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Fiscal policy, distortionary taxation, and direct crowding out under monopolistic competition

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A simple macroeconomic model with monopolistic competition on the goods market is developed which displays Keynesian features. The model is used to study the effects of a rise in public spending on national income. The model extends the literature in two directions. First, we assume that the government balances its budget by employing distortionary income taxation. Second, we allow for direct crowding out since public consumption enters private utility in a non-separable fashion. With upward sloping labour supply, an increase in public spending depresses national income, more so in the long run than in the short run.

1. Introduction

Market clearing macroeconomic models of monopolistic competition which give rise to Keynesian multiplier effects in output have been studied, among others, by Blanchard and Kiyotaki (1987), Dixon (1987), Mankiw (1988), and Startz (1989). Recently, Heijdra and van der Ploeg (1996) have extended this branch of models to include the effect of the number of product varieties on the price index and thus the real wage. They show that the long-run national income multiplier of an increase in public spending exceeds the short-run multiplier provided the diversity effect is sufficiently strong. These results are derived under the assumption that the government can employ lump-sum taxes to balance its budget.

In this paper we extend Heijdra and van der Ploeg (1996) in two directions. First, we assume a constrained world in which the government has to resort to distortionary income taxation to balance its budget. Second, we allow for direct crowding out (see Buiter, 1977) by including public consumption in private welfare in a non-separable way. We show that these two assumptions critically affect the national income multiplier associated with a given rise in public spending. Furthermore, as in Dixit and Stiglitz (1977) and Heijdra and van der Ploeg (1996) we allow for the effect of the number of product varieties on the real wage. Finally, we derive the marginal cost of public funds to determine the optimal size of the public sector.

The paper is structured as follows. In Section 2 we present a simple macroeconomic model with monopolistic competition. Section 3 studies the Keynesian multiplier effects of public spending in the short run (with a fixed number of firms). In addition we determine the marginal cost of public funds and study the effects of direct crowding out on the optimal provision of public goods. In Section 4 we investigate government policy in the long run (with free entry and exit of firms). Section 5 concludes.

2. A model of monopolistic competition

2.1 Consumers and firms

The economy consists of H identical households who derive utility from full consumption, C_F, leisure, $1 - L$, and public consumption, G

$$U = [\beta C_F^{(\sigma-1)/\sigma} + (1-\beta)[1-L]^{(\sigma-1)/\sigma}]^{\sigma/(\sigma-1)} + \eta\Gamma(G), 0 < \beta < 1, \sigma, \eta, \Gamma' \geq 0 \quad (1)$$

where σ is the elasticity of substitution between full consumption and leisure, $\Gamma(G)$ represents the pure public good aspect of government consumption, and η is a shift parameter. Full consumption is a linear combination of goods purchased privately (C) and goods received from the government (G/H)

$$C_F \equiv C + \alpha G/H \quad (2)$$

where α represents the constant marginal rate of substitution between public and private consumption in private utility. Our preference specification captures the notion that public spending may have both public and private good aspects (see Christiano and Eichenbaum, 1992). To put it in terms of Bailey's example (1971, p. 154), a household may not only derive utility from the fact that it receives a meal without charge at its job, but also from the fact that the government provides free meals to all other households as well. The first effect represents the private good aspect and is captured by the parameter α in (2), whereas the second effect is the public good aspect captured by $\Gamma(G)$ in (1). The parameter α thus measures the degree of direct crowding out and we assume that $0 < \alpha < 1$.[1]

Consumers like variety, and private consumption is a CES-aggregate of existing product varieties $C_j (j = 1, \ldots, N)$, which are close but imperfect substitutes with constant substitution elasticity θ

$$C = \left[\sum_{j=1}^{N} C_j^{(\theta-1)/\theta}\right]^{\theta/(\theta-1)}, \theta > 1 \quad (3)$$

The representative household maximises utility subject to the given level of public spending and the household budget constraint, $C = (1 - t_Y)(WL + \Pi)$, where W is the real wage, t_Y is a proportional income tax, and Π stands for real

[1] Empirical evidence for the United States indeed suggests that $0 < \alpha < 1$. See Kormendi (1983) and Aschauer (1985).

Table 1 Summary of the model*,†

$Y = HC + G$	(T.1)
$C + \alpha(G/H) = cI_F$	(T.2)
$(1 - t_E)W[1 - L] = (1 - c)I_F$	(T.3)
$I_F = (1 - t_E)(W + \Pi), t_E \equiv (1 - \alpha)t_Y$	(T.4)
$H\Pi \equiv (1/\theta)Y - WNF$	(T.5)
$mkW \equiv N^{1/(\theta-1)}$	(T.6)
$G = t_Y Y,$	(T.7)
$c \equiv \beta^\sigma P_V^{\sigma-1}, P_V \equiv [\beta^\sigma + (1-\beta)^\sigma[(1-t_E)W]^{1-\sigma}]^{1/(1-\sigma)}, V \equiv I_F/P_V$	(T.8)

* The variables are defined as follows: Y is real national income, H is the number of households, C is private consumption per household, G is public consumption, t_Y is the income tax rate, t_E is the effective tax rate, W is the real wage, c is the marginal propensity to consume out of full income, I_F is full income per household, Π is profit income per household, α is the marginal rate of substitution between private and public consumption in private utility, θ is the elasticity of substitution between different product varieties, N is the number of firms, F is fixed cost, $m \equiv \theta/(\theta - 1) > 1$ is the markup, k is the marginal labour requirement, V is indirect private utility, and P_V is the price index for private utility.

† In the short run, N is fixed and Π may be non-zero. In the long run, variation in N ensures that $\Pi = 0$.

profit income received from firms. The ideal price index for private consumption (P in (4)) is chosen as the numeraire. Table 1 contains the resulting expressions for private consumption (eq. (T.2)) and labour supply (eq. (T.3)) in terms of after-tax full income (I_F in (T.4)) and the marginal propensity to consume out of after-tax full income (c in (T.8)). Note that $t_E = (1 - \alpha)t_Y$ is the 'effective' income tax rate.[2] Indirect private utility (V) can be written as $V \equiv I_F/P_V$, where P_V is the ideal price index for private utility (see (T.8)).

The demand for product variety j is as follows

$$C_j = \left(\frac{P_j}{P}\right)^{-\theta} C, \quad P = \left[\sum_{j=1}^{N} P_j^{1-\theta}\right]^{1/(1-\theta)} \tag{4}$$

where P_j is the price of product variety j and θ is also the absolute value of the price elasticity of demand.

Firms are engaged in monopolistic competition since there are many firms that each produce a somewhat unique product. The typical firm produces its output Y_j under increasing returns to scale with labour as the sole production factor. The production technology is given by $L_j = F + kY_j$, where L_j, F and $1/k$ denote, respectively, the units of labour employed by firm j, the fixed cost and the marginal productivity of labour. Firm j chooses its output level to maximise profits, $\Pi = P_jY_j - W^N L_j$, subject to its demand curve and the respective output levels

[2] Each household receives a virtual income transfer, $\alpha G/H$, from the government, but also has to pay taxes $t_Y[WL + \Pi]$ to finance government spending. Hence, in view of the government budget restriction (T.7), and since $Y = H[WL + \Pi]$ (see below), the net tax per household amounts to $(1 - \alpha)t_Y Y/H$. Since $0 < \alpha < 1$, the statutory tax, t_Y, exceeds the effective tax, t_E. Note that we follow Aschauer (1985) by assuming that households understand the government budget constraint.

of the other firms. Labour is perfectly mobile across firms so all firms pay the same nominal wage $W^N(\equiv WP)$. The optimal output price is a gross mark-up, m, on marginal cost, i.e. $P_j = mW^N k$ with $m \equiv \theta/(\theta - 1) > 1$.

2.2 Government and symmetric market equilibrium

As in private consumption, public consumption is composed of N different varieties with substitution elasticity θ. The government has to resort to distortionary income taxation in order to balance its budget (see (T.7)). The symmetry assumption ensures that all firms and consumers behave in the same manner: $P_j = \bar{P}$, $Y_j = \bar{Y}$, $L_j = \bar{L}$ and $C_j = \bar{C}\,(j = 1, \ldots, N)$. Equilibrium on the labour market requires that labour demand (NL_j) equals labour supply (HL). Goods market equilibrium implies that: $Y_j = HC_j + G_j$. Then, real national income is defined as $Y \equiv (\Sigma_{j=1}^{N} P_j Y_j)/P$ which satisfies $Y = H(WL + \Pi)$. Aggregate profits and the pricing equation can be expressed as in (T.5) and (T.6), respectively. With a fixed number of firms there is a positive relationship between aggregate profits and national income, the strength of which is regulated by the degree of monopoly power $(1/\theta)$.

3. Government policy in the short run

3.1 Short-run output multipliers

In this section we study the short run which is characterised by a fixed number of firms and thus (by (T.6)) a constant real wage. Hence, following a shock non-zero profits can emerge. We solve the model (by substituting (T.2), (T.4), (T.5), and (T.7) into (T.1)) to obtain the goods market equilibrium (GME) condition which incorporates the positive feedback effect between aggregate output and profit income

$$Y = cW[H - NF] + (c/\theta)Y \tag{5}$$

By totally differentiating (5), and noting (T.8), we obtain the GME-schedule which is drawn in Fig. 1

$$[1 - c/\theta]\frac{\mathrm{d}Y}{Y} = \frac{(1-\sigma)(1-c)(1-\alpha)\,\mathrm{d}t_Y}{1-(1-\alpha)t_Y} \tag{6}$$

The GME-locus is downward sloping if $\sigma > 1$. Then, the substitution effect dominates the pure income effect in labour supply so that a rise in the income tax rate induces households to substitute leisure for private consumption,[3] as a result of which employment and real national income fall. The GME-locus rotates in a clockwise fashion if the substitution elasticity between private consumption and

[3] The Slutsky decomposition for labour supply is $\mathrm{d}L/\mathrm{d}W^* = \sigma c(1-c)/W^* - c(1-c)/W^*$, where $W^* \equiv (1 - t_E)W$ is the after-tax effective real wage. The first term on the right-hand side is the pure substitution effect (the slope of the Hicksian labour supply curve) and the second term is the income effect. If $\sigma = 1$ the two effects cancel.

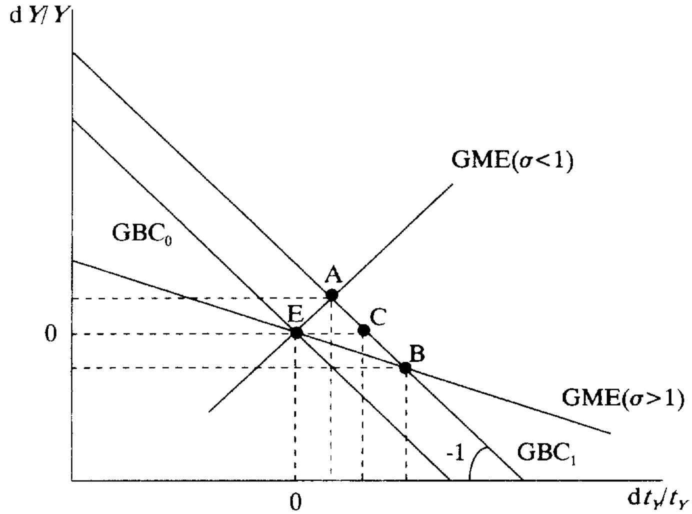

Fig. 1. The multiplier under distortionary taxation.

Key: GBC is the government budget constraint and GME is the expression for the multiplier. An increase in government spending shifts GBC to the right. If $\sigma = 1$ the tax is non-distorting and the equilibrium shifts from E to C. If $\sigma > 1$, the tax destroys part of the tax base and the equilibrium shifts from E to B. The opposite holds if $\sigma < 1$.

leisure rises, the pre-existing income tax rises, market power of firms increases, and the degree of direct crowding out falls. Consequently, a given rise in the income-tax rate induces a larger decline in output. In the Cobb–Douglas case ($\sigma = 1$) we get a horizontal GME-locus. In that particular case, which was also studied by Molana and Moutos (1992), a rise in the income tax rate does not affect output and thus the income tax base is fixed. For the case of a backward bending labour supply curve (i.e. $\sigma < 1$) we get a positively sloped GME-locus. A rise in the income tax rate increases output in this case.

The government budget constraint (GBC)-locus is obtained by differentiating (T.7)

$$\frac{\mathrm{d}G}{Y} = \mathrm{d}t_Y + t_Y \frac{\mathrm{d}Y}{Y} \tag{7}$$

A rise in income taxes to finance public spending has a positive tax-rate effect (first term on the right-hand side) and a tax base effect (second term on the right-hand side).

By substituting (7) into (6) and noting (T.5), we can solve for the short-run national income and profit multipliers

$$\left(\frac{\mathrm{d}Y}{\mathrm{d}G}\right)^{SR} = \theta\left(\frac{\mathrm{d}H\Pi}{\mathrm{d}G}\right)^{SR} = \frac{(1-c)(1-\sigma)(1-\alpha)(1+\theta_E)}{1-c/\theta+(1-\sigma)(1-c)\theta_E} \tag{8}$$

where $\theta_E \equiv t_E/(1-t_E) > 0$. It is straightforward but tedious to show that the denominator in (8) is positive provided the economy operates on the upward sloping section of the Laffer curve.[4] A rise in public spending shifts the GBC-locus outwards and leaves the GME-locus unaffected. For an upward-sloping labour supply curve ($\sigma > 1$), an increase in public spending unambiguously decreases employment and real national income. Only in the case of a backward-bending labour supply curve (i.e. $\sigma < 1$) can we obtain a positive national income multiplier.

The analysis in this section generalises the results obtained by Molana and Moutos (1992) in two directions. First, we allow for direct crowding out. Second, by letting σ in (1) differ from unity, we obtain a non-zero uncompensated wage elasticity of labour supply which in turn explains a non-zero multiplier. This contrasts with the results of Molana and Moutos (1992) who obtain a multiplier of zero because in their model income and substitution effects exactly cancel. Our analysis thus demonstrates the crucial importance of the government financing method to both the magnitude and the sign of the output multiplier. Indeed, it is straightforward to derive the output multiplier if lump-sum taxes can be used

$$1 - \alpha > \left(\frac{\mathrm{d}Y}{\mathrm{d}G}\right)^{SR} = \theta\left(\frac{\mathrm{d}H\Pi}{\mathrm{d}G}\right)^{SR} = \frac{(1-c)(1-\alpha)}{1-c/\theta} > 0 \tag{9}$$

Equation (9) generalises the results of Heijdra and van der Ploeg (1996) by including direct crowding out. Furthermore, by setting $\sigma = 1$ and $\alpha = 0$, (9) collapses to the expressions derived by Dixon (1987) and Mankiw (1988). The important thing to note is that with lump-sum taxation the multiplier is always positive. The intuition behind this result is that in that case there is no substitution effect and only the income effect in labour supply survives. Since leisure is a normal good an increase in the lump-sum tax leads to an increase in labour supply and thus a positive output multiplier.

3.2 The marginal cost of public funds in the short run

In this section we study the optimal provision of public consumption in a constrained world in which the government has to resort to income taxation to balance its budget. The policy maker chooses G and t_Y to maximise social welfare, $H\Lambda \equiv H[V + \eta\Gamma(G)]$, subject to the government budget constraint (T.7), where V is the indirect utility of the household (see (T.8)). The first-order conditions for the income tax rate and public consumption are, respectively

$$\frac{H(W+\Pi)}{P_V}\left[1 + \frac{1-t_E}{P_V}\frac{\partial P_V}{\partial t_E}\right]\frac{\mathrm{d}t_E}{\mathrm{d}t_Y} = \mu Y \tag{10}$$

and

$$\frac{(1-t_E)}{P_V}\left(\frac{\mathrm{d}H\Pi}{\mathrm{d}G}\right)^{SR} + \eta H\Gamma'(G) = \mu\left(1 - t_Y\left(\frac{\mathrm{d}Y}{\mathrm{d}G}\right)^{SR}\right) \tag{11}$$

[4] This result is proved in a separate appendix which is available from the first author upon request. The intuitive idea is to require that the tax revenue is increasing in the tax rate, i.e. $\mathrm{d}t_Y Y/\mathrm{d}t_Y > 0$. This implies a positive denominator for (8).

where μ denotes the marginal social disutility of raising one unit of public revenue. The marginal utility of after-tax income is denoted by λ and satisfies $\lambda = U_C = 1/P_V$. By using this result, eq. (10) yields an expression for the gross marginal cost of public funds[5]

$$\frac{\mu}{\lambda} = 1 - \alpha \tag{12}$$

Rewriting (11) yields an expression for the net marginal cost of public funds in the short run ($\mathrm{MCPF}^{\mathrm{SR}}$)

$$\frac{\eta H\Gamma'(G)}{U_C} = \frac{\mu}{\lambda}\left[1 - t_Y\left(\frac{\mathrm{d}Y}{\mathrm{d}G}\right)^{SR}\right] - (1 - t_E)\frac{1}{\theta}\left(\frac{\mathrm{d}Y}{\mathrm{d}G}\right)^{SR} (\equiv \mathrm{MCPF}^{SR}) \tag{13}$$

Equation (13) is the modified Samuelson rule, which says that the sum of the marginal rates of substitution between public and private consumption (the left-hand side of (13)) should equal the net marginal cost of public funds (the right-hand side of (13)).

Substitution of (8) and (12) into (13) yields

$$\mathrm{MCPF}^{\mathrm{SR}} = \frac{(1-\alpha)[1 - c/\theta - (1-c)(1-\sigma)/\theta]}{1 - c/\theta + (1-c)(1-\sigma)\theta_E} \tag{14}$$

Under perfect competition (i.e. if $1/\theta \to 0$) the second term on the right-hand side of (13) drops out. Hence, the gross marginal cost of public funds (i.e. the cost without taking into account the distortion caused by imperfect competition) is $\mathrm{MCPF} = (1-\alpha)/[1 - (1-c)(\sigma - 1)\theta_E]$. In the absence of direct crowding out ($\alpha = 0$), with a pre-existing income tax ($t_Y > 0$), and with an upward-sloping labour supply curve ($\sigma > 1$) the MCPF is larger than unity. Hence, an extra unit of public revenue raised is distortionary. Intuitively, the rise in the income tax reduces after-tax income which erodes the tax base of the existing tax. Larger pre-existing income taxes have a larger distortionary effect. A higher degree of direct crowding out (large α) reduces MCPF.

Under imperfect competition (i.e. $1 > 1/\theta > 0$) and with an upward-sloping labour supply curve ($\sigma > 1$) the net marginal cost of public funds is higher than under perfect competition. The negative profit and output multiplier effect of a rise in public spending (see (8)) reduces the size of the tax base which makes the existing tax more distortionary. Hence, raising public revenue becomes more costly as the profit multiplier becomes larger (in absolute terms). The $\mathrm{MCPF}^{\mathrm{SR}}$ is particularly large if the initial income tax rate is large (large θ_E), substitution between private consumption and leisure is easy (large σ), and there is not much direct crowding out of private consumption (small α). If labour supply is inelastic ($\sigma = 1$) and direct crowding out is absent the $\mathrm{MCPF}^{\mathrm{SR}}$ is unity. The income tax rate is non-distortionary in this case so that we get a first-best outcome.

[5] This would be the relevant marginal cost of public funds if the economy is perfectly competitive and the policy maker has access to lump-sum taxation.

4. Government policy in the long run

In this section we consider the long run in which there is free entry and exit of firms. The equilibrium number of firms is then implicitly defined by the zero pure profit condition ($H\Pi = 0$ in (T.5)) in combination with the rest of the model. With upward-sloping labour supply ($\sigma > 1$), a rise in public spending has a negative impact effect on employment and national income (the numerator of (15)) due to the distortionary effect of income taxes. In addition it also reduces profit income in the short run. Short-run losses induce exit of firms which causes a rise in the true price index P and thus a fall in the real wage and a reduction in labour supply. This additional substitution effect in labour supply ensures that the long-run GME-locus is steeper with respect to the income tax axis than the short-run GME-locus. Hence, a given rise in government spending (which shifts the GBC-locus to the right) yields a larger (in absolute value) national income multiplier in the long run than in the short run.[6] The long-run real national income multiplier is given by

$$\left(\frac{\mathrm{d}Y}{\mathrm{d}G}\right)^{LR} = \frac{(1-c)(1-\sigma)(1-\alpha)(1+\theta_E)}{1-(1/\theta)[c+\sigma(1-c)]+(1-\sigma)(1-c)\theta_E} \tag{15}$$

where the denominator is positive.[7]

The policy maker maximises long-run social welfare $HV = H(1-t_E)W/P_V + \eta H\Gamma(G)$ subject to its budget constraint. The first-order conditions of the government's optimisation program can be combined to yield an expression like (13) but with the long-run multiplier replacing the short-run multiplier.[8] The net marginal cost of public funds under free entry/exit ($\mathrm{MCPF}^{\mathrm{LR}}$) is thus

$$\mathrm{MCPF}^{\mathrm{LR}} = \frac{(1-\alpha)[1-1/\theta]}{1-(1/\theta)[c+\sigma(1-c)]+(1-c)(1-\sigma)\theta_E} \tag{16}$$

For an upward-sloping labour supply curve the marginal cost of public funds is smallest in the short run. Hence, the optimal level of public spending is lower in the long run than in the short run.

[6] In a recent paper Dixon and Lawler (1996) show that this conclusion can be reversed if there are increasing marginal costs. They eliminate the diversity effect in the utility function so that the real wage is constant in the long run and counter-cyclical in the short run. This latter aspect is a problematic implication of their approach.

[7] This result is shown in the separate appendix to this paper (see footnote 4). We use the Samuelsonian correspondence principle by expressing short-run profit as a function of the number of firms (i.e. $H\Pi(N)$), taking into account all general equilibrium repercussions. We then postulate that entry over time ($\dot{N}$) is positively related to profits, i.e. $\dot{N} = \gamma H\Pi(N)$ with $\gamma > 0$, so that the stability condition requires that $\mathrm{d}\Pi(N)/\mathrm{d}N$ be negative. This implies that the denominator of (15) is positive.

[8] The reason for this is that the profit and diversity effects are parameterised by a single coefficient ($1/\theta$) if the standard Dixit–Stiglitz preferences are used. See eqs (9) and (9′) in Heijdra and van der Ploeg (1996) on this point.

5. Conclusion

In this paper a simple macroeconomic model with imperfect competition on the goods market is developed. It extends the literature in two directions. First, the government employs distortionary income taxes to raise public revenue. Second, we assume public consumption to enter private utility in a non-separable way. This enables us to study the issue of direct crowding out of private by public consumption. The model is used to investigate the effect on national income of a rise in public spending. We distinguish the short run (with a fixed number of firms) and the long run (with free entry and exit). Furthermore, we derive the marginal cost of public funds to determine the optimal provision of public goods.

We show that national income multipliers in the short as well as in the long run are negative when the labour supply curve is upward sloping. The rise in income taxes necessary to finance public consumption depresses the after-tax real wage and thus discourages labour supply. The national income multiplier is particularly small if there is a large pre-existing income tax, substitution between leisure and private consumption is easy, firms have a lot of market power, and there is not much direct crowding out of private consumption. Short-run national income multipliers turn out to be smaller (in absolute value) than long-run multipliers. We derive that the marginal cost of public funds is smaller in the short run than in the long run which implies a larger optimal size of the government sector in the short run.

Overall our results highlight the fact that recent results on Keynesian multipliers are not very robust and that more research is needed into the integration of the public finance and stabilisation approaches to public policy. Allowing for direct crowding out and distortionary taxation is merely a first step in this endeavour.

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