow Heijdra (1998) by assuming that the government sets public expenditure in real terms in order to generate an amount G of a public good, which is obtained by using all n varieties according to the following CES function:

$$G = n^{\frac{1}{1-\gamma}} \left[\sum_{i=1}^{n} G_i^{\frac{\gamma-1}{\gamma}} \right]^{\frac{\gamma}{\gamma-1}}, \qquad \gamma > 1 \tag{8}$$

where γ is the elasticity of substitution.The main additional assumption we introduce in this paper is that this elasticity of substitution is different from that of the private sector. Once a level of public expenditure G has been chosen, the government, which behaves competitively on the goods market, chooses the quantity of each good G_i to be purchased, in order to minimize nominal expenditure, i.e. the cost of production of the amount G of the public good. Therefore we have the following dual problem:

$$\text{Min} \sum_{i=1}^{n} P_{iG} G_i$$
$$\text{subject to} \;\; n^{\frac{1}{1-\gamma}} \left[\sum_{i=1}^{n} G_i^{\frac{\gamma-1}{\gamma}} \right]^{\frac{\gamma}{\gamma-1}} = G,$$

where P_{iG} is the price paid by the government for good i (which in principle might differ from that paid by the private sector). The solution for each G_i is the following demand function

$$G_i = \left(\frac{P_{iG}}{P_G} \right)^{-\gamma} \frac{G}{n}, \tag{9}$$

where P_G is the aggregate price index defined consistently with equation (8)[3]

$$P_G = \left[\frac{1}{n} \sum_{i=1}^{n} P_{iG}^{(1-\gamma)} \right]^{\frac{1}{1-\gamma}}.$$

2.3 The firms

On the production side, we assume that n monopolistically competitive firms produce, by means of labour only, the n goods that enter the private and public consumption bundles. Though each firm i produces a single good, Y_i, which is an imperfect substitute of all the others, we assume that the production function is identical for all goods and given by:

$$Y_i = L_i^{\alpha}, \qquad \alpha > 0 \tag{10}$$

where L_i is the amount of labour employed by firm i. We do not impose *a priori* any further restriction on the parameter α, which determines the prevailing returns to scale.[4]

On the basis of the optimal household's and government's decisions, we can write the following demand function faced by firm i:

$$Y_i^d = C_i + G_i = \left(\frac{P_i}{P} \right)^{-\rho} \frac{C}{n} + \left(\frac{P_{iG}}{P_G} \right)^{-\gamma} \frac{G}{n}. \tag{11}$$

[3] It can be checked that the solutions (9) and the price index P_G are such that by substituting them into the government objective function $\sum_{i=1}^{n} P_{iG} G_i$, we obtain $\sum_{i=1}^{n} P_{iG} G_i = P_G G$.

[4] In (10) increasing returns to scale are conceived of as increasing returns to labour. We adopt this simplifying assumption in order to evaluate the impact of technological conditions on the optimal behaviour of firms in the labour market through one single parameter. It is worth stressing right now that similar behavioural relations could be obtained by solving a more articulated model in which returns to scale are evaluated with respect to both labour and capital. See also Manning (1990, 1992).

Notice that two relative prices appear in (11), P_i/P and P_{iG}/P_G. However, we assume that firms are not able to discriminate between the private and the public sector, so that the price charged must be the same and $P_i = P_{iG}$, for all i. Since the market is characterized by monopolistic competition, each firm chooses this price in order to maximize nominal profits, given the demand function (11), the production function (10), and the aggregate price indices, P and P_G. The nominal wage is taken as given, under the assumption of perfect competition on the labour market. The restriction that both γ and ρ - which turn out to be also the elasticity of public and private demand for good i with respect to its relative price - be greater than one, guarantees that the firm's optimization problem is well-defined for any composition of demand.

Profit maximization entails the following first order condition:[5]

$$P_i\left(1-\frac{1}{\epsilon_i}\right)=\frac{W}{\alpha L_i^{(\alpha-1)}}, \tag{12}$$

where $\epsilon_i = \rho + (\gamma - \rho)\, G_i/Y_i^d$ is the price elasticity of firm i's demand. The latter is a weighted average of the elasticity of private and public demand, where the weights are the share of each component in total demand.[6] Notice that the definition of ϵ_i makes it clear that, though private and public demand are isoelastic, the elasticity of the overall demand schedule faced by firm i is not constant.

2.4 The symmetric macroeconomic equilibrium

Since all firms face identical demand functions and are subject to the same technological constraint, their optimal price must be the same. This also implies that under symmetry the two price indexes, P and P_G, coincide:

$$P_G = P. \tag{13}$$

Therefore, all firms face the same level of private consumption, the same level of public consumption, and *a fortiori* the same level and composition of demand. This implies that the elasticity of demand in the firm's symmetric equilibrium can be written as:

$$\epsilon_i = \epsilon = \rho + (\gamma-\rho)\,\frac{\widetilde{G}}{\widetilde{Y^d}}, \tag{14}$$

where we denote with $\widetilde{\ }$ the per capita value of the relevant variable, and $\widetilde{Y^d} = \widetilde{C} + \widetilde{G}$. Moreover, under symmetry each firm employs $1/n$ of total employment; therefore, by evaluating (12) in the symmetric equilibrium and by using (13) and (14) we obtain:

$$\frac{W}{P} = \alpha\widetilde{L}^{\alpha-1}\left(1-\frac{1}{\epsilon}\right) = \alpha\widetilde{L}^{\alpha-1}\left[1-\left(\rho+(\gamma-\rho)\,\frac{\widetilde{G}}{\widetilde{Y^d}}\right)^{-1}\right]. \tag{15}$$

[5] Since we have imposed no restrictions on technology, we specify the following requirement for the second order conditions to be satisfied at the optimal solution: $\frac{1}{\alpha} > 1 - \frac{1}{\epsilon_i}$.

[6] Gali (1994a) studies a model where the two components of aggregate demand characterized by different elasticity are private consumption and investment.

This equation is generally called the *price-setting* (PS) *schedule*. It shows the relation between the firms' desired level of employment and the real wage at the firms' symmetric optimum. To close our macro model we notice that under symmetry,

$$Y = n\widetilde{Y} = n\widetilde{L}^{\alpha}. \tag{10'}$$

By using (5), aggregate demand is

$$Y^d = C + G = \beta\left(Y - T + \frac{\overline{M}}{P}\right) + G, \tag{16}$$

where T denotes real taxes. Equations (7-7bis), (10'), (15) and (16) determine the equilibrium levels of L, Y, W/P, P, given the exogenous policy variables M, G and T. Notice that, were the relative price elasticity of public and private demand equal, $\gamma = \rho$, then the system would exhibit the standard dichotomy property associated with full wage and price flexibility: equations (7), (10') and (15) would determine L, Y, and W/P, independently of the demand variables M, G and T.[7] The essence of the elasticity transmission mechanism, however, is that if $\gamma \neq \rho$, then the real policy variable G actually enters the price-setting rule; it may therefore affect output and employment by changing the firms' desired mark-up.

3 The elasticity transmission mechanism and the properties of technology

It is clear from the above that the key equation of the model is the price-setting schedule (15). Provided an equilibrium exists at $L < \overline{L}$, an increase in employment might occur, if an increase in public expenditure induces the firms to employ a greater amount of labour at the reservation wage ν. Figure 1 shows that this requires an upward shift of the PS schedule through a reduction in the desired price-over-cost margin when the PS schedule is downward sloping, and a downward shift of the curve *via* an increase in the desired mark-up when the PS is upward sloping.

This suggests that preliminary to any study of the pro- or counter-cyclical impact of public expenditure on the desired mark-up, is the analysis of the slope of the PS schedule.

INSERT FIGURE 1 ABOUT HERE

3.1 The slope of the PS schedule

First, we notice that equation (14) con be written as:

$$\epsilon\left(\widetilde{G}, \widetilde{L}\right) = \rho + (\gamma - \rho)\,\frac{\widetilde{G}}{\widetilde{L}^{\alpha}},$$

[7] We recall that the structure of the household's preferences is such that any effect on the labour supply is ruled out.