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ABSTRACT

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Luís F. Costa**

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1. INTRODUCTION

IN STATIC GENERAL EQUILIBRIUM MODELS considering imperfectly competitive goods markets, the effectiveness of fiscal policy to stir output is shown to be greater than in the walrasian case. This line of research begins with the seminal papers of Dixon (1987), Mankiw (1988) , and Startz (1989) (henceforth DMS), and includes more recent articles such as Dixon and Lawler (1996) and Reinhorn (1998). However, labour is considered to be the only input in these models, ignoring the implications of the existence of investment.

Here, I develop a simple intertemporal model allowing us to study the steady-state role of optimal capital stock in the fiscal policy transmission mechanism. This can be seen as a dynamic extension of the models in the Blanchard and Kiyotaki (1987) tradition. In section 2, the optimal intertemporal behaviour for agents is derived. The microeconomic equations are put together, the model is closed, and the long-run equilibrium is derived in Section 3. In section 4, I derive the static fiscal output multiplier and analyse it under several assumptions about the initial steady state. Economic interpretation and comparison with the DMS framework are done in section 5, using some numerical simulations. Section 6 analyses the net output multiplier. Section 7 concludes.

I demonstrate results depend strongly both on the set of parameter values chosen and on the output definition. Using plausible calibrations the multiplier is larger in the

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walrasian case for small initial government purchases, and smaller for intermediate values.

2. THE MODEL

This model represents an artificial closed economy composed of three groups of agents: one representative household, n Dixit and Stiglitz (1977) monopolistic producers, and the government. I assume there is no uncertainty, agents are infinitely living, and money does not exist. I use very standard assumptions and specific functional forms, so I will not be exhaustive in the model description.

2.1. The representative household

This agent maximises an additively separable intertemporal utility function, depending on an aggregate consumption index and labour supply:

(1.) $$\max_{C_t, N_t} \sum_{t=0}^{\infty} \beta^t . \left[\frac{C_t^{\gamma}}{\gamma} - \xi . \frac{N_t^{\mu}}{\mu} \right] ,$$

where C_t is the aggregate consumption index, N_t the labour supply, $0<\beta<1$ is the discount factor, $1/(1-\gamma)$ with $\gamma \leq 1$ gives us the elasticity of intertemporal substitution in consumption (EIS_C), and $1/(\mu-1)$ with $\mu \geq 1$ gives us the elasticity of intertemporal substitution in labour supply (EIS_L). The consumption index is a CES function of the quantities consumed for n goods, and there is no love for variety:

(2.) $$C_t = n^{\frac{1}{1-\sigma}} . \left(\sum_{j=1}^{n} C_{j,t}^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}} .$$

$C_{j,t}$ is the consumption of good j and $\sigma>1$ is the reciprocal of the elasticity of substitution between goods. The appropriate cost-of-living index, P_t, is also a CES function of all the $p_{j,t}$, the individual prices, and it is normalised to unity. The budget constraint expressed in terms of aggregate consumption good is given by:

(3.) $$(1+r_{t-1}).B_{t-1} + w_t.N_t + \pi_t = B_t + \sum_{j=1}^{n} p_{j,t}.C_{j,t} + T_t ,$$

where B_t is a government real bond designated in aggregate consumption held by the household at the end of period t, r_t is the real interest rate paid on bonds held until the end of period t, w_t is the real wage rate, π_τ total real profit income, and T_t is a real lump-sum tax. For similar models in open economy see, *inter alia*, Costa (1998b) and Obstfeld and Rogoff (1995). Behavioural equations (consumption *Euler* equation, demand for goods, and labour supply) are exactly the same as in the above-mentioned articles. Since I am interested in the steady state analysis, I present them in appendix A.

2.2. Government

Government purchases a basket of the n goods, represented by G_t, with identical preferences to the household. Since the household is infinitely living ricardian equivalence holds, the only source to finance government spending is the lump-sum tax on the household, balancing the budget overtime: $G_t=T_t$.

2.3. Firms

Firm j (j=1, ..., n) maximises a stream of discounted cash flows:

$$\text{(4.)} \qquad \max_{q_{j,t},N_{j,t},I_{j,t}} \sum_{t=0}^{\infty} a_t.\pi_{j,t} \qquad , \qquad \pi_{j,t} = p_{j,t}.q_{j,t} - w_t.N_{j,t} - I_{j,t} \ ,$$

where $\pi_{j,t}$ represents its cash flow, $q_{j,t}$ its output, $N_{j,t}$ its labour demand, and $I_{j,t}$ its gross investment in the aggregate capital good. I assume the technology to produce the capital good uses no labour and it is identical to the household's sub-utility function given by (2.).[1] The firm's discount factor given by $a_t = \Pi_{s=1}^{t} 1/(1+r_{s-1})$. Firm j uses the following *Cobb-Douglas* technology to produce its good: $q_{j,t} = A_t.N_{j,t}{}^{\psi}.K_{j,t-1}{}^{1-\psi}$, where A_t is total factor productivity, $K_{j,t}$ is the capital stock owned by this firm at the end of period t, and $0<\psi\leq 1$. Capital is accumulated according to: $K_{j,t} = (1-\delta).K_{j,t-1} + I_{j,t}$, where δ is a constant depreciation rate.

The number of firms, n, is assumed to be sufficiently big to avoid the existence of *Ford* effects as it happens in d'Aspremont et al. (1989), Costa (1998a) , and Costa (1998b). Therefore, the 'objective' demand function faced by this firm is given by:

$$\textbf{(5.)} \qquad D_{j,t} = p_{j,t}{}^{-\sigma}.\frac{Q_t}{n} \ ,$$

where $Q_t=C_t+I_t+G_t$ is the aggregate demand, and $I_t = \Sigma_{j=1}^{n} I_{j,t}$. Assuming the equilibrium is symmetric, $p_{j,t}=P_t=1$, and we obtain a *Lerner* index given by $m=1/\sigma$, representing the market power of the individual firm. Again, see appendix A for equations giving us the supply of good j, and the demands for labour and investment, in its dynamic forms.

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[1] I also assume $p_{j,t}$ is the opportunity cost of not selling a unit of good j, therefore the aggregate price index for the capital stock is the same as the consumption cost-of-living index, i.e., is equal to unity.

3. LONG-RUN GENERAL EQUILIBRIUM

To close the model, an aggregate output definition is needed:

(6.) $$Y_t = \sum_{j=1}^{n} p_{j,t}.q_{j,t} \quad .$$

This definition corresponds to gross output, i.e., GDP. In section 6 this assumption is relaxed. It follows from (6.) and from the market clearing condition in all markets, $q_{j,t}=D_{j,t}$ for all j=1, ..., n, that aggregate demand equals aggregate output: $Q_t=Y_t$. We also need an aggregate capital stock definition given by: $K_t = \Sigma_{j=1}^{n} K_{j,t}$.

3.1. Steady state

Assuming the economy can reach a zero-growth steady state, the conditions defining it are given by the three dynamic equations in the model: the consumption *Euler* equation, the capital accumulation equation, and the optimal capitalistic intensity ($k_t=K_t/N_{t+1}$). Therefore, these equations can be written as follow, where variables with asterisks represent their steady-state equilibrium values:

(7.) $$r^* = \frac{1-\beta}{\beta} \; ;$$

(8.) $$I^* = \delta.K^* \; ;$$

(9.) $$k^* = \frac{1-\psi}{\psi}.\frac{w^*}{r^*+\delta} \quad .$$

Equation (7.) represents the condition equalising the real interest rate to the household's discount rate, imposing zero growth in consumption. The zero net-investment condition necessary for a stationary capital stock is given by (8.). Finally, the optimal input allocation is represented by (9.). Reducing the steady-state system to three equations in Y^* (or Q^*), C^* and I^*, we obtain:

(10.) $$\text{(a) } Y^* = C^* + I^* + G^* \quad , \quad \text{(b) } Y^* = a_0.z^{a1}.C^{*a2} \quad , \quad \text{(c) } I^* = b_0.z^{b1}.C^{*b2} \; ,$$

where z=1/(1-m) is an alternative market power measure,[2] $a_1=1+b_1<0$, $b_1=-\mu.[\psi.(\mu-1)]<0$, $a_2=b_2=-(1-\gamma)/(\mu-1)<0$, and $a_0,b_0>0$ are functions of the fundamental parameters.

[2] This measure is equal to the ratio of price to the marginal cost.

4. STATIC FISCAL MULTIPLIER

The multiplier can be derived using a first-order *Taylor* approximation around the initial steady state. Since there is no closed-form solution to (10.),[3] the implicit function theorem is used to derive the multiplier: $h=1+C_G+I_G$, where $X_R=dX^*/dR^*$, $X=C, I, Y$ and $R=G, z$. The reduced forms for these expressions are given by:

$$\text{(11.)} \qquad \text{(a) } C_G=-\frac{1}{1+\frac{1-\gamma}{\mu-1}.\left(1+\frac{1-s}{e}\right)}<0 \;\;,\;\; \text{(b) } I_G=\frac{s-e}{(1-s)+\frac{\mu-\gamma}{1-\gamma}.e}>0 \;,$$

where $e=C^*/Y^*\in(0,1]$ is the consumption share, and $s=e+I^*/G^*\in(0,1]$ is the private expenditure share in aggregate demand. Using these results, the following reduced form for the multiplier is obtained:

$$\text{(12.)} \qquad h=\frac{1}{(1-s)+\frac{\mu-\gamma}{1-\gamma}.e}>0 \;.$$

We can notice this multiplier is strictly positive for finite values of EIS_C. Furthermore, it decreases with both shares e and s.

4.1. The government shut-down fallacy

First, let us assume $G^*=0$ (or $s=1$) in the initial steady state. Considering government expenditure is pure waste, this is the government expenditure level maximising household's utility.[4] In this case, we may state:

PROPOSITION 1: *If government expenditure is zero (government shut down) in the initial steady state, then the static fiscal multiplier is larger under perfect competition than in the monopolistic case.*

PROOF: First, let us express consumption share as a function of government purchases and the mark-up, $e=e(G^*,z)$. It is easy to demonstrate that $(de/dz)|_{s=1}=(1-e)/z>0$, i.e., the consumption share in aggregate demand increases with the mark-up. Consequently, a bias towards consumption exists in the monopolistic equilibrium ($z>1$), when compared with the walrasian case ($z=1$), i.e., $e(0,z)>e(0,1)$, for all $z>1$. Since $s=1$ in the initial steady state, we obtain:

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[3] A closed-form solution exists in the special case where $G^*=0$.

[4] For a recent article analysing the relationship between optimal fiscal policy and the multiplier, within the DMS framework, see Reinhorn (1998).

$$h|_{z=1} \equiv \frac{1-\gamma}{e(0,1).(\mu-\gamma)} > h|_{z>1} \equiv \frac{1-\gamma}{e(0,z).(\mu-\gamma)} ,$$

provided EIS_C and EIS_L are finite. *Q.E.D.*

This result contradicts the findings of the DMS articles, and also other models considering labour to be the only input used in production as it happens in Costa (1998a) and Costa (1998b), *inter alia*. Thus, is the absence of capital in the production function a necessary condition to observe a larger fiscal multiplier under imperfect competition than in the walrasian case?

4.2. The general case

In general, we cannot ignore the role of the government share in aggregate demand (1-s), in the multiplier. Therefore, imperfect competition affects the multiplier to the extent it affects $e(G^*,z)$ and $1\text{-}s(G^*,z)$. Considering Y_z, I_z and C_z (under certain conditions) are negative, i.e., the output, investment and consumption levels decrease with the mark-up,[5] it is easy to see that:

$$\frac{d(1-s)}{dz} = -(1-s).\frac{Y_z}{Y^*} > 0 \ .$$

Hence, if we could prove $de/dz>0$ holds for all $s\in[0,1)$, the multiplier would be strictly decreasing in the mark-up. However, a higher monopoly degree reduces both consumption and output, and the way it affects the consumption share depends on the relative weight of these two changes:

$$\frac{de}{dz} = -\frac{e.h.x_0}{\psi.z.(1-\gamma)} \quad , \quad x_0 = (s-e).\psi.(\mu-\gamma) - (1-s).\left[\mu.(1-\psi)+\psi\right] \ .$$

When s=1, it is easy to see that $x_0>0$. However, for $s\in(0,1)$, x_0 implies $G^*/I^* < [\psi.(\mu-\gamma)]/[\mu.(1-\psi)+\psi]$ must hold. Since I cannot guarantee this condition holds even for plausible sets of parameters, further investigation has to be done. Considering de/dz does not have an unambiguous sign holding for all the range of the parameters, a simplifying assumption as to be made. First, let us write this expression as: $de/dz=e.C^*.(C_z\text{-}e.Y_z)$.

ASSUMPTION 1: *There exists a unique finite number $G_0\geq 0$, such that, for a given value for z and for $G^*=G_0$, $de/dz=0$, i.e., $C_z/Y_z=e$.*

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[5] See appendix B for reduced forms and necessary condition.

Hence, if assumption *1* holds, then de/dz is positive in the first interval[6] and negative in the second. When this analysis is transposed to the multiplier itself, we notice that:

(13.) $$\frac{dh}{dz} = -h^2.\left[\frac{\mu-\gamma}{1-\gamma}.\frac{de}{dz} + \frac{d(1-s)}{dz}\right].$$

Thus, three cases have to be considered:

Case I $\frac{de}{dz} > 0 \Rightarrow \frac{dh}{dz} < 0$ **;**

Case II $\frac{de}{dz} < 0 \wedge -\frac{de}{dz} < \frac{1-\gamma}{\mu-\gamma}.\frac{d(1-s)}{dz} \Rightarrow \frac{dh}{dz} < 0$ **;**

Case III $\frac{de}{dz} < 0 \wedge -\frac{de}{dz} > \frac{1-\gamma}{\mu-\gamma}.\frac{d(1-s)}{dz} \Rightarrow \frac{dh}{dz} > 0$ **.**

For $G^* \in [0,G_0)$, we are clearly in case I. However, I cannot demonstrate what happens for $G^* > G_0$ without further information. Thus, another assumption is needed:

ASSUMPTION 2: *There exist two finite numbers,* $G_A, G_B \geq 0$ *and* $G_A \leq G_B$*, such that they are the only existing feasible solutions for the equation* $\partial h/\partial z=0$.

If assumption *2* holds, three intervals for G^* that generate different signs for dh/dz can be found: (i) for $G^* \in [0,G_A)$, dh/dz is negative since $[0,G_0) \subset [0,G_A)$ and it is negative in the first of these intervals; (ii) for $G^* \in (G_A,G_B)$, dh/dz is positive; (iii) for $G^* \in (G_B,+\infty)$, dh/dz is negative. In next section I try to assess the how realistic the two assumptions are and how important the switching points G_A and G_B can be to explain the role of imperfect competition in the multiplier mechanism.

5. SIMULATION AND INTERPRETATION

5.1. Simulation

Set A in Table I, a plausible set of parameter values, is used to generate numerical values for the multiplier and its components. The value for β yields a 5% per period discount rate (and steady state real interest rate), γ implies EIS_C=0.75, and σ determines a *Lerner* index of 0.17. All these values were taken from Sutherland (1996). The value for δ assumes a forty-period maximum lifetime for the capital

[6] Remember I demonstrated it was positive for s=1.

stock. This value was taken from Hairault and Portier (1993). The value for ψ produces a 62.5% labour share in total income, which is lower than the 70% proposed in Hairault and Portier (1993), but is consistent with most values used in the real business cycles literature.[7] The value for μ generates EIS_L=0.67< EIS_C, which is generally accepted as a stylised fact. The value for ξ gives rise to an employment level equal to 0.33, given all the other values and a government consumption share equal to 0.20. This last value was taken from Baxter (1995).

[Insert Table I **here]**

Functions *de*/*dz* (left-hand side) and *dh*/*dz* (right-hand side) are plotted in Figure 1, using set A.[8] For this simulation G_A corresponds to 1-*s*=0.22, and G_B corresponds to 1-*s*=0.87. According to OECD (1976-1996), the average share of government expenditure in goods and services in the GDP for the period 1974-94, a proxy for 1-*s*, varied between 0.098 (Japan) and 0.271 (Sweden), in a sample of 25 countries. Given this fact, most interesting cases can be found within an interval for witch G_A sits, roughly, in the middle. Hence, given the simulations made, assumptions *1* and *2* are likely to hold for plausible sets of parameter values.

[Insert Figure 1 **here]**

5.2. Economic interpretation for the switching points

5.2.1. Very small values of G^*

For $G^* \in [0,G_0)$, case I is the relevant one. Figure 2 illustrates the initial general equilibrium for the special case G^*=0, for which fiscal policy maximises household's welfare. The household's maximisation problem is presented the (N^*,C^*) space (a), and *U* are the indifference curves, *w* the wage rates, BC the budget constraints, and M refers to the monopolistic equilibrium and W to the walrasian one. The figure in the (I^*,C^*) space (b) represents the macroeconomic equilibrium for this special case where $Y^*=C^*+I^*$. There are two explanations for the existence of a bias towards consumption in the monopolistic equilibrium (e_M>e_W), in this case: (i) due to the existence of pure profits in the monopolistic case, i.e., $\pi^*_M > r^*.K^*_M$, the household has an extra source of permanent income and, consequently, it can afford future consumption without saving such a big proportion of its income; (ii) the other effect comes from a lower

[7] See, *inter alia*, Baxter (1995) , 58%, and Kydland and Prescott (1982), 64%.

[8] Similar pictures were obtained for other plausible sets of parameter values.

real wage under imperfect competition[9] that makes labour cheaper relatively to capital,[10] lowering the optimal capital level in the monopolistic case when compared with the competitive one. Thus, the crowding-out effect of public expenditure in consumption[11] is proportionally larger under imperfect competition, and the positive effects on output and investment are smaller.

[Insert Figure 2 **here]**

5.2.2. Small values for G^*

For $G^* \in (G_0, G_A)$, more government expenditure reduces e. However, this change is very small and e is still very high. Also, 1-s, government's share in aggregate demand, is still too small to off-set the consumption crowding out effect. Here, case II is the relevant one.

5.2.3. Intermediate values for G^*

Let Figure 3 be used to represent what happens when $G^* \in (G_A, G_B)$. Here, 1-s is more important now. Nevertheless, consumption crowding out is still the main mechanism to explain the differences in the multipliers under different mark-up levels. We can see, on (b), that e/s is now larger in the walrasian case, i.e., OW is steeper than OM. Furthermore, due to efficient allocation, 1-s is smaller in the walrasian case. Thus, $e=(s.e)/s$ is larger in the competitive case. Consequently, given the bias towards investment in the monopolistic case, a permanent increase in lump-sum taxes as a proportionally smaller negative impact than in the walrasian case.[12] This corresponds to case III.

[Insert Figure 3 **here]**

5.2.4. Large values for G^*

For $G^*>G_B$ we are in case II again, but for different economic reasons. Now, e is small, due to increasing shares of both government consumption and investment,[13]

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[9] Inefficiency under imperfect competition implies a lower consumption level, expanding labour supply, and a reduction in labour demand, when compared with the walrasian case.

[10] Remember the interest rate was assumed to be fixed in order to have a zero growth steady state.

[11] Notice it is partial for finite elasticities of intertemporal substitution, as we can see in (11.) (a).

[12] A similar consumption-led mechanism, due to the existence of distortionary taxation on labour income, can be observed in Torregrosa (1998). There, despite the fact that labour is the only input, the multiplier may be negative.

[13] Private expenditure may even be crowded in by government purchases because:

and these last two components dominate what happens to aggregate demand (and output). Considering extra units of capital are used more efficiently in the competitive case, the multiplier is larger there than under monopolistic competition. Of course there is a value for G^* such that N^* equals the time endowment, and no more capacity can be added. But even before that point, we expect the multiplier to decrease with G^*, if consumption of goods and leisure is so low that the optimal response to higher taxes is to reduce labour supply. Considering the estimates for G_B already imply such a high value for 1-s,[14] we will concentrate in the range $G^* \in [0, G_B)$.

5.3. Comparing with the DMS framework

As it can be seen in Dixon (1987), referring to the DMS framework:

> "(...) the government expenditure multiplier is in a very precise sense «Walrasian» in this model. By this we mean that the mechanisms underlying the Walrasian multiplier are the same with imperfect competition. There will be crowding out, and the multiplier has the Walrasian value as its lower bound, is strictly less than unity, and strictly increasing in the degree of monopoly."[15]

The model here presented shares the crowding-out feature for consumption, even if the same does not apply for investment. The second characteristic, "being less than unity", does not hold in general, but I expect it to hold for plausible calibrations.[16] Finally, my investigation clearly contradicts the possibility of extending the third property - a multiplier "strictly increasing in the degree of monopoly" - to a model where labour is not the sole input. In order to evaluate how robust these results are, numerical values for G_A and G_B were generated, modifying the values for key parameters in the benchmark set (set A). The outcomes are shown in Table 2.

[Insert Table 2 **here]**

$$\frac{\partial(C^* + I^*)}{\partial G^*} = -h.e.(1-\gamma).\left(\frac{EIS_C}{EIS_L} - \frac{I^*}{C^*}\right) ,$$

and assuming $EIS_C > EIS_L$, I cannot guarantee $C^* > I^*$, a sufficient condition for crowding out to exist. For large values of I^* and small values of C^*, the expression may well be positive. Obviously, I do not advocate this to be a realistic assumption.

[14] I was not able to generate values inferior to 0.80, for plausible features of the initial steady state.

[15] Op. cit. pp. 135.

[16] For set A, 1-s=0.87 would be needed in order to generate a multiplier bigger than unity.

The changes in γ were made to produce values for EIS_C equal to 1 (γ=0), and 1.25 (γ=1/5). When ψ=0.55 the labour share in total income is 0.46, and for ψ=0.95 is equal to 0.79. The parameter σ determines the mark-up level, z, equal to 1 (σ=+∞, i.e., perfect competition), or equal to 1.4 (σ=3.5). Finally, for μ=2.33 EIS_L=EIS_C=0.75, and for μ=2.2 EIS_L=0.83>EIS_C=0.75. We can notice all the values for G_A generate government shares in aggregate demand (1-s) very similar to those observed in the OECD countries. Only for ψ=0.55 the model generates a value of G_A low enough to generate a larger multiplier under imperfect competition for all the countries in the sample.

We can observe 1-$s(G_A)$ is highly sensitive to changes in the parameters, especially γ, ψ and σ. A larger value for one of these parameters generates a lower value for G_A. In the limit, the DMS framework can be seen as a special case of this model where ψ=1, i.e., labour is the only input, and γ=1, i.e., present and future consumption are perfect substitutes. Also, it seems plausible that the efficiency gains from reducing the mark-up increase with the degree of imperfect competition in the initial steady state.[17] Apparently, the elasticity of intertemporal substitution in labour supply, and its relationship with its homologous in consumption, does not play an essential role determining the position of G_A.

Thus, a second set of parameters was used, set B in Table I, keeping the main features of the benchmark initial steady state. The main differences are an elasticity of intertemporal substitution in consumption equal to unity, a larger mark-up level (z=1.4),[18] and a slightly larger labour share in total income (0.643). Set B, generated 1-$s(G_A)$=0.09, hence including all the countries in the 1992 sample in the interval (G_A,G_B), compared with only five countries meeting the same criterion in set A. Finally, the proportional difference between the monopolistic and the walrasian multipliers, $\eta(G^*,z)=h(G^*,z)/h(G^*,1)-1$ was plotted in Figure 4, using the two sets. Three main characteristics can be observed: (i) the smaller value of G^* for which η=0 (approximately equal to G_A) is 1.6 times larger for set A; (ii) the maximum value for the η(.) function is 3.4 bigger in set B; (iii) the value for η is always larger for set B. Therefore, any conclusion drawn about the importance of imperfect competition for the long-run effectiveness of fiscal policy depends decisively upon the parameter values chosen for the artificial economy. If we intend to simulate the features of a specific real economy, special attention has to be paid to the estimates for the elasticity of intertemporal substitution in consumption, labour elasticity in the

[17] A similar effect for the free-entry multipliers was noticed in Costa (1998a) and Costa (1998b).

[18] See Hairault and Portier (1993) for a discussion about estimates for z in the US economy.

production function (i.e., z times the labour share in total income), the mark-up level in the economy, and the share of government purchases in aggregate demand. Consequently, the DMS conclusion that fiscal policy is more effective on output under imperfect competition does not hold in general when the model is extended introducing capital as an input.

6. NET OUTPUT

Let us use now a different definition for output, net of capital depreciation, instead of (6.):[19]

$$(14.)\qquad y_t = Y_t - \delta . K_{t-1} \ .$$

In this case, the steady-state equilibrium is given by $y^*=C^*+G^*$. The net-output multiplier is thus given by:

$$(15.)\qquad h_N = \frac{dy^*}{dG^*} = 1 + C_G = \frac{1}{1+\dfrac{\mu-1}{1-\gamma}.e_N} > 0 \ , \qquad e_N = \frac{C^*}{y^*} \ .$$

PROPOSITION 2: *Under the normal assumptions, the net output multiplier is strictly increasing in the monopoly degree.*

PROOF: First, we know that $e_N(G^*,z)=1-G^*/y(G^*,z)$. For a given level of government consumption G^*, e_N varies with the mark-up in the same direction that y^* does it. Using the equilibrium equation, we recognise that $y_z=C_z$. Thus, as long as C^* decreases with the mark-up level, so does y^* and consequently e_N. Since h_N is strictly decreasing in e_N for finite values of EIS_C and EIS_L, and e_N is decreasing in z, the net output multiplier increases with z. *Q.E.D.*

Hence, if we use this output definition, our findings corroborate the DMS conclusions about the monotonicity of the multiplier.

7. CONCLUSIONS

In this article I present a zero-growth steady-state model for a closed economy, considering capital accumulation. This model can be considered as an intertemporally founded extension of the static framework in the Dixon (1987), Mankiw (1988), and Startz (1989) (DMS) tradition.

[19] This definition corresponds to NNP.

The role of imperfect competition in the size of the static fiscal (output) multiplier of government purchases was analysed. The "optimal" fiscal policy, i.e., the one that maximises the representative household's utility, corresponds to zero government purchases. In this case, it can be unambiguously shown that imperfect competition produces a smaller multiplier since it introduces a bias towards consumption that amplifies the crowding out effect of government expenditure. This is exactly the opposite to the DMS conclusions.

However, I cannot demonstrate this proposition (or the opposite) holds in general. For plausible parameter values I found two switching points for the multiplier's derivative with respect to mark-up. For small values of government consumption the multiplier is larger in the walrasian case, and for intermediate values the opposite happens. Consumption crowding out is the main mechanism explaining the differences. For (implausibly) large values of government expenditure the walrasian case overtakes the monopolistic one due to more efficient usage of investment.

Also, I showed the first switching point is very sensitive to changes in the key parameters, namely labour elasticity in the production function, elasticity of intertemporal substitution in consumption, and the degree of market power. We concluded it is not possible to defend *a priori* neither the DMS results nor the opposite for this extended model.

Finally, it was demonstrated that the multiplier is strictly increasing in the monopoly degree when we use net instead of gross output. In this case, the DMS results hold.

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APPENDIX A

The behavioural equations are:

(A.1.) $$C_{t+1} = \left[\beta.(1+r_t)\right]^{\frac{1}{1-\gamma}}.C_t$$

(A.2.) $$N_t = \left[\frac{1}{\xi}.(C_t)^{\gamma-1}.w_t\right]^{\frac{1}{\mu-1}}$$

(A.3.) $$C_{j,t} = \left(p_{j,t}\right)^{-\sigma}.\frac{C_t}{n}$$

(A.4.) $$G_t = T_t$$

(A.5.) $$G_{j,t} = \left(p_{j,t}\right)^{-\sigma}.\frac{G_t}{n}$$

(A.6.) $$k_{j,t} = \frac{w_{t+1}}{r_t + \delta}.\frac{1-\psi}{\psi}$$

(A.7.) $$N_{j,t} = \left[z.\frac{w_t}{A_t.\psi}\right]^{-\frac{1}{1-\psi}}.K_{j,t-1}$$

(A.8.) $$I^i_{j,t} = \left(p_{i,t}\right)^{-\sigma}.\frac{I^i_t}{n}$$

(A.9.) $$I_{j,t} = n^{\frac{1}{1-\sigma}}.\left(\sum_{i=1}^{n} I^i_{j,t}{}^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma}{\sigma-1}}$$

(A.10.) $$N_t = \sum_{j=1}^{n} N_{j,t}$$

Equation (A.1.) is the consumption Euler equation, (A.2.) is the labour supply and (A.3.) is the household's demand for good *j*. (A.4.) represents the government budget constraint and (A.5.) its demand for good *j*. Equation (A.6.) stands for firm *j*'s the optimal capitalistic intensity, (A.7.) its demand for labour, (A.8.) its demand for good *i*, and (A.9.) its gross investment. Equation (A.10.) is the market demand for labour.

APPENDIX B

The derivatives of consumption, investment and output with respect to the mark-up measure are given by the following expressions:

$$C_z = -\frac{h.C^*}{(1-\gamma).\psi.z}.\left[\mu.(1-s+e) - \psi.(\mu-1)\right] ,$$

which is negative if total consumption share in aggregate demand, 1-s+e, is larger than $\psi.\mu/(\mu-1)$. This condition held for all the simulations made;

$$I_z = -\frac{h.I^*}{(1-\gamma)}.\left[\mu.e + \psi.(1-\gamma)\right] < 0 \;;$$

$$Y_z = -\frac{h.C^*}{(1-\gamma)^2.\psi^2.e.z}.\left[(s-e) + e.\frac{\mu.(1-\psi)+\psi}{(1-\gamma).\psi}\right] < 0 \;.$$

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TABLES

TABLE I

NUMERICAL VALUES FOR THE PARAMETERS

Set	β	γ	δ	ψ	μ	σ	ξ	A^*	n
A	1/1.05	-1/3	0.025	0.75	2.5	6	19.10	1	100
B	1/1.05	0	0.025	0.90	2.5	3.5	12.99	1	100

TABLE II

CHANGES IN THE PARAMETER VALUES AND THE SWITCHING POINTS

Set		$1\text{-}s(G_A,z)$	$1\text{-}s(G_B,z)$
A		0.22	0.87
γ	0	0.16	0.90
	1/5	0.14	0.91
ψ	0.55	0.24	0.81
	0.95	0.07	0.97
σ	$+\infty$	0.27	0.84
	3.5	0.18	0.89
μ	2.33	0.22	0.86
	2.2	0.23	0.85

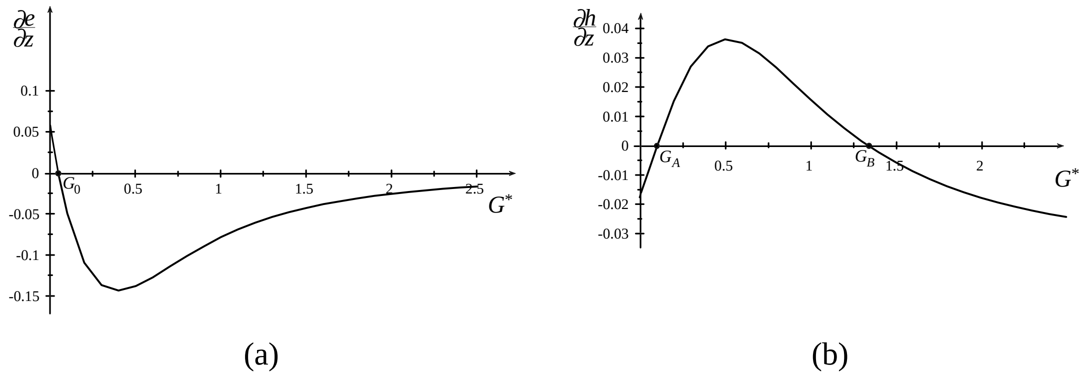

FIGURE 1 - Consumption Share, Multiplier, and Imperfect Competition

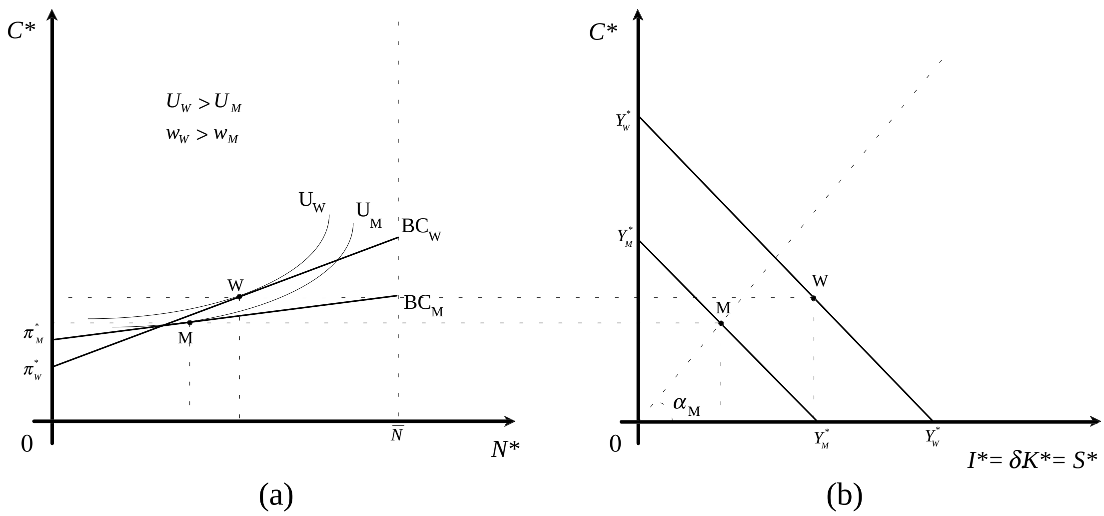

FIGURE 2 - General Equilibrium with Government Shut Down

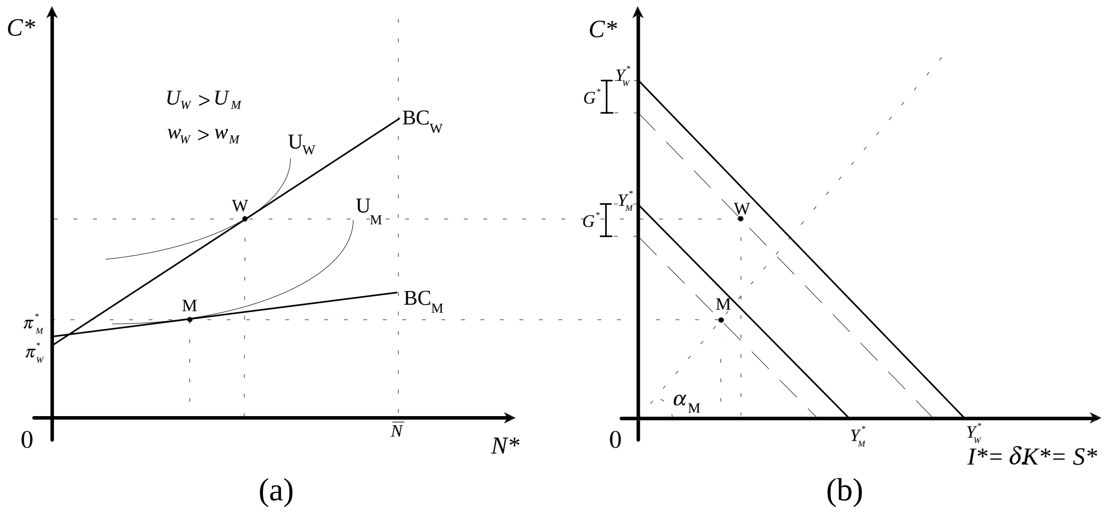

FIGURE 3 - General Equilibrium with Intermediate Government Procurement

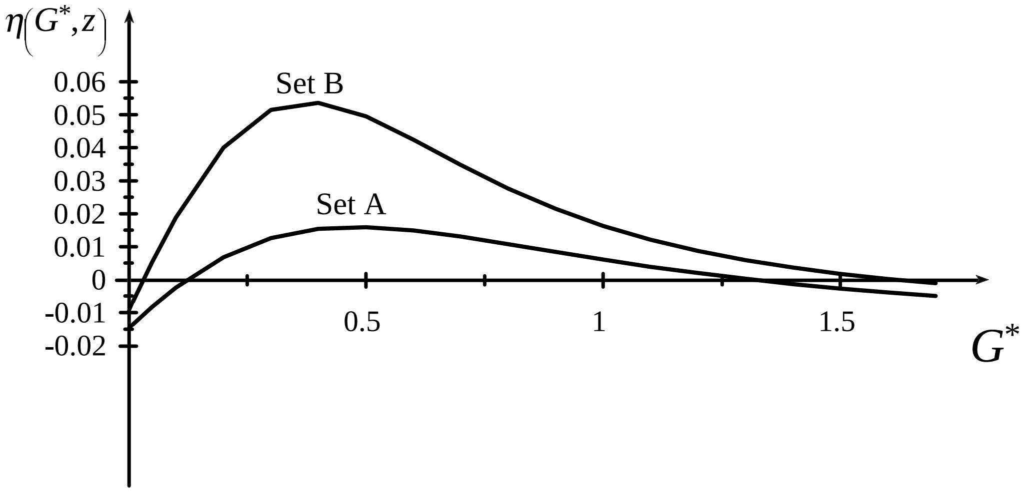

FIGURE 4 - Walrasian and Monopolistic Multipliers for Two Parameter Sets