Useful Government Spending, Direct Crowding-Out and Fiscal Policy Interdependence

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Abstract

This paper introduces perfect substitutability between private and public consumption in a dynamic, open economy with imperfect competition and nominal rigidities. This implies a direct crowding-out e¤ect that, generalising to the two-country case some well-known properties of a closed economy, tends to reduce consumption following both domestic and foreign expansions. A less expected result is that substitutability has a positive e¤ect on the short-run output spillover. We also show that, if we modify the model to allow for home bias in government spending, temporary …scal expansions display a "quasi-neutrality" property.

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1 Introduction

For almost three decades, the standard tool for the analysis of international monetary and …scal policy transmission has been the two-country version of the Mundell-Fleming (hereafter MF) model[1]. Although this framework is still widely used for policy evaluations, it presents several shortcomings. In particular, it is based on an ad-hoc approach in which the relationships between macroeconomic variables are not derived from a microfounded analysis of the agents' behavior. The lack of microfoundation also implies that it is impossible to carry out an explicit welfare analysis of the impact of monetary and …scal policies.

Early attempts to develop a more rigorous framework for the analysis of macroeconomic interdependence can be found in the work of Svensson (1987), Svennson and van Wijnbergen (1989) and Rankin (1990). More recent research, following the path-breaking contribution of Obstfeld and Rogo¤ (hereafter OR, 1995, 1996), has seen the emergence of a new paradigm, that embodies market imperfections such as monopolistic competition and price-stickiness in an optimizing setup[2]. In this literature, the analysis of the international e¤ects of macroeconomic policies can be based on a rigorously microfounded framework. Further, the representative agent approach allows an explicit evaluation of the welfare e¤ects of such policies. Although the OR framework is a ‡exible tool that can be used to address several issues in open economics macroeconomics, existing contributions tend to focus on the e¤ects of money shocks, neglecting the role played by government spending. Furthermore, even when government spending is introduced in the analysis, it is usually assumed to be pure waste (as in OR 1995, 1996) or to a¤ect private utility only in an additively separable way[3].

This paper aims at …lling in these gaps in the literature, developing a version of the OR model in which government expenditure a¤ects utility in a non-separable fashion. In doing this, we choose to model private and public

[1] Mundell (1968), Fleming (1962).

[2] The supply side of this framework is akin to the one provided in the closed economy literature by Blanchard and Kiyotaki (1987) and Ball and Romer (1990). For a comprehensive survey of this new literature, often referred to as The New Open Economy Macroeconomics, see Lane (1999).

[3] The contribution of Corsetti and Pesenti (1998), while being more elaborated in other dimensions, introduces welfare enanching govenment expenditure only in an additively separable way.

consumption as perfect substitutes. The main purpose of this paper is that of studying the consequences of the introduction of this hypothesis on the short-run and long-run multipliers of domestic and foreign fiscal expansions. Our specification of preferences rests on the idea that public expenditure can have a direct crowding-out effect on private consumption. The debate on crowding-out goes back to Keynes (1929), that referred to it as diversion. In more recent times, the subject has been studied in a IS/LM framework by Bailey (1971) and Buiter (1977). Silvestre (1993) stressed the importance of carrying-out an analysis of this phenomenon in an imperfect competition framework. This has been done for a static, closed economy with imperfect competition by Heijdra and Ligthart (1997) but, to the best of our knowledge, there is no contribution in the literature that analyses non-separability between public and private consumption in the framework used in this paper.

We show that the introduction of useful government spending tends to reduce consumption following both domestic and foreign permanent expansions. It also has a negative impact on output, with the exception of the short-run effect following a foreign expansion. Contrary to the MF case, in our model a short-run negative output spillover arises. The introduction of non-separability, having a positive differential effect, mitigates the negative spillover. Both the negative spillover and the positive differential effect of non-separability can be explained with the fact that our money demand equations, being derived from microfoundation, are functions of consumption rather than gross income.

Our model nests the closed economy case, providing microfoundation for results previously illustrated in the IS/LM analysis. As our model also nests the OR case of pure waste government expenditure, a second purpose of this paper is that of carrying out a detailed analysis of fiscal policy interdependence in that case. This is a quite interesting exercise, given that OR sketch a version of the model that encompasses government spending but they do not analyse the positive and normative implications of fiscal policy in any detail.

Finally, we consider a variant of the model with complete home bias in government spending. This modification breaks down the transmission mechanisms at work in the baseline version. As a result, temporary fiscal expansions display a form of short-run "quasi-neutrality", i.e. a temporary expansion in one country raises that country's output on a one-to-one basis, leaving all the other (domestic and foreign) variables unaffected. The latter property is present in similar models (e.g. Svennson 1987, Rankin

1990, Corsetti and Pesenti 1997), but an intuition for its causes has not been provided yet. Our analysis shows that home bias in government spending can be considered as the main determinant of "quasi-neutrality". A simple intuitive explanation is that, if government spending is used to purchase only domestically produced goods, the costs of an expansion for domestic residents are offset by the positive stimulation of domestic demand, and the effect on domestic consumption is therefore zero.With no home-bias the spillover effects are mostly driven by the impact that consumption has, through money demand, on the nominal exchange rate. Therefore, the zero effect on domestic consumption that arises when we introduce home bias also explains why there is no effect on foreign variables.

The paper is organized as follows: Section 2 introduces the model, in Section 3 the multipliers of a domestic and foreign fiscal expansion are explicitly derived and discussed. Section 4 discusses some welfare implications, Section 5 introduces home-bias in government spending in the original setup, while Section 6 draws some conclusions.

2 The Model

The model presented in this section is an extension of OR (1995,1996). The exposition aims at introducing the building blocks of the model as well as the main innovations relative to the basic framework.

2.1 The Optimization Problem

There is a continuum of infinitely-lived agents that are both consumers and monopolistic producers. Both the agents and the single differentiated good that each of them produces are indexed by $z \in [0;1]$: There are only two countries in the world: Home and Foreign. Home agents are on the interval [0,n], while foreign agents are on the interval (n,1]. We will introduce the equations for the representative domestic agent, bearing in mind that the model is symmetric and so are the equations concerning the foreign representative individual. The representative agent, indexed by $j \in [0;1]$, maximizes his intertemporal utility function, given by:

$$U_t^j = \sum_{s=t}^{\infty} \beta^{s-t}\left[\log(C_s^j + \gamma G_s) + \chi \log \frac{M_s^j}{P_s} - \frac{k}{2} y_s(j)^2\right] \quad (1)$$

where $0<\beta<1$ is the discount factor, and all the parameters are positive.

Formula (1) indicates that the agent gains utility from a real private consumption index, from (per-capita) government spending and from real money balances. The consumption index C, defined as:

$$C^j = \left[\int_0^1 c^j(z)^{\frac{\theta-1}{\theta}} dz\right]^{\frac{\theta}{\theta-1}} \tag{2}$$

aggregates over the consumption of the single goods z by agent j, and $\theta > 1$ is the price elasticity of demand faced by each monopolist[4]. If p(z) is the home-currency price of good z, the home money price level is:

$$P = \left[\int_0^1 p(z)^{(1-\theta)} dz\right]^{\frac{1}{1-\theta}} \tag{3}$$

The introduction of welfare enhancing government expenditure is the main innovation of this paper. Notice that, as it will be clear from what follows, introducing government spending in a non-separable way changes the first order conditions, and therefore both the positive and normative effects, with respect to the pure waste case. If government spending was introduced in a additively separable way, on the contrary, only the normative effects would be affected. Our model nests the OR case of pure waste government expenditure for $\gamma = 0$. Finally, the agent experiences disutility in having to give up leisure in order to produce more output[5], as expressed by the term $-\frac{k}{2}y_s(j)^2$. This is a crucial difference with classical IS/LM models, where an increase in output is assumed to be unambiguously welfare enhancing.

The utility function of the representative foreign individual is completely analogous to that of the home individual, with the difference that foreign agents gain utility from foreign government expenditure. Furthermore, home money is hold only by home agents and foreign money only by foreign agents. The deflator for foreign money balances M^{*j}_s is:

$$P^* = \left[\int_0^1 p^*(z)^{(1-\theta)} dz\right]^{\frac{1}{1-\theta}} \tag{4}$$

where p*(z) is the foreign currency price of good z.

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[4] Following Dixit and Stiglitz (1977), C^j is a constant elasticity of substitution (CES) function. The lower is θ the larger is the degree of monopolistic distortion in the economy.

[5] Remember that each individual j has the monopoly to produce good j. This specification of consumers preferences allows us to eliminate the labor market from the analysis.

An important hypothesis of the model is that there are no impediments to trade, so that the law of one price holds. This means that, denoting with ε the nominal exchange rate (the price of foreign currency in terms of home currency), the following relationship holds for each good:

$$p(z) = \varepsilon p^*(z) \tag{5}$$

where p(z) and p*(z) are the prices of the same good respectively in home and foreign currency. It follows that the home and foreign consumer prices indexes are linked by the Purchasing Power Parity (PPP):

$$P = \varepsilon P^* \tag{6}$$

In every period, the representative individual is subject to the budget constraint:

$$P_t B^j_{t+1} + M^j_t = P_t(1 + r_t)B_t + M^j_{t-1} + p_t(j)y_t(j) - P_t C^j_t - P_t \tau_t \tag{7}$$

where B is a riskless real bond denominated in the composite consumption good, that gives account of international shifts in wealth, r_t is the real interest rate on bonds between t-1 and t, $y_t(j)$ is output of good j and $p_t(j)$ is its domestic currency price. M^j_{t-1} denotes nominal money balances held at the beginning period t and τ_t lump-sum taxes, that are assumed to be payable in the consumption good C_t.

In this framework, the home individual demand[6] for good z is:

$$c^j(z) = [\frac{p(z)}{P}]^{-\theta} C^j \tag{8}$$

By symmetry, the foreign individuals demand for z is:

$$c^{*j}(z) = [\frac{p^*(z)}{P^*}]^{-\theta} C^{*j}$$

The home government finances its spending by means of taxes and seigniorage, according to its budget constraint, expressed in per-capita terms by

$$G_t = \tau_t + \frac{(M_t - M_{t-1})}{P_t} \tag{9}$$

[6] The demand function (8) maximizes (2) subject to $\int_0^1 p(z)\, c(z)\, dz = X$ where X denotes the fixed total nominal expenditure on goods.

An analogous constraint holds abroad[7]. The (per-capita) government real consumption index aggregate over government spending for the different varieties of goods, with the same elasticity of substitution[8]:

$$G = \left[\int_0^1 g(z)^{\frac{\theta-1}{\theta}} dz\right]^{\frac{\theta}{\theta-1}} \tag{10}$$

A starred version holds for the foreign government. The home and foreign government demands for good z take the same form as the private consumption demands:

$$g(z) = \left[\frac{p(z)}{P}\right]^{-\theta} G \tag{11}$$

$$g^*(z) = \left[\frac{p^*(z)}{P^*}\right]^{-\theta} G^* \tag{12}$$

Therefore the demand functions for the representative (home and foreign) agents output take the form[9]:

$$y^d = \left[\frac{p(z)}{P}\right]^{-\theta} (C^w + G^w) \tag{13}$$

$$y^{*d} = \left[\frac{p^*(z)}{P^*}\right]^{-\theta} (C^w + G^w) \tag{14}$$

where the superscripts w indicates world aggregates[10]. Dropping the index denoting agent j in order to ease exposition, the first order conditions

[7] As the agents are infinitely lived, government debt would be redundant. The introduction of overlapping generations in the model, that would break down Ricardian equivalence, is left for future work.

[8] This assumption eliminates the so called "elasticity effect of the spending mix" (see Dixon and Rankin 1994, p. 189 and the references therein cited): changing the share of government demand on total demand has no effects on the (constant) elasticity of total (private plus public) demand.

[9] Equations (13) and (14) are derived integrating demand for good z across all agents, and exploiting the fact that the law of one price and the PPP imply that $p(z)/P = p^*(z)/P^*$ for any good z.

[10] That is $C^W + G^W = n(C + G) + (1 - n)(C^* + G^*)$: Notice that all the variables without the w superscript are per-capita. All world variables can be derived aggregating the per-capita variables considered so far over the n home individuals and the $1 - n$ foreign individuals. Symmetry implies that the operation of integration reduces to taking a population weighted average of per-capita variables .

are the following[11]:

$$C_{t+1} + \gamma G_{t+1} = \beta(1 + r_{t+1})(C_t + \gamma G_t) \tag{15}$$

$$\frac{M_t}{P_t} = \frac{\chi(1 + i_{t+1})}{i_{t+1}}(C_t + \gamma G_t) \tag{16}$$

$$y_t^{\frac{\mu+1}{\mu}} = \frac{(\mu - 1)}{\mu}\frac{1}{k}(C_t^w + G_t^w)^{\frac{1}{\mu}}\frac{1}{(C_t + \gamma G_t)} \tag{17}$$

where i_{t+1} is the nominal interest rate between t and t + 1 defined by the Fisher relation:

$$1 + i_{t+1} = \frac{P_{t+1}}{P_t}(1 + r_{t+1})$$

If we introduce a notion of consumption that includes government spending as well as private consumption, redefining $C + \gamma G$ as "full consumption" (as in Heijdra and Ligthart, 1997) the above expressions are quite standard ones. Equation (15) is the Euler equation that characterizes consumption smoothing. Equation (16) resembles a "textbook" Keynesian money demand function, with the difference that money demand is a positive function of full consumption instead of income. This shows that microfoundation can be consistent with the traditionally postulated money demand equations: money demand is in any case a positive function of a variable that represents the scale of transactions and a negative function of the interest rate. The result that money demand is not a function of gross income, however, will turn out to be crucial for the fact that some of our results in Section 3 are opposite to the "standard" MF ones[12]. Finally, equation (17) is the labor-leisure trade-off, that equates the marginal disutility of giving up leisure to produce an extra unit of output with the utility deriving from consuming the added revenue that the extra unit of output brings.

[11] To derive the first order conditions, notice that the demand curve (13) implies:

$$p_t(j)y_t(j) = P_t y_t(j)^{\frac{\mu-1}{\mu}}(C_t^w + G_t^w)^{\frac{1}{\mu}}$$

Substituting the latter expression in to the period budget constraint (7), we obtain an expression for C_t^j, that can be substituted in to (1). After these manipulations, the optimization problem of the representative individual becomes an unconstrained one.

[12] As in Rankin (1990).

2.2 The Initial Steady-State

In order to solve the model, it is necessary to consider a log-linear approximation around a symmetric steady-state. This will be done initially for a flexible-price steady state, and the hypothesis of price stickiness will be subsequently introduced. The most convenient steady-state to consider is one in which initial foreign asset and government expenditure are zero for both countries, i.e.: $B_0 = B_0^* = G_0 = G_0^* = 0$

Symmetry implies that $p_0(h)/P_0 = p_0(f)/P_0^* = 1$; where $p_0(h)$ and $p_0(f)$ are respectively the prices of home and foreign goods and $C_0 = C_0^* = y_0 = y_0^* = C_0^w$. The $_0$ subscript denotes the initial pre-shock value. In the aggregate, global net foreign assets are zero:

$$nB_{t+1} + (1-n)B_{t+1}^* = 0 \tag{18}$$

and an aggregate goods market clearing condition must hold:

$$C_t^w + G_t^w = Y_t^w \tag{19}$$

In the initial steady state all the exogenous variables are constant, this implies that consumption is constant as well. Indicating with a bar steady-state variables, the Euler equation (15) with constant consumption gives[13]:

$$\bar{r} = \delta = \frac{1-\beta}{\beta}$$

where $\delta > 0$ is the rate of time preference.

In the steady-state, consumption is equal to steady-state real income minus government expenditure in both countries:

$$\bar{C} = \delta\bar{B} + \frac{\bar{p}(h)\bar{y}}{\bar{P}} - \bar{G} \tag{20}$$

$$\bar{C}^* = -\frac{n}{1-n}\delta\bar{B} + \frac{\bar{p}^*(f)\bar{y}^*}{\bar{P}^*} - \bar{G}^* \tag{21}$$

where in (21) $\bar{B}^*$ is expressed in function of $\bar{B}$ using (18).

[13] In what follows the time subscript will be dropped, as the variables are considered at the steady state.

We will now present the log-linearization of the model around the symmetric-steady state previously defined. Each variable will be expressed in log-deviations from the steady state, and log-deviations will be denoted by lower cases[14], for example:

$$c = \frac{dC}{C_0} \simeq \frac{C - C_0}{C_0}$$

Lower cases with a bar will denote long-run variables (i.e. log deviations from one steady state to another) . The variables whose initial steady-state value is zero will be normalized by initial world consumption[15], for example:

$$g = \frac{dG}{C_0^w}$$

2.3 Log-Linearization

Assuming symmetry among each country's producers and approximating around a symmetric steady where the law of one price holds for each individual good yields the log-linear version of the price indexes equations (3) and (4):

$$p_t = np_t(h) + (1 - n)[e_t + p^*(f)] \qquad (22)$$

$$p_t^* = n[p_t(h) - e_t] + (1 - n)[p_t^*(f)] \qquad (23)$$

where the prices indexes and the single-good prices are now expressed as deviations from the initial steady-state and $e_t = d\varepsilon_t/\varepsilon_0$.

The purchasing power parity equation (6) becomes:

$$e_t = p_t - p_t^* \qquad (24)$$

Log-linearization of the world demand functions for representative domestic and foreign products (13) and (14) yields:

$$y_t = \theta[p_t - p_t(h)] + c_t^w + g_t^w \qquad (25)$$

[14] We have already used lower cases to indicate the levels of some of the variables (for example for the prices), but as in what follows we will make extensive use of log-linearizations, the slight overlapping in the notation should not be cause of confusion.

[15] Notice that, following the hypotheses of symmetry and of zero initial government spending, this is equivalent to normalizing by C, C^*, y, y^* or y^w.

$$y_t^* = \theta[p_t^* - p_t^*(f)] + c_t^w + g_t^w \tag{26}$$

The log-linear version of the world good-market equilibrium condition is:

$$y_t^w = c_t^w + g_t^w \tag{27}$$

The labor-leisure trade off equation (17) and its foreign equivalent become[16]:

$$(\theta + 1)y_t = -\theta(c_t + \gamma g_t) + c_t^w + g_t^w \tag{28}$$

$$(\theta + 1)y_t^* = -\theta(c_t^* + \gamma g_t^*) + c_t^w + g_t^w \tag{29}$$

Log-linearization of the home Euler equation (15) and of its foreign equivalent yields:

$$c_{t+1} + \gamma g_{t+1} = c_t + \gamma g_t + \frac{\delta}{1+\delta} r_{t+1} \tag{30}$$

$$c_{t+1}^* + \gamma g_{t+1}^* = c_t^* + \gamma g_t^* + \frac{\delta}{1+\delta} r_{t+1} \tag{31}$$

where r_{t+1} is now the deviation of the real interest rate from its steady state value, $\delta = \bar{r}$.

Log-linearizing the money demand equation (16) and its foreign equivalent we have:

$$m_t - p_t = c_t + \gamma g_t - \frac{r_{t+1}}{1+\delta} - \frac{p_{t+1} - p_t}{\delta} \tag{32}$$

$$m_t^* - p_t^* = c_t^* + \gamma g_t^* - \frac{r_{t+1}}{1+\delta} - \frac{p_{t+1}^* - p_t^*}{\delta} \tag{33}$$

Finally, it is necessary to log-linearize equations (20) and (21)[17]:

$$\bar{c} = \delta\bar{b} + \bar{p}(h) + \bar{y} - \bar{p} - \bar{g} \tag{34}$$

[16] In what follows, remember that initial government expenditure is fixed to zero and this variables is normalized with respect to consumption.

[17] Asset holdings are normalized by world consumption.

$$\bar{c}^* = -\left(\frac{n}{1-n}\right)\delta\bar{b} + \bar{p}^*(f) + \bar{y}^* - \bar{p}^* - \bar{g}^* \tag{35}$$

Notice that in the last two equations the time subscript was dropped, because they are valid only for steady-state changes.

In next Section, we will solve the model for the effects of Home and Foreign government expenditure expansions, explicitly deriving the multipliers of fiscal policy shocks on short-run and long-run consumption and output, in a sticky price world.

In doing this, we will mainly restrict our attention to permanent fiscal policy shocks, in which:

$$g = \bar{g} = g_p$$

and

$$g^* = \bar{g}^* = g_p^*$$

where g and g^* indicates short-run (period one) deviations from the steady-state. Due to the way in which we will introduce nominal rigidity, the economy adjusts to a flexible-price equilibrium after one period. The barred variable is, therefore, the long-run (period two) deviation from the initial steady state, that corresponds to the new (post-shock) steady state. In what follows g, g^* will be referred to as the temporary components and $\bar{g}$, $\bar{g}^*$ as the anticipated components of total (permanent) expansions.

3 Fiscal Policy Interdependence

3.1 Sticky prices

The equilibrium conditions derived in the previous section refer to a flexible price steady-state. As we are interested in carrying out our analysis of fiscal policy interdependence in a sticky-price world, we have to introduce this hypothesis in the model before explicitly deriving the multipliers.

By following OR (1995, 1996), we assume that the domestic-currency price of domestic goods and the foreign-currency price of foreign goods are set one period in advance. Following a shock, therefore, these prices do not change in the first period but adjust to a flexible-price level in the second period. This allows us to set $p(h) = p^*(f) = 0$ in the log-linearized price index equations (22) and (23). This dynamic can be rationalized referring to the literature on time-dependent behavior in price setting (for example Fischer 1977)[18]. Although this is a very simplified way to introduce price rigidity, it allows us to study the effects of nominal stickiness on a wide set of macroeconomic variables. The hypothesis of sticky prices introduces a typically Keynesian feature in the model: output becomes demand-determined in the short-run. Therefore, the labor-leisure trade-off equations (28) and (29) bind only in the long-run, when prices are free to adjust to their new steady-state value. The discussion of what would happen in a closed economy is of course an important benchmark for our analysis. As our model tends to a closed economy when $n \to 1$, we will present some interesting results for this case before proceeding with the two-country analysis.

3.2 The Closed Economy Benchmark: the Balanced-Budget Multiplier Revisited

Using a system that involves the log-linearized versions of the money demand equations (32) and (33), and of the Euler equations (30) and (31), we can derive an expression for world consumption as a function of fiscal policy shocks, that illustrates what would happen in an equivalent closed economy. It turns out that the effect of the anticipated component is zero, and the total effect is therefore equal to the temporary one[19]. The solution is (see Appendix):

$$c^w = -\gamma g^w \tag{36}$$

where, of course, $g^w = ng + (1-n)g$. Substituting (36) in to the world good-market equilibrium condition (27) we obtain the corresponding expression for world output:

$$y^w = (1-\gamma)g^w \tag{37}$$

[18] Although OR justify the hypothesis of one period fixed-prices referring to the menu-costs literature, we believe that the time-dependent price setting literature is more relevant here, because the fact that prices are fixed does not depend on the size of the shock.

[19] As we are focusing on fiscal policy, in what follows we will always set money shocks to zero: $m = m^* = \overline{m} = \overline{m}^* = 0$. As the effects of shocks are additive, nothing is lost with this approach.

Interestingly enough, (36) and (37) reproduce, for ° = 0; the "textbook" balanced budget-multiplier[20]: a tax-…nanced increase in government expenditure adds itself, and nothing more, to national income, with no e¤ect on consumption. This result is a step further in reconciling microfounded models with the Keynesian IS/LM analysis of …scal policy in a closed economy.

When agents attach a positive value to government expenditure in their utility (° > 0) the consumption and output multipliers are reduced by an amount that is increasing in °. This is a generalization of the complete crowding-out case studied, among others, by Bailey (1971) and Buiter (1977). Their analysis is not based on microfounded models, but it is consistent with our when ° = 1[21]. In this case the increase in government expenditure crowds-out private consumption to the last penny, with no e¤ect on output. In our model we can have less than complete crowding-out because our preferences speci…cation in (1) allows us to consider the case in which the marginal rate of substitution between private and public consumption is less than unity. As ° gives the inclination of the indi¤erence curves between private and public consumption, a reduction of this parameter from 1 to a value less than 1 implies that the reduction in C that is needed to keep utility on the same indi¤erence curve, following an expansion in G, becomes smaller. This can be easily checked graphically (Fig. 1), and provides an explanation for the possibility of less than complete crowding-out in our model[22]. This last case is probably the empirically relevant one, and in our discussion of multipliers we will therefore assume 0 < ° < 1 (as in Barro, 1981; Aschauer, 1985; Heijdra and Litgthart, 1997).

FIGURE 1 ABOUT HERE

[20] See, for example, Bailey (1971, p.153).

[21] For example Buiter (1977, p. 317) de…nes the consumption function as $C = C^P + G^P$, where C^P and G^P are, respectively, private and public consumption, implicitely assuming ° = 1.

[22] Notice that varying ° does not change the degree of substitutability between C and G: As the indi¤erence curves are straight lines for every positive value of °, private and public consumption are perfect substitutes for any positive °. Varying ° only modi…es the marginal rate of substitution between them.

3.3 Two Relationships between Relative Consumption and the Exchange Rate

We can now proceed with the analysis of the open economy case. Following Aoki (1981), a symmetric two country model can be "decoupled" into independent systems in sums and differences. It is convenient, therefore, to solve the model initially for country differences, and subsequently derive the levels of the variables using the relationship:

$$x = x^{w} + (1 - n)(x - x^{*}) \tag{38}$$

where x indicates a generic variable.

The first step to solve the model is to define two relationships between the short-run levels of the exchange rate and of relative consumption. The first relationship can be derived using the Euler equations (30) and (31), the money demand equations (32) and (33), and the PPP (24):

$$e = -(c - c^{*}) - \gamma(g - g^{*}) \tag{39}$$

This expression nests the one derived by OR in the pure waste case[23]. The difference is that in our model domestic and foreign fiscal expansions affect the exchange rate (through the effect on money demand).

To derive a second relationship, we must consider two equations that give the level of the current account in the two countries in the short-run (when the shock hits the economy):

$$B_{t+1} - B_{t} = r_{t}B_{t} + \frac{p_{t}(h)y_{t}}{P_{t}} - C_{t} - G_{t} \tag{40}$$

Log-linearization of equation (40), taking into account that initial foreign assets are zero, and using equation (22) with $p(h)$ and $p^{*}(f)$ set to zero yields[24]:

$$\overline{b} = y - c - (1 - n)e - g \tag{41}$$

In a similar way, for the Foreign country we obtain:

[23] To derive (39) it is also necessary to take in to account the fact that, since inflation and the real interest rate are constant across steady states, the money demand equations (32) and (33) imply the following solutions for steady-state price levels: $\overline{p} = \overline{m} - \overline{c} - \gamma\overline{g}$ and $\overline{p}^{*} = \overline{m}^{*} - \overline{c}^{*} - \gamma\overline{g}^{*}$.

[24] The variable $\overline{b}$ denotes assets entering period 2 after the shock.

$$(\frac{-n}{1-n})\bar{b} = \bar{b}^* = y^* - c^* + ne - g^* \quad (42)$$

Subtracting (42) from (41) we have:

$$\bar{b} = (1-n)[(y-y^*) - (c-c^*) - (g-g^*) - e] \quad (43)$$

Notice that subtracting equation (26) from (25), applying the PPP (24) and the hypothesis of fixed prices yields:

$$y - y^* = \theta e \quad (44)$$

Substituting (44) into (43) yields:

$$\bar{b} = (1-n)[(\theta-1)e - (g-g^*) - (c-c^*)] \quad (45)$$

Now, notice that combining (long-run versions of) equations (34), (35),(28),(29), (25) and (26) yields:

$$\bar{b} = \frac{(1-n)2\theta}{(1+\theta)}\frac{1}{\delta}(\bar{c}-\bar{c}^*) - \frac{(1-n)}{(1+\theta)}\frac{1}{\delta}[\gamma(1-\theta)-\theta-1](\bar{g}-\bar{g}^*) \quad (46)$$

Substituting the last expression in to (45), gives the second relationship[25] between e and $c - c^*$:

$$e = \frac{2\theta+(1+\theta)\delta}{(\theta^2-1)\delta}(c-c^*) + \frac{1}{(\theta-1)}\left\{\frac{2\theta\gamma+(1+\theta)\delta}{(1+\theta)\delta}(g-g^*) - \frac{1}{\delta}(\gamma-1)(\bar{g}-\bar{g}^*)\right\} \quad (47)$$

This relationship is again equivalent to the one derived by OR for $\gamma = 0$. Notice that, if $0 < \gamma < 1$; the introduction of our additional hypothesis implies a higher depreciation for the home currency following a domestic expansion.

[25] In deriving (47), we also made use of the fact that the Euler equations imply $(\bar{c}-\bar{c}^*) = -\gamma(g-g^*) + (c-c^*) + \gamma(g-g^*)$

3.4 Short-Run Consumption Multipliers: Direct Crowding-Out in an Open Economy

The next step to find a reduced form for short-run consumption c, is to solve the system of (39) and (47) for the short-run consumption differential $c - c^*$. This yields:

$$c - c^* = -\frac{\delta(1+\theta)}{2\theta + \theta(1+\theta)\delta}\Gamma - \frac{\delta(\theta^2 - 1)}{2\theta + \theta(1+\theta)\delta}\gamma(g - g^*) \tag{48}$$

where $\Gamma = [\frac{2\theta\gamma + (1+\theta)\delta}{(1+\theta)\delta}(g - g^*) - \frac{1}{\delta}(\gamma - 1)(\bar{g} - \bar{g}^*)]$

Applying formula (38) to (48) and making use of formula (36) yields a reduced form for c:

$$\begin{aligned} c \;=\; & -n\gamma g - (1-n)\gamma g^* - \frac{(1-n)[2\gamma\theta + \delta(1+\theta)]}{2\theta + \theta(1+\theta)\delta}(g - g^*) + \\ & -\frac{(1-n)\delta(\theta^2 - 1)}{2\theta + \theta(1+\theta)\delta}\gamma(g - g^*) + \frac{(1-n)(1+\theta)}{2\theta + \theta(1+\theta)\delta}(\gamma - 1)(\bar{g} - \bar{g}^*) \end{aligned} \tag{49}$$

Although the latter expression might seem cumbersome, it is very useful to perform policy experiments. In particular, setting $g = \bar{g} = g_p$ and $g^* = \bar{g}^* = g^*_p = 0$ in (49), we obtain the effect of a domestic permanent expansion on short-run consumption. In order to have some insights on how the results for our model differs from the OR case of pure waste, it is interesting to perform this experiment considering first the case of $\gamma = 0$, and subsequently to look at the differential effect of the hypothesis $\gamma > 0$.

When government expenditure is pure waste we have:

$$c = [-\frac{(1-n)(1+\theta)(\delta + 1)}{2\theta + \theta(1+\theta)\delta}]g_p \tag{50}$$

Equation (50) indicates that a permanent domestic fiscal expansion lowers consumption. This is clearly connected with the fact that, this policy being financed with domestic taxes, it makes home agents poorer. Therefore, they react reducing their consumption. The difference with the closed economy case, in which when $\gamma = 0$ the effect on consumption is zero rather than negative[26], is due to the fact that in an open economy in which neither private agents nor the government display home-bias for domestically

[26] Remember equation (36).

produced goods, a domestic fiscal shock stimulates the demand for both domestic and foreign goods. Part of the benefits of the expansionary policy, therefore, accrue to foreign agents, while all the costs (the lump-sum increase in taxation) are sustained by the domestic country. Formally, this implies that the negative effect on consumption in (50) is increasing in the dimension of the foreign country.

The differential effect[27] of $\gamma > 0$ turns out to be:

$$c = \gamma[-n + (1-n)\frac{(1-\theta) + \delta(1-\theta^2)}{2\theta + \theta(1+\theta)\delta}]g_p \tag{51}$$

Not surprisingly, (51) reproduces (36) when $n \to 1$. The negative effect[28] derived in (51) is consistent with the intuition of direct crowding-out: when private and public consumption are perfect substitutes the reduction in private consumption following a domestic expansion is bigger than in the case of pure waste. Notice that this result, although consistent with an intuitive argument, can not be taken for granted a priori. In an intertemporal optimizing model of this kind, infact, the effect of the anticipated component of a permanent expansion on short-run consumption could in principle lead to different conclusions. Examples of the latter can be found in the closed-economy literature. For example Rankin (1987), in an overlapping generation model in which government spending is assumed to benefit only the young, finds that the effect of an anticipated increase in government expenditure on current consumption becomes less negative when government expenditure affects utility, compared to the pure waste case, and could also become positive depending on the parameters values. Similarly Neary and Stiglitz (1983), find that in a general equilibrium model an anticipated increase in spending, bringing about an anticipated multiplier effect on the consumer's future income, raises current consumption.

To see whether similar effects are at work in our model, it is possible to decompose the fiscal policy shock in to its temporary and anticipated components[29]. Like in the closed economy models mentioned above, the effect of the anticipated component in equation (51) is indeed positive[30]. However, the sign of the total effect in equation (51) points out that, the

[27] The total effect is equal to the sum of (50) and (51).

[28] Remember that $\theta > 1$:

[29] This can be done using the reduced form for consumption, equation (49).

[30] It is equal to $\gamma\frac{(1-n)(1+\theta)}{2\theta+\theta(1+\theta)\delta}\bar{g}$:

(negative) effect of the temporary component is dominant in determining the result that consumption falls more if government spending affects utility in a non-separable way. The same decomposition in the pure waste case (equation 50) shows that both the temporary and anticipated effects have a negative impact on consumption.

Turning to foreign fiscal policy shocks, we can set $g^* = \overline{g}^* = g_p^*$ and $g = \overline{g} = g_p = 0$ in (49). This gives the total spillover effect:

$$c = (1 - \gamma)\left[\frac{(1 - n)(1 + \theta)(\delta + 1)}{2\theta + \theta(1 + \theta)\delta}\right]g_p^* \tag{52}$$

For $\gamma = 0$; the last expression indicates that a foreign fiscal expansion has a positive spillover effect on consumption. In that case equation (52) is a mirror image of (50), and can be explained with a symmetric argument: when the foreign government expands, domestic agents experience the benefit of such policy but not the costs, and this allows them to raise their consumption. Recalling that we assumed $0 < \gamma < 1$, (52) also shows that the introduction of utility enhancing government spending has the effect of reducing the positive consumption spillover following a foreign expansion. It is important to stress that it is the fact that foreign agents gain utility from foreign government expenditure that affects the home agents' reaction[31]. As foreign consumption falls also on domestic goods, the reduction in foreign consumption due to direct crowding-out negatively affects the demand for home agents goods, therefore reducing home consumption. This effect, however, is not so strong to reverse the basic result of an overall positive consumption spillover[32]. Decomposition of the international spillover in to its temporary and anticipated components shows that both effects go in the same direction.

3.5 Output Effects with Microfounded Money Demand

A similar analysis can be applied to study the effects on output. We start applying formula (38) to equation (44). This gives:

$$y = y^w + (1 - n)\theta e \tag{53}$$

[31] Remember that in this policy experiment domestic shocks are set to zero.

[32] Consumption can fall, of course, if we relax our assumption and allow γ to be bigger than unity. The latter case, however, has been considered in previous literature as a purely theoretical possibility with no empirical relevance (see Heijdra and Ligthart, 1997, p.812).

To find an expression for the short-run exchange rate, we solve for e the system of equations (39) and (47), obtaining:

$$e = \frac{(1+\theta)\delta}{2\theta+\theta\delta(1+\theta)}\left\{\frac{2\gamma\theta+\delta(1+\theta)}{(1+\theta)\delta}(g-g^{*})-\frac{1}{\delta}(\gamma-1)(\overline{g}-\overline{g}^{*})\right\}+ \\ -\gamma\frac{[2\theta+(1+\theta)\delta]}{2\theta+\theta\delta(1+\theta)}(g-g^{*}) \quad (54)$$

Substituting (37) and (54) in to (53) we derive the reduced form for y (see Appendix).

The total effects on output of a domestic and foreign fiscal expansion can be derived as before. This yields the following expressions for the multipliers:

$$y = (1-\gamma)[n+\frac{(1-n)(1+\theta)(1+\delta)}{\delta(1+\theta)+2}]g_p \quad (55)$$

$$y = (1-\gamma)(1-n)[\frac{(1-\theta)}{\delta(1+\theta)+2}]g_p^{*} \quad (56)$$

Remembering that $\theta > 1$ and $0 < \gamma < 1$, equations (55) and (56) tell us that a domestic fiscal expansion increases home output, while a foreign expansion has the opposite effect.

If we were in a flexible price world, the result that the agents of the country that expands decide to work more could be explained, as for consumption, with the fact that home agents have to pay taxes to finance this policy. As leisure is a normal good, they would react increasing their labor supply, thereby increasing output. In the fixed price case, however, this argument becomes irrelevant, because the economy is not on the labor supply curve. An explanation for the results in (55) and (56) seems rather to be connected with the nominal exchange rate movements. From equation (54) it can be shown that following a domestic fiscal expansion the domestic exchange rate depreciates, but the depreciation is mitigated as γ increases[33]. As a depreciation raises demand for home exports lowering their relative

[33] Formally

$$e = (1-\gamma)\frac{(1+\theta)(1+\delta)}{\theta[\delta(1+\theta)+2]}g_p$$

where an increase in e indicates depreciation of the home currency.

price, and viceversa, the exchange rate movements can explain the effect on output derived in (55), that is positive but decreasing in γ.

A symmetric argument can be used to explain the negative spillover on output when the foreign country expands, and the fact that an increase in γ mitigates the magnitude of this effect. The dynamic of the exchange rate gives some insights on why the spillover effect is opposite to the standard result in the literature on macroeconomic interdependence, i.e. the one derived in the two-country version of the MF model. In MF a fiscal expansion in one country raises output in the other. This happens because the country that expands faces an appreciation of its currency, and this channel of international transmission is dominant in determining the sign of the positive output spillover. On the contrary, in our model, the currency of the country that expands depreciates. In terms of equation (54), this means that an increase in g_p^* implies a reduction in e[34].

The fact that the currency of the country that expands depreciates can be explained with an argument similar to the one developed by OR in the pure waste case[35]. Taking as example a foreign expansion, we have that this policy implies a fall in relative foreign consumption. Lower consumption abroad in turn implies a lower foreign money demand, that requires a depreciation of the foreign currency. The reason for which here the negative spillover is mitigated with respect to the OR case, is that in our model a foreign fiscal expansion affects the foreign money demand not only through the fall in relative consumption. There is another effect of fiscal policy on money demand, that depends on the fact that our money demands are positive functions not only of private consumption but of the fiscal stance of the countries as well[36]. When the foreign country expands, therefore, there is a positive effect on the foreign money demand that partially offset the negative one already described by OR.

The two effects can be analyzed formally going back to the two partial relationships used to derive the final relationship between fiscal policy shocks and the exchange rate, i.e. equations (39) and (47). Inspection of those

[34] Formally:

$$e = (1 - \gamma) f - \frac{(1+\theta)(1+\delta)}{\theta[\delta(1+\theta)+2]} g g_p^*$$

The former expression shows that an increase in g_p^* implies an appreciation of the home currency and a depreciation of the foreign currency (the one of the country that expands).

[35] See OR(1996, p.704).

[36] Remember equations (32) and (33).

shows that the e¤ect on the exchange rate that arises through (39) goes in the opposite direction with respect to the …nal e¤ect derived in (54). The positive relationship between e and g¤ in (39) arises through the direct e¤ect of a …scal expansion on the money demand, that is absent in OR. On the contrary, the negative partial relationship between e and g¤ derived in (47) is due to the indirect e¤ect of …scal policy on money demand, that acts through the fall in relative consumption. This last negative relationship more than o¤set the one derived in (39), and it is therefore the dominant one in determining the …nal e¤ect. The e¤ects at work following a foreign expansion are summarized in Table 1 (a symmetric Table can be used to illustrate the internal multiplier).

Table 1. E¤ects of a Foreign Expansion

Indirect E¤ect (OR):
g*"=) (c ¡ c¤) "=) Foreign Money Dem.#=) e #=) y #
Direct E¤ect (° > 0) :
g*"=) (c + °g¤) "=) Foreign Money Dem."=) e "=) y "
0<° < 1 ensures that the …nal output spillover is negative

An important remark must be made on the speci…cation of the money demand equations. Both the e¤ects emphasized in the previous discussion depend on the fact that, in our model, the money demand equations are explicitly derived from microfoundation, and are functions of what we have de…ned "full consumption" (that can in turn be thought to be a function of disposable income). This is a di¤erence with the traditional MF model, where money demand is a function of gross income. The observation that modelling money demand as a function of disposable rather than gross income is crucial in determining the direction of …scal policy spillovers is consistent with some previous …ndings in the literature. In particular, the derivation of money demand from microfoundation is the explanation provided by Rankin (1990) for the fact that his two-country model with nominal rigidities yields results that are at odds with the MF ones[37]. Our analysis seems to con…rm the relevance of this argument.

[37] The consequences of having disposable rather than gross income as argument of the money demand function were …rst analysed in a closed-economy IS/LM model by Holmes and Smith (1972)

In summary, the …scal policy interdependence pattern emerging from the analysis of short-run multipliers calls for four general considerations. First, our analysis of a two-country world is consistent with the conventional wisdom for the closed economy case. As n ! 1; the basic results on the crowding-out e¤ects of …scal policy already emphasized by Bailey (1971) and Buiter (1977) are reproduced by our model. The main contribution of our analysis with respect to the closed economy case is, therefore, that of deriving those results in an explicitly microfounded framework. Second, our results for the two-country interdependence generalize those for the closed economy case with regards to the e¤ects on consumption, as the introduction of perfect substitutability between public and private consumption has a negative e¤ect on both the domestic multiplier and the international spillover. Third, our results are opposite to the MF ones with respect to the output spillover, and this seems to depend crucially on the way in which money demand equations are speci…ed in microfounded models. Fourth, turning to the welfare analysis, the short-run e¤ects of …scal policy in the case of pure waste go in the direction of lowering home welfare following a domestic expansion and raising it following a foreign expansion. This is consistent with the claim made by OR (1995,1996) that a …scal expansion is a beggar-thyself but not a beggar-thy-neighbor policy. The introduction of the additional hypothesis of perfect substitutability unambiguously lowers welfare following a foreign expansion, but it has ambiguous e¤ects with respect to a domestic expansion, as it lowers consumption but raises leisure[38]. Of course, a complete welfare analysis can be done only after having derived the long-run e¤ects. This will be an interesting exercise in the pure waste case, given that OR claim their results on …scal policy verbally[39], but do not provide detailed derivations. This task is left for Section 4. An intermediate step is that of explicitly analysing macroeconomic interdependence in the long run. This is the focus of what follows.

3.6 E¤ects of Fiscal Policy on Long Run Variables

Although prices adjust to a ‡exible steady-state in the long-run, the long-run multipliers are not the same that we would observe in a ‡exible-price

[38] See the di¤erential e¤ects of ° in Table 1.

[39] "Regardless of the directions of the positive e¤ects, overall Foreign bene…ts and Home looses when Home's government spends more" (OR, 1996, p.706).

economy. They are affected, through the asset accumulation process, by the fact that prices are sticky in the first period[40].

In order to derive the long-run multipliers it is therefore necessary to find a reduced form that expresses shifts in the foreign assets $\bar{b}$, in terms of fiscal policy shocks only. To do this, we start substituting (39) and (44) into (43), this yields[41]:

$$\bar{b} = (1 - n)[\theta e + (\gamma - 1)(g - g^*)] \tag{57}$$

Substituting (54) for e in (57) gives the reduced form for $\bar{b}$ (see Appendix). At this point, we can derive an expression for relative long-run consumption inverting (46). Solving the deriving expression for levels through formula (38), substituting (78) for $\bar{b}$ and taking into account that (see Appendix for the derivation):

$$\bar{c}^w = -\frac{(1 + \gamma)}{2}\bar{g}^w \tag{58}$$

yields a reduced form for $\bar{c}$ (see Appendix), that can be used to derive the multipliers.

For a domestic expansion when $\gamma = 0$ we have:

$$\bar{c} = [-\frac{n}{2} - \frac{(1 - n)(1 + \theta)(\delta + 1)}{2\theta + \theta(1 + \theta)\delta}]g_p \tag{59}$$

The differential effect of $\gamma > 0$ is:

$$\bar{c} = \gamma[-\frac{n}{2} + (1 - n)\frac{(1 - \theta) + \delta(1 - \theta^2)}{2\theta + \theta(1 + \theta)\delta}]g_p \tag{60}$$

Remembering that $\theta > 1$, equations (59) and (60) clearly indicate that the long-run effects on consumption of this policy go in the same direction as the short-run ones. Consumption falls, and falls more when $\gamma > 0$: Furthermore,

[40] This is not true, of course, for the world long-run multipliers derived in (A3). As the world economy is not affected by the distribution of wealth between the two countries, they are the same as in the flexible-price case.

[41] This is the point where price-stickiness affects the long-run effects. In a flexible price world, in fact, it is impossible to set p(h) and $p^*(f)$ to zero in equation (43). In order to derive a semi-reduced form for $\bar{b}$, different from (57), it is necessary to consider short-run versions of the labor-leisure trade off equations, that bind in that case. For the details see Ganelli (1998).

comparing (59) with (50) it is clear that-the long run e¤ect is equivalent to the short-run one plus the additional term $¡\frac{n}{2}$. This means that in the long run consumption falls more than in the short run. This di¤erence might be explained recalling the way in which we have introduced nominal rigidities. Agents knows that prices, following a demand shock, increase in the second period, but not in the short-run, as they are sticky. Therefore, they reduce their consumption more in the period in which prices are expected to rise. Comparing (60) and (51), however, shows that the direct crowding-out e¤ect is smaller in the long run.

Turning to a foreign expansion, the total multiplier is given by:

$$\bar{c} = ¡(1 ¡ n)(1 ¡ °)[\frac{±µ^2 ¡ 2± ¡ µ± ¡ 2}{2µ[2 + ±(1 + µ)]}]g_p^¤ \qquad (61)$$

Equation (61) shows that the e¤ect of a foreign …scal expansion is in general ambiguous[42]. To have an idea of the sign of the international spillover e¤ects we can give some numerical examples. Remembering that ± is the real interest rate, and setting it equal to 0:05, we can solve a second order equation in the numerator of (61) in order to …nd for which values of µ it is positive. Neglecting the negative root given by this equation, a condition for the term in the square brackets in (61) to be positive (i.e for the spillover e¤ect to be negative), is $µ > 7$. Previous research suggests that a sensible value for µ should be below this threshold[43]. The latter result would, therefore, seems reassuring, in the sense that the e¤ect of a foreign …scal expansion should increase home consumption in the long run as well as in the short run. However, it also indicates the possibility of a negative international spillover on consumption in a situation of low market power (as µ increases[44]) and/or high real interest rate[45].

Overall, the above analysis shows that also in the long-run, the e¤ects of consumption multipliers are in line with what we would expect on the basis of

[42] To see this, notice that the numerator can be rearranged as $¡µ±(1 ¡ µ) ¡ 2(1 + ±)$, i.e. as the sum of a positive and of a negative value.

[43] For example, Sutherland (1996) sets $µ = 6$ in numerical simulations for a similar model.

[44] This is consistent with the intuition that in a Walrasian world of perfect competition …scal policies are unable to raise welfare.

[45] Setting ±=0.03 the threesold value for µ turns out to be around 8.8. This suggests that there is an inverse relationship between the level of the real interest rate and the threshold value for µ that implies negative consumption spillovers.

the analysis of a closed economy. The fact that public and private consumption are perfect substitutes has a crowding-out e¤ect on private consumption in the case of a domestic expansion, as consumption falls more than in the pure waste case (the di¤erential e¤ect of $° > 0$ in (60) is negative). The introduction of this hypothesis has also the e¤ect of reducing the increase in consumption deriving from a foreign expansion in the (empirically plausible) case in which the consumption spillover is positive. The introduction of a positive °; therefore, tends to push consumption choices in the same direction in the short and long run.

We can combine (34), (35), (25)and (26) to derive a semi-reduced form for long-run relative output as a function of $\bar{b}$ and $(\bar{g} ¡ \bar{g}^¤)$. Applying formula (38) to the resulting expression, together with the fact that (see Appendix):

$$y^w = \frac{(1 ¡ °)}{2}\bar{g}^w \tag{62}$$

gives:

$$\bar{y} = \frac{1}{2}(1 ¡ °)\bar{g} ¡ \frac{1}{2}±\bar{b} \tag{63}$$

substituting the reduced form for $\bar{b}$ in (63) yields the reduced form for long-run output(see Appendix).

The multipliers in this case are:

$$\bar{y} = (1 ¡ °)\frac{2 + 2± + n±(µ ¡ 1)}{2[2 + ±(1 + µ)]}g_p \tag{64}$$

$$\bar{y} = (1 ¡ °)\frac{1}{2}±(1 ¡ n)[\frac{µ ¡ 1}{2 + ±(1 + µ)}]g_p^¤ \tag{65}$$

Equations (64) and (65)show that the e¤ects of both domestic and foreign …scal expansions are positive but decreasing in °.

In interpreting these results, we must bear in mind that in the long run the economy is on the labor supply curve. Furthermore, in this model a domestic (foreign) expansion implies an increase in $\bar{b}$ $(\bar{b}^¤)$, i.e. in the current account entering the second period[46]. What does this imply for the domestic multiplier? It is straightforward to notice that the increase in e that follows a domestic expansion raises $\bar{b}$ in equation (57), and in turns $\bar{b}$ has a negative

[46] The international shift in wealth is due to the fact that a domestic expansion lowers home consumption and raises home output in the short-run, and viceversa.

effect on domestic output in (63). In words, the nominal depreciation, that makes output increase in the short-run, makes the country richer in the long-run. As now the economy is on the labor supply curve, this effect should push agents to consume more leisure and work less. Given this, why output still increases in the long-run? First, there is also a negative effect on $\bar{b}$ in (57), due to the term $(\gamma - 1)g$, that arises through equation (41). Although not dominant in determining the sign of the effect on $\bar{b}$, the latter captures the fact that domestic agents pay taxes in the first period to finance the fiscal expansion. Second, the incentive that domestic agents have to increase leisure because of the increase in their wealth entering period 2 (the long-run), is more than offset by a long-run supply side effect. This reflects the fact that home agents have to finance the expansion in the long-run as well in the short-run. Formally, the dominant effect is given in (63) by the factor $\frac{1}{2}(1 - \gamma)$ that, being derived from the labor-leisure equations, clearly captures long-run factors. As an increase in γ reduces the term $\frac{1}{2}(1 - \gamma)$, it is not surprising that the differential effect of $\gamma > 0$ in (64) is negative.

The previous discussion also casts some light on the fact that the international spillover becomes positive in the long-run. In this case, when g_p^* increases e and $\bar{b}$ go down, implying a negative effect on domestic output in (63). The appreciation of the domestic currency following a foreign expansion implies current account losses, making the home country poorer and pushing agents to increase their labor supply. In this case, this is the final effect, because the taxation burden falls on foreign agents. The multipliers derived so far can now be added up together to carry out a welfare analysis. This is the focus of next Section.

4 Welfare Implications

Table 2 summarizes the positive effects of different policies on short and long-run variables, distinguishing the pure waste case from the differential effect of $\gamma > 0$:

The results in Table 2 support the OR claim that the a domestic expansion is a beggar-thyself policy, as both the short and long-run movements go in the direction of reducing home welfare. It is not straightforward, however, to evaluate whether the home country is going to benefit from a foreign expansion, as this policy has an ambiguous e¤ect on long-run consumption and a positive e¤ect on long-run output. Therefore, the OR claim that the Home country gains when the other expands is not unambiguously true, at least in theory. However, this is the result that arises for sensible parameter values.

Table 2. Positive E¤ects of Permanent Fiscal Expansions

	Home ° = 0	Home di¤er.° > 0	Foreign ° = 0	Foreign di¤. ° > 0
c	-	-	+	-
y	+	-	-	+
$\bar{c}$	-	-	+/-	-/+
$\bar{y}$	+	-	+	-

In order to see this, we can add up together the positive e¤ects in a log-linearized version of the utility function. As customary in this literature, we focus on the real component of the utility function (1), neglecting the welfare e¤ects of real balances. The log-linearized expression is therefore:

$$dU^R = c + °g ¡ \frac{µ ¡ 1}{µ}y + \frac{1}{±}(\bar{c} + °\bar{g} ¡ \frac{µ ¡ 1}{µ}\bar{y}) \quad (66)$$

When ° = 0 this is equivalent to the expression used by OR. In this case, plugging in (66) the multipliers derived in Section 3, and setting $g^¤ = \bar{g}^¤ = g_p^¤ = 1$, $g = g^¤ = g_p = 0$, some algebra shows that the short-run negative e¤ect on output (i.e. positive e¤ect on utility) following this policy dominates the long-run one, that goes in the opposite direction. The only ambiguity left to evaluate the overall consequence of a foreign expansion is, therefore, that on long-run consumption. In Section 3, however, we proved that the long-run consumption spillover is positive for sensible parameters values. We can therefore conclude, like OR, that the total welfare spillover in the pure waste case, although ambiguous prima facie, is likely to be positive. A …scal expansion is not very likely to be a beggar-thy-neighbor policy.

Table 2 also shows that allowing ° > 0 reduces home consumption but raises home leisure in every period, following a domestic expansion. The indirect e¤ects on utility illustrated in the second column of Table 1 must also be weighted against the fact that government spending now directly a¤ects utility. As before, substituting in (66) the multipliers of a unity domestic expansion, it is possible to prove that the introduction of a positive ° unambiguously raises the welfare e¤ects of this policy compared to the baseline case. This happens because the direct increase in utility more than o¤sets the reduction in consumption due to direct crowding-out[47]. Whether the differential effect of $\gamma > 0$ is strong enough to reverse the OR beggar-thyself result depends on the specific parameters value.

5 Home Bias in Government Spending: the Missing Piece in the Quasi Neutrality Puzzle?

In Section 3 and 4 we mainly focused on permanent fiscal policy expansions. An interesting issue arises if we consider temporary expansions. In models that are similar in spirit to the one we are presenting, temporary expansions tends to be quasi-neutral, in the sense that they imply a unity multiplier on the output of the country that expands, without any effect on the other variables[48]. Although in all the models in which this property holds government spending falls only on domestically produced goods, the link between this hypothesis and quasi-neutrality has not been fully investigated yet. In this Section we argue that home bias in government spending is the main explanation for quasi-neutrality.

From the reduced forms of our model, it is possible to show that quasi-neutrality does not hold, not even in the OR case of pure waste. However, if we modify the OR framework allowing for home bias in government spending, quasi-neutrality immediately arises. In what follows we prove this formally, restricting our analysis to the case of no direct crowding-out ($\gamma = 0$). With home bias, the domestic government consumption index is redefined as:

$$G = \left[\int_0^n g(z)^{\frac{\theta-1}{\theta}} dz\right]^{\frac{\theta}{\theta-1}} \tag{67}$$

The index for the foreign country is, similarly, an integral between n and 1. In this framework, the (per-capita) demand for the domestic representative agent's good comes only from domestic government and it is given by:

$$g(z) = \frac{1}{n}\left[\frac{p(z)}{P_G}\right]^{-\theta} G$$

[47] Of course, in addition to this, we also have a positive effect on leisure.

[48] See, for example Corsetti and Pesenti (1997), Rankin (1990, Table 1 p.252) or Svennson (1987). The latter model is stochastic, but as fiscal shocks are serially uncorrelated, they can be interpreted as temporary.

where government expenditure is now deflated by a price index that is different form the private consumption one[49], given by:

$$P_G = [\frac{1}{n}\int_0^n p(z)^{1-\theta}dz]^{\frac{1}{1-\theta}}$$

Aggregating demand from home government with demand from domestic and foreign private agents gives the new world demand for the domestic agent's output as:

$$y^d = [\frac{p(z)}{P}]^{-\theta}C^w + [\frac{p(z)}{P_G}]^{-\theta}G \qquad (68)$$

Log-linearization of (68), taking in to account that in the initial symmetric steady-state $P_0 = P_{G0} = p_0(z)$, yields:

$$y_t = \theta[p_t - p_t(h)] + c_t^w + g_t$$

Proceeding in a symmetric way for the foreign country we find a corresponding expression, that enables us to express relative output as:

$$y - y^* = \theta e + (g - g^*) \qquad (69)$$

As the only change in the model concerns the demand equations, the expressions used in Section 3 are still valid as long as the demand equations were not used to derive them[50]. This is the case for equation (43). Substituting (69) into (43) yields an expression for the current account as a function of the exchange rate and of the consumption differential, in which the effects of the temporary components of fiscal policy cancel out:

$$\bar{b} = (1 - n)[(\theta - 1)e - (c - c^*)] \qquad (70)$$

---

[49] The indexes of aggregate private consumption, and therefore their deflators, are unchanged.

[50] The existence of two different price indexes for private and public consumption implies that the government budget constraint should be rewritten as:

$$\frac{P_{G_t}}{P_t}G_t = \tau_t + \frac{M_t - M_{t-1}}{P_t}$$

but this is irrelevant when we log-linearize around a symmetric steady-state where $P_0 = P_{G0} = p_0(z)$:

The last expression corresponds to equation (45) in Section 3, with the di¤erence that the term $(g - g^*)$ does not appear in it. The fact that differential …scal expansions now a¤ect di¤erential demand (because there is home bias), implies the disappearance of di¤erential e¤ects of …scal expansions, that were present in Section 3. Intuitively, the gains that home agents derive, in terms of increased demand for their goods, from domestic expansions, perfectly o¤set the costs deriving from the taxes that they have to pay to …nance this policy. Equation (70) is a …rst step in proo…ng that quasi-neutrality holds under the new assumptions: it shows that the current account is not directly a¤ected by temporary …scal policy expansions. The fact that g and g^* do not appear in (70) also means that it is not necessary to carry out explicitly the rest of the calculations in order to prove our claim. The other relationship derived in Section 3 (equation 39), infact, still holds, and with pure waste government expenditure it can be rewritten as:

$$e = -(c - c^*) \tag{71}$$

It is clear from Section 3 that the remaining changes to the algebra are concerned only with the e¤ects of anticipated …scal policy. As in this Section we are only interested to the temporary ones, we can repeat the analysis of Section 3 writing the variables as implicit functions of the anticipated components. This leads to the following expressions for the nominal exchange rate and the consumption di¤erential[51]:

$$e = f[(c - c^*); (\bar{g} - \bar{g}^*)] \tag{72}$$

$$c - c^* = f(\bar{g} - \bar{g}^*) \tag{73}$$

Equation (72) proves that the nominal exchange rate is a function only of the anticipated components, and is therefore not a¤ected by permanent policies. Solving (73) for levels gives:

$$c = c^w + (1 - n) f(\bar{g} - \bar{g}^*) \tag{74}$$

[51] Notice that we have replaced $(\bar{c} - \bar{c}^*)$ with $(c - c^*)$ exploiting a well known property of the model when $° = 0$. The result that the exchange rate and relative consumption are not functions of temporary shocks stems from the fact that $(g - g^*)$ does not a¤ect $\bar{b}$.

Clearly, the result that when $\gamma = 0$ in (36) world consumption is zero still holds[52]. Therefore (74) proofs that temporary expansions do not affect consumption. What about output? Solving for levels equation (69), and substituting (72) for the nominal exchange rate gives:

$$y = y^w + (1 - n)(g - g^*) + (1 - n)\theta f(\bar{g} - \bar{g}^*) \tag{75}$$

Again neglecting the effects of the anticipated component and using the fact that, with $\gamma = 0;\ y^w = g^w = ng + (1 - n)g^*$ gives:

$$y = ng + (1 - n)g^* + (1 - n)(g - g^*) \tag{76}$$

From (76) we can derive the following expressions for domestic and foreign temporary fiscal expansions: $y = g$ and $y = 0g^* = 0$

This completes our proof. After the introduction of home bias in government spending, the model displays the quasi neutrality property: a temporary fiscal expansion in one country implies a unity multiplier on that country's output, while all the other macroeconomic variables (output in the other country, consumption in both countries, the current account and the nominal exchange rate) are not affected.

This section is illuminating in showing how crucially the fiscal policy interdependence pattern depicted in Section 3 depends on the assumption of no home-bias. With home bias, the costs of having to pay taxes to finance the domestic expansion are perfectly offset by the positive stimulation of domestic demand. Unlike in Section 3, the benefits of such policy are now not shared with the foreign country. The internal multiplier for consumption is therefore zero rather than negative. This breaks down what we previously called the indirect effect of fiscal expansions on money demand. As in the pure waste there is no direct effect, the exchange rate neither depreciates nor appreciates, and the output spillover is therefore zero.

6 Conclusions

This paper fills in a gap in the literature, offering a systematic study of direct crowding-out in the OR framework. In this intertemporal optimizing framework fiscal policy is effective in influencing macroeconomic variables,

[52] The new hypothesis introduced in this Section would change only the effects of the anticipated components in the derivations of Appendix (3).

and therefore welfare. Unlike in Keynesian ad hoc models, however, the final impact on agents' welfare can not be measured simply by output movements, but all the positive effects need to be added up into a welfare metric. Microfoundation also implies that the positive and normative results crucially depend on the preferences specification. We find that non-separability tends to have negative effects on consumption and output following both domestic and foreign expansions. The more relevant exception is the positive effect that non-separability has on the (negative) foreign expansion multiplier on output in the short-run. Both the positive effect of non-separability and the fact that the total spillover effect is opposite to the one obtained in the MF model can be explained with the derivation of money demand equations from microfoundation.

Section 5 shows how sensitive the results of the baseline model are to modifications of the assumption that both private agents and the government do not distinguish between domestic and foreign produced goods. The latter result has some important policy implications. It points out that national policy makers and international agencies should take in to account, when assessing the international effects of fiscal policies, not only the level of public expenditure but also its composition. The latter aspect tends to be neglected in international treaties that emphasize numerical targets for macroeconomic variables.

In our analysis we focused on the simple case of complete home bias. A more thorough investigation of intermediate degrees of home bias, both in private and public consumption, could be a fruitful paths for future research. The fact that the predictions of this class of models are strongly affected by changes in the microeconomic foundations should not be cause of discouragement. It should rather be a stimulus to undertake the work needed to build a new paradigm for the analysis of macroeconomic interdependence, that is still under construction.

APPENDIX

A1). Reduced forms:

$$
\begin{aligned}
y = \; & n(1-\gamma)g + (1-n)(1-\gamma)g^{*} + \\
& +(1-n)\frac{2\gamma\theta + (1+\theta)\delta}{\delta(1+\theta)+2}(g-g^{*}) - (1-n)\gamma\frac{[2\theta + (1+\theta)\delta]}{\delta(1+\theta)+2}(g-g^{*}) +
\end{aligned}
$$

$$-(1-n)\frac{(1+\theta)}{\delta(1+\theta)+2}(\gamma-1)(\bar{g}-\bar{g}^{*}) \tag{77}$$

$$\begin{aligned}\bar{b} = {} & (1-n)\left\{\frac{2\gamma\theta+\delta(1+\theta)}{2+(1+\theta)\delta}(g-g^{*}) - \frac{[2\theta+(1+\theta)\delta]}{2+(1+\theta)\delta}\gamma(g-g^{*}) + \right. \\ & \left. +(\gamma-1)(g-g^{*}) - \frac{(1+\theta)}{2+(1+\theta)\delta}(\gamma-1)(\bar{g}-\bar{g}^{*})\right\}\end{aligned} \tag{78}$$

$$\begin{aligned}\bar{c} = {} & -\frac{n}{2}(1+\gamma)\bar{g} - \frac{(1-n)}{2}(1+\gamma)\bar{g}^{*} + \\ & +(1-n)\frac{(1+\theta)}{2\theta}\delta\left\{\frac{2\gamma\theta+\delta(1+\theta)}{2+(1+\theta)\delta}(g-g^{*}) - \frac{[2\theta+(1+\theta)\delta]}{2+(1+\theta)\delta}\gamma(g-g^{*}) + \right. \\ & \left. +(\gamma-1)(g-g^{*}) - \frac{(1+\theta)}{2+(1+\theta)\delta}(\gamma-1)(\bar{g}-\bar{g}^{*})\right\} + \frac{1-n}{2\theta}[\gamma(1-\theta)-\theta-1](\bar{g}-\bar{g}^{*})\end{aligned} \tag{79}$$

$$\begin{aligned}\bar{y} = {} & \frac{1}{2}(1-\gamma)\bar{g} - \frac{1}{2}\delta(1-n)\left\{\frac{2\gamma\theta+\delta(1+\theta)}{2+(1+\theta)\delta}(g-g^{*}) + \right. \\ & - \frac{[2\theta+(1+\theta)\delta]}{2+(1+\theta)\delta}\gamma(g-g^{*}) + \\ & \left. +(\gamma-1)(g-g^{*}) - \frac{(1+\theta)}{2+(1+\theta)\delta}(\gamma-1)(\bar{g}-\bar{g}^{*})\right\}\end{aligned} \tag{80}$$

A2). Proof that $c^w = -\gamma g^w$ and $y^w = (1-\gamma)g^w$

This can be proofed solving a system for the short-run world consumption and real interest rate. A first relationship between these two variables is derived multiplying (30) by n and (31) by $(1-n)$ and adding the results:

$$c^w = \frac{(\gamma-1)}{2}\bar{g}^w - \gamma g^w - \frac{\delta}{(1+\delta)}r$$

A second relationship between c^w and r can be derived using the log-linearized money demand equations (32) and (33):

$$c^w = \frac{r}{(1+\delta)} - \gamma g^w + \frac{(1-\gamma)}{2\delta}\overline{g}^w$$

To derive the last expression it is necessary to multiply (32) by n and (33) by $(1-n)$ and to add the results. Further, we used of equations (22) and (23), with $p(h) = p^*(f) = 0$, we used the solutions for long-run prices (see note 23) , we set money shocks to zero and we used (see A3) $\overline{c}^w = -\frac{(1+\gamma)}{2}\overline{g}^w$. Putting to system the two expression that we have derived, we get the solution for c^w, in which the anticipated effects of fiscal policy cancel, equation (36):

$$c^w = -\gamma g^w$$

Substituting the last expression in to the world good-market equilibrium condition (27) and solving for y^w gives:

$$y^w = c^w + g^w = -\gamma g^w + g^w = (1-\gamma)g^w$$

A3). Proof that $\overline{c}^w = -\frac{(1+\gamma)}{2}\overline{g}^w$ and $\overline{y}^w = \frac{(1+\gamma)}{2}\overline{g}^w$

As we are deriving a long-run relationship, the log-linearized labor-leisure trade-off equations bind. Multiplying (28) by n and (29) by $(1-n)$ and adding the results gives:

$$(1+\theta)\overline{y}^w = (1-\theta)\overline{c}^w + (1-\gamma\theta)\overline{g}^w$$

Putting at system the last expression with the world good-market equilibrium condition (27) yields equations (58) and (62).

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Figure 1: Indi¤erence Curves between Private and Public Consumption in Period Utility (Following the same expansion in government expenditure, showed on the horizontal axis, the reduction in private consumption that keeps the individual on the same indi¤erence curve is smaller if gamma is less than unity)