Non-traded goods and the international transmission of fiscal policy

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Abstract. This paper looks at the effect of non-traded goods on the international transmission of fiscal policy. Intertemporal movements in the price of non-traded goods affect real interest rates differentially between countries. The real interest rate effects of a fiscal expansion depend crucially upon both the composition of fiscal spending and the intertemporal elasticity of substitution. With a high intertemporal elasticity of substitution in consumption, a temporary fiscal expansion on non-traded goods will lead consumer real interest rates to move in opposite directions between countries.

Biens non-transigés internationalement et transmission internationale de la politique fiscale. Ce mémoire examine l'effet des biens non-transigés internationalement sur la transmission internationale des effets de la politique fiscale. Les mouvements intertemporels dans le prix des biens non-transigés affectent d'une manière différenciée le taux d'intérêt réel d'un pays à un autre. Les effets d'une expansion fiscale sur les taux d'intérêt réels dépendent d'une manière fondamentale à la fois de la composition des dépenses gouvernementales et de l'élasticité intertemporelle de substitution. Si l'élasticité de substitution dans la consommation est élevée et l'élasticité de l'offre faible, une expansion dans les dépenses fiscales de biens non-transigés entraînera les taux d'intérêts réels dans des directions opposées dans l'un et l'autre pays.

Theoretical models in international economics tend to stress the close real interest rate linkage between countries that is implied by free capital mobility. However, in the presence of non-traded goods movements in consumption based real interest rates can differ across countries even in the presence of free capital mobility. Dornbusch (1983) demonstrates how intertemporal movements in the real exchange rate affects consumption opportunities for residents of a small open economy and so must be included in an appropriate welfare based definition of the real interest rate.

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This distinction is important for the international transmission of fiscal policy. There has been a widespread attempt in recent years to develop consistent intertemporal general equilibrium models to study the effects of fiscal policies in a multi-country setting. (See, e.g., Buiter, 1985; Frenkel and Razin, 1985, 1986a, b; Greenwood and Kimbrough, 1985; and Persson, 1985.) The role of real interest rates in the transmission of fiscal policies is of major importance for these models.

This paper adds to this literature by constructing a simple general equilibrium two-country model to look at the simultaneous interaction between real interest rates and intertemporal movements in real exchange rates in response to a temporary fiscal spending expansion in one country. In essence the model represents a simplified version of the Dornbusch (1983) model extended to a two-country setting.

We first develop a model in which factors are specific and there is no intersectoral supply response. There are two ways in which fiscal spending may be carried out in the model. Spending may fall on either the internationally traded good or the non-traded good of the spending country. This distinction is of key importance for the international transmission and the internal domestic effects of a fiscal spending expansion.

A temporary fiscal spending expansion on traded goods has all the effects we might expect. Real interest rates are bid up in all countries, and the current account of the expansionary country deteriorates. However, fiscal expansion taking place in the non-traded goods sector will have a very different series of effects. Principally this may lead to asymmetric movements in real interest rates across countries in response to the expansion. The crucial feature of the model which determines these effects is the intertemporal elasticity of substitution in consumption of the country experiencing the fiscal expansion. A fiscal expansion in the non-traded goods sector with a low elasticity of substitution (less than unity) will unambiguously raise (welfare based) world real interest rates and cause the expansionary country's current account to deteriorate. However, with a high substitution elasticity (greater than unity) a fiscal spending expansion in the home country will raise domestic real interest rates but *lower* foreign real interest rates. Real interest rates thus move asymmetrically across countries with a high substitution elasticity. Furthermore, in this case the current account of the home country will improve while that of the foreign country deteriorates.

These results indicate that knowledge of both the composition of spending and the elasticity of substitution are crucial ingredients in making any predictions about the international response to fiscal policy. In addition, they provide a cautionary note against too literal an interpretation of the consequences of perfect capital mobility for real interest rate equalization.

When the model is extended to allow for an intersectoral supply response, the same general type of results pertain. However, supply elasticities are now an important part of the response to a fiscal expansion in addition to the

intertemporal elasticity of substitution. A temporary fiscal expansion falling on traded goods unambiguously raises consumer real interest rates and deteriorates the home country current account. Again, for an expansion on non-traded goods, the results may go either way. With a high elasticity of supply in the traded goods sector combined with a low intertemporal elasticity of substitution, real interest rates move together and the home country current account deteriorates. On the other hand, a low elasticity of supply combined with a high elasticity of substitution implies real interest rates will move in opposite directions and the home current account improves.

We employ a very simple two-period model to demonstrate these effects. The model is set out in the next section. The third section develops the main results of the paper. The fourth section then extends the model to take account of intersectoral factor movements.

A TWO-COUNTRY MODEL

Assume that there are two countries; home and foreign. Foreign variables are denoted with an asterisk. Both countries produce a single homogeneous traded good; Y_i and Y_i^*, as well as a non-traded good specific to each country N_i and N_i^*, where i refers to the period of production ($i = 1, 2$). As in Frenkel and Razin (1986b) we initially assume that these output levels are fixed. This implies that factors of production are specific to each sector within a country (this assumption is relaxed in a later section). We thus have three goods in the model and denote the traded good as the numeraire. Thus $P_i(P_i^*)$ refers to the period i relative price of the home (foreign) non-traded good, in terms of the traded good.

Home country consumers have the following preferences:

$$U = [(C_1)^{(1-\sigma)}/(1-\sigma)] + \delta[(C_2)^{(1-\sigma)}/(1-\sigma)], \tag{1}$$

where $C_i = C_{ni}^{\beta} C_{yi}^{(1-\beta)}$. $C_{ni}(C_{yi})$ is period i consumption of non-traded (traded) goods, and δ is the time discount rate. Similarly foreign consumers have preferences given by

$$U^* = [(C_1^*)^{(1-\sigma^*)}/(1-\sigma^*)] + \delta^*[(C_2^*)^{(1-\sigma^*)}/(1-\sigma^*)] \tag{2}$$

where $C_i^* = C_{ni}^{*\beta^*} C_{yi}^{*(1-\beta^*)}$. The elasticity of intertemporal substitution is given by $(1/\sigma)$ for the home country and $(1/\sigma^*)$ for the foreign country. This preference structure is more restrictive than some structures used in previous work, for example, Greenwood (1984) and Greenwood and Kimbrough (1985); but it has the advantage that it allows one to focus clearly on the role of intertemporal substitution elasticities in consumption. In addition, (1) and (2) produce an exact price index for each country's consumers. These indices are used below to define consumption-based real interest rates.

Consumers receive income from production of both traded and non-traded goods in each period. The government levies lump sum taxes and spends on the

domestic non-traded good and the internationally traded good. Since lump sum taxes allow us to substitute government budget constraints directly into private budget constraints, we may write the consolidated budget constraints facing consumers as

$$P_1C_{n1} + C_{y1} + \rho(P_2C_{n2} + C_{y2}) = P_1(N_1 - G_{n1}) + (Y_1 - G_{y1}) + \rho[P_2(N_2 - G_{n2}) + (Y_2 - G_{y2})] \quad (3)$$

for home consumers, and

$$P_1^*C_{n1}^* + C_{y1}^* + \rho(P_2^*C_{n2}^* + C_{y2}^*) = P_1^*(N_1^* - G_{n1}^*) + (Y_1^* - G_{y1}^*) + \rho[P_2^*(N_2^* - G_{n2}^*) + (Y_2^* - G_{y2}^*)] \quad (4)$$

for foreign consumers. $\rho = (1 + i)^{-1}$ is the market discount factor in terms of traded goods, where i is the one-period interest rate paid on an internationally traded bond, denominated in terms of traded goods. We denote i as the *market* interest rate. G_{ni} and G_{yi} represent home government spending on nontraded and traded goods respectively, with G_{ni}^* and G_{yi}^* being the corresponding terms for the foreign government.[1]

Home consumers maximize (1) subject to (3), while foreign consumers maximize (2) subject to (4). Optimal consumption levels are given by

$$C_i = W(\delta' R/\rho)^{i-1}/P_i^{\beta}(1 + \delta' R)$$

$$C_i^* = W^*(\delta'^* R^*/\rho)^{i-1}/P_i^{*\beta^*}(1 + \delta'^* R^*)$$

$$C_{ni} = \beta(P_i^{\beta}/P_i)C_i \qquad C_{ni}^* = \beta^*(P_i^{*\beta^*}/P_i^*)C_i^*$$

$$C_{yi} = (1 - \beta)P_i^{\beta}C_i \qquad C_{yi}^* = (1 - \beta^*)P_i^{*\beta^*}C_i^*$$

$$W = P_1(N_1 - G_{n1}) + (Y_1 - G_{y1}) + \rho[P_2(N_2 - G_{n2}) + (Y_2 - G_{y2})]$$

$$W^* = P_1^*(N_1^* - G_{n1}^*) + (Y_1^* - G_{y1}^*) + \rho[P_2^*(N_2^* - G_{n2}^*) + (Y_2^* - G_{y2}^*)]$$

$$\delta' = \delta^{(1/\sigma)} \text{ and } \delta'^* = \delta^{*(1/\sigma^*)},$$

where $R = (\rho\tau^{\beta})^{\alpha}$, $R^* = (\rho\tau^{*\beta^*})^{\alpha^*}$, $\tau = (P_2/P_1)$, $\tau^* = (P_2^*/P_1^*)$, and $\alpha = [1 - (1/\sigma)]$, $\alpha^* = [1 - (1/\sigma^*)]$. The terms P_i^{β} and $P_i^{*\beta^*}$ are exact consumer price indices for the home and the foreign country, respectively. Then $\rho\tau^{\beta}$ and $\rho\tau^{*\beta^*}$ represent consumption based real discount factors for the home and the foreign country, respectively, and are thus inversely related to *consumption real interest rates*. Because non-traded goods enter into the consumption bundle, the intertemporal relative price of non-traded goods affects consumption opportu-

1 We abstract from any direct utility effects of fiscal spending. These could be included in an additive fashion without changing the results at all. As in Frenkel and Razin (1985), we could think of any change in government spending in the model as a variation around the optimal spending level (i.e., zero).

nities and so must be included in an appropriate definition of consumption real interest rates. Furthermore, given that non-traded goods are specific to each country's consumers, consumption real interest rates are not necessarily equated across countries. The terms α and α^* capture the effect of the intertemporal elasticity of substitution. When this elasticity is greater than unity $\alpha < 0$ and $\alpha^* < 0$, and vice versa.

A world competitive equilibrium for this model is a set P_i, ρ, and P_i^* for which consumers are maximizing utility, and all markets clear. There are six goods market clearing conditions; home and foreign non-traded goods in periods 1 and 2, as well as the traded goods market in both periods. By Walras's law we can drop one of the traded goods market clearing conditions. Thus a competitive equilibrium is characterized by

$$N_i - G_{ni} = C_{ni} \tag{5a}$$

$$Y_1 + Y_1^* - G_{y1} - G_{y1}^* = C_{y1} + C_{y1}^* \tag{5b}$$

$$N_i^* - G_{ni}^* = C_{ni}^* \tag{5c}$$

for $i = 1, 2$, and C_{n1}, C_{ni}^*, C_{y1} and C_y^* are given from the above solutions for demands.

Because of homotheticity, the market-clearing equations have a convenient recursive structure. This is shown as follows. Adding together the periods 1 and 2 non-traded goods market-clearing conditions for both countries (discounting by ρ) gives the following restriction on the non-traded prices for period 1:

$$P_1 = \beta/(1-\beta)\{[Y_1 - G_{y1} + \rho(Y_2 - G_{y2})]/ [N_1 - G_{n1} + \rho\tau(N_2 - G_{n2})]\} \tag{6}$$

$$P_1^* = \beta^*/(1-\beta^*)\{[Y_1^* - G_{y1}^* + \rho(Y_2^* - G_{y2}^*)]/ [N_1^* - G_{n1}^* + \rho\tau(N_2^* - G_{n2}^*)]\}. \tag{7}$$

Equation (6) implies that total domestic wealth W, in terms of traded goods, can be written as

$$W = [(Y_1 - G_{y1}) + \rho(Y_2 - G_{y2})]/(1-\beta).$$

An analogous condition holds for the foreign economy. Likewise total wealth in terms of nontraded goods will equal $1/\beta$ times the present value of private income from non-traded goods. Substituting these conditions into the period 1 non-traded goods market-clearing conditions for both countries gives the following three equilibrium conditions in τ, τ^*, and ρ:

$$N_1 - G_{n1} = [N_1 - G_{n1} + \rho\tau(N_2 - G_{n2})]/(1 + \delta' R) \tag{8}$$

$$N_1^* - G_{n1}^* = [N_1^* - G_{n1}^* + \rho\tau^*(N_2^* - G_{n2}^*)]/(1 + \delta'^* R^*) \tag{9}$$

and

$$Y_1 + Y_1^* - G_{y1} - G_{y1}^* = \{[(Y_1 - G_{y1}) + \rho(Y_2 - G_{y2})]/(1 + \delta' R)\} + \{[(Y_1^* - G_{y1}^*) + \rho(Y_2^* - G_{y2}^*)]/(1 + \delta'^* R^*)\}. \quad (10)$$

Given solutions for τ, ρ, and τ^*, we may recover the equilibrium values for P_1 and P_1^* from (6) and (7). Equation (10) specifies both the traded goods market clearing condition and period 1 world current account balance. In the next section we use (8)–(10) to investigate the effects of a temporary fiscal expansion in the home economy.

A TEMPORARY FISCAL EXPANSION

We concentrate on a temporary fiscal expansion because of its unambiguously positive effect on real interest rates in a single good world economy model with free capital mobility such as Greenwood and Kimbrough (1985) (without capital controls) or Frenkel and Razin (1985). The results here provide a contrast to these effects and emphasize the importance of non-traded goods in determining real interest rates.

We may transform equations (8) and (9) to get the following restrictions on consumption real interest rates

$$\rho\tau^{\beta} = \{\rho^{(1-\beta)}[(N_1 - G_{n1})/(N_2 - G_{n2})]^{\beta}\}^{[1/(1-\beta\alpha)]} \quad (11)$$

$$\rho\tau^{*\beta^*} = \{\rho^{(1-\beta^*)}[(N_1^* - G_{n1}^*)/(N_2^* - G_{n2}^*)]^{\beta^*}\}^{[1/(1-\beta^*\alpha^*)]}. \quad (12)$$

Thus consumption real interest rates in each economy depend only on the market real discount factor, ρ, and relative endowments of non-traded goods, net of fiscal spending rates. Note that (12) implies that a temporary fiscal expansion in the home economy will raise the foreign real interest if and only if ρ *falls*. Thus, the foreign country's consumer real interest rate will always move in the same direction as the market interest rate.

Substituting (11) and (12) into (10), we arrive at the following equation in ρ:

$$Y_1 - G_{y1} - \frac{(Y_1 - G_{y1}) + \rho(Y_2 - G_{y2})}{\{1 + \delta'[\rho^{(1-\beta)}(N_1 - G_{n1}/N_2 - G_{n2})^{\beta}]^{[\alpha/(1-\beta\alpha)]}\}} = -\left\{ Y_1^* - G_{y1}^* - \frac{(Y_1^* - G_{y1}^*) + \rho(Y_2^* - G_{y2}^*)}{\{1 + \delta'^*[\rho^{(1-\beta^*)}(N_1^* - G_{n1}^*/N_2^* - G_{n2}^*)^{\beta^*}]^{[\alpha^*/(1-\beta^*\alpha^*)]}\}} \right\} \quad (13)$$

This represents the world current account balance, adjusted for the consumer real interest rate terms. From (13) we can determine the effect of a fiscal expansion falling on either traded or non-traded goods on the equilibrium value of ρ. Then (11) and (12) may be used to determine the effect on τ and τ^*, and finally (6) and (7) determine the response of P_1 and P_1^*.

Except for special cases (e.g., identical preferences and output levels), equation (13) does not have an analytical solution. However, we may differentiate to get the following equation in rates of change.[2]

$$\hat{\rho} = -[\theta(1-\phi)/\Delta][dG_{y1}/(Y_1 - G_{y1})] - [\theta(1-\phi)\alpha\beta/\Delta(1-\alpha\beta)] \times [dG_{n1}/(N_1 - G_{n1})], \quad (14)$$

where $\hat{\rho} = d\rho/\rho$ etc., $\theta = Y_1 - G_{y1}/(Y_1 - G_{y1} + Y_1^* - G_{y1}^*)$,
$(1-\phi) = \rho(Y_2 - G_{y2})/[Y_1 - G_{y1} + \rho(Y_2 - G_{y2})]$, and
$\Delta = [\theta\phi(1-\alpha)/(1-\beta\alpha) + (1-\theta)\phi^*(1-\alpha^*)/(1-\beta^*\alpha^*)] > 0$.

Let us first look at the case where a fiscal spending expansion falls on traded goods. Then $dG_{y1} > 0$ and $dG_{n1} = 0$. Equation (14) indicates that ρ falls so that the market interest rate unambiguously rises. From (11) and (12) both home *and* foreign consumer real interest rates rise. Thus a temporary fiscal expansion falling on traded goods raises all world real interest rates, crowding out consumer spending. The effects on the current account are also familiar. Using (13) and (14) and the definition; CA = home country current account surplus (in terms of traded goods), we may show that

$$dCA/Y_1 = -[(1-\phi)(1-\theta)\phi^*(1-\alpha^*)/\Delta(1-\beta^*\alpha^*)] \times [dG_{y1}/(Y_1 - G_{y1})] < 0. \quad (15)$$

The home country current account deteriorates, while the foreign current account will improve. It may also be quite easily demonstrated that both P_1 and P_1^* will fall. The fiscal expansion will directly reduce the relative price of non-tradables at home by reducing domestic private income, while indirectly reducing the foreign price through the negative impact of the rise in interest rates on foreign demand. The direct effect on the home price will tend to be greater, so the fiscal expansion will cause a real exchange rate depreciation.[3]

Equations (15) and (16) also indicate that the higher is the share of the home country's privately consumable output of traded goods in world output (i.e., θ), then the greater will be the effect of a rise in G_{y1} on ρ and the less will be the effect on the current account. In addition, the smaller is ϕ, the period 1 share of the total home country endowment of privately consumable traded goods, then the greater will be the effect of a rise in G_{y1} on the home current account and so on the market interest rate.

Now look at the effect of a rise in fiscal spending on the non-traded good, with $dG_{n1} > 0$ and $dG_{y1} = 0$. The effect on ρ now depends upon the sign of α. When the elasticity of intertemporal substitution is less than unity, ($\alpha > 0$) ρ falls (the market interest rate rises). Then, from (11) and (12), consumer real

2 In this equation we assume an initial point of zero current account balance for each country. Allowing for non-zero initial current account balances makes the derivations more cumbersome but does not alter the main results.

3 Here we are using the convention that the real exchange rate is measured as the ratio of the foreign price level to the domestic price level, that is, $(P_1^{*\beta^*}/P_1^{\beta})$.

interest rates must rise in both countries. The fiscal expansion unambiguously raises the level of world real interest rates.

Alternatively, when $\alpha < 0$, ρ *rises*, and thus the market interest rate *falls*. Since we know that the foreign consumption real interest rate moves in the same direction as the market interest rate for a fiscal expansion emanating from the home economy, it must be the case that the foreign consumption real interest rate *falls* in response to a domestic fiscal expansion on non-traded goods. Fiscal expansion is transmitted abroad negatively. Consumption real interest rates in the home economy will always rise as may be demonstrated from (11) and (13)[4]

$$(\hat{\rho} + \beta\hat{\tau}) = \beta/(1 - \alpha\beta)\{1 - [(1 - \beta)\theta(1 - \phi)\alpha/\Delta(1 - \beta\alpha)] \times [dG_{n1}/(N_1 - G_{n1})] < 0.$$

In contrast to the effects of a fiscal expansion on traded goods, we see that when fiscal spending falls on the non-traded good, real interest rates may move asymmetrically across countries. Domestic consumer real interest rates always rise following the fiscal expansion, but foreign real interest rates may rise or fall. Note that the crucial condition for the effect on real interest rates is the intertemporal elasticity of substitution of the country undergoing the fiscal expansion and is not directly related to the other country's elasticity.

The movement in the real interest rate has implications for the response of the current account. The change in the home country's current account is given by

$$dCA/Y_1 = -\{\beta\alpha(1 - \phi)[(1 - \theta)\phi^*(1 - \alpha^*)]/(1 - \beta\alpha)\Delta(1 - \beta^*\alpha^*)\}[dG_{n1}/(N_1 - G_{n1})] \gtrless 0. \quad (16)$$

When $\alpha > 0$ ($\alpha < 0$), the current account deteriorates (improves) in response to a domestic fiscal expansion falling on non-traded goods. With a high elasticity of intertemporal substitution, a fiscal expansion may actually improve the current account, and as a consequence, the foreign current account must deteriorate.

These results are best explained by focusing on the partial equilibrium effects of a rise in G_{n1} on domestic consumption of the traded good (and thus the current account), for a given world market interest rate. The direction of this effect then predicts the movements in ρ necessary to equilibrate the world market for the traded good, and thus determines the comovements of consumer real interest rates.

Differentiating the demand function $C_{y1}(\cdot)$ from the preceding section, we may establish that

$$\hat{C}_{y1\rho} = \beta\hat{P}_1 - (1/\sigma)(1 - c_w)\beta(\hat{P}_1 - \hat{P}_2) - c_w\beta[dG_{n1}/(N_1 - G_{n1})]. \quad (17)$$

4 Note that $1 - \beta\alpha > 0$ always holds.

The term $c_w = (1/1 + \delta R)$ represents the propensity to consume out of wealth for all goods in period 1. A rise in G_{n1} *for a given* ρ has three channels of influence on C_{y1}. First, it causes a rise in the relative price of the non-traded good in period 1, leading to an intratemporal substitution in consumption towards the traded good, raising C_{y1}. This is captured by the first expression in (17). Secondly, it raises the intertemporal price ratio, P_1/P_2, thereby raising the domestic consumer real interest rate. This reduces current consumption of the traded good and is captured in the second expression in (17). The magnitude of this effect is determined by the intertemporal elasticity of substitution $(1/\sigma)$, as well as the propensity to consume out of wealth in period 2, $(1 - c_w)$. Finally, a rise in G_{n1} directly reduces domestic private wealth. This always reduces consumption of traded goods, as indicated by the third expression in (17). The magnitude of this effect is determined by c_w.

Summing all these effects, we see that the response of the home country's current account (the negative of the response of C_{y1}), to a temporary fiscal expansion on non-traded goods is apparently ambiguous. The direct price substitution effects lower the current account, while the real interest rate and wealth effects improve the current account. For a high intertemporal elasticity of substitution, the real interest rate effect will dominate, causing a fall in C_{y1} and an improvement in the current account. For a low elasticity, C_{y1} will rise and the current account will deteriorate. To be more precise, we substitute for $\hat{\rho}_{1\rho}$ and $\hat{P}_{2\rho}$ from (6) and (7) into (17), and it may be established that

$$\text{Sign } \hat{C}_{y1\rho} = -\text{Sign } [1 - (1/\sigma)].$$

Thus the relevant condition is whether or not the intertemporal elasticity of substitution exceeds unity.

Now let us look at the global effects of the rise in G_{n1} to determine the equilibrium response of ρ which will clear the world market for traded goods. From above we know that when $\alpha > 0$, home consumption of the traded good rises, and the current account deteriorates, for given ρ. This implies that the fiscal expansion causes a net excess demand for traded goods. To clear the period 1 traded goods market, ρ must fall, or the market interest rate must rise. From (11), this implies that the initial rise in home consumer real interest rates is *magnified* by the effect on ρ. The home current account falls in equilibrium, as (16) establishes. For the foreign economy, the rise in the market interest rate represents an exogenous shock. The movement in the intertemporal relative price τ^* will cushion the effects of this shock on foreign consumer real interest rates somewhat, but the overall effect is to raise foreign consumer real interest rates whatever the value of α^*.[5] The foreign current account will then improve, as the rise in the world market interest rate leads to a fall in foreign consumption of traded goods.

In contrast, for $\alpha < 0$, the intertemporal elasticity of substitution exceeds

5 The effects on the foreign economy are similar to Dornbusch's (1983) description of the response of a small open economy to a rise in the exogenous world interest rate.

unity. A fiscal expansion in the non-traded goods sector will then cause a ceteris paribus improvement in the home country current account. A net excess supply of traded goods in period 1 ensues, and a *fall* in the market interest rate is necessary to restore equilibrium. The net effect is still to raise the home consumption real interest rate, and in equilibrium the home current account will improve. The effects of the fall in the market real interest rate on the foreign economy are then precisely the opposite of the first case; foreign consumer real interest rates *fall*, foreign consumption of traded goods rises, and the foreign current account deteriorates.

Finally, for the knife-edge case where $\alpha = 0$, home consumption of traded goods is unaffected by an expansion in G_{n1}. Thus world excess demand for traded goods is unchanged, and the world market interest rate is unaffected.

The effect of the fiscal expansion on non-traded goods prices and the real exchange rate may be established from equations (6) and (7). P_1 will rise following the fiscal expansion. The effect on the foreign price is ambiguous. When $\alpha > 0$, the foreign price will fall, following the negative effects of the rise in the world market interest rates, while with $\alpha < 0$, P_1^* will rise. Again the direct effects on the home price will tend to dominate, so the home country real exchange rate will appreciate.

In summary we may conclude that when fiscal spending is heavily biased towards non-traded goods, the most important determinant of the international transmission mechanism is the intertemporal elasticity of substitution of the country undergoing the fiscal shock. Asymmetric movements in real interest rates are associated with a high elasticity of substitution.

These results can be related to a recent paper by Greenwood (1984). Using a more general preference structure, he shows that the effect of a temporary rise in government spending on non-traded goods on the current account of a small open economy is determined by the sign of the cross derivative of the period utility function, U_{21} (where $U = U(C_{ni}, C_{yi})$, $i = 1, 2$, in our notation). When $U_{21} > 0$ (< 0), the fall in consumption of the non-traded good reduces (raises) the marginal utility of traded goods consumption in the same period, thus causing a fall (rise) in the consumption of traded goods and an improvement (deterioration) in the current account. Thus the degree of complementarity between the consumption of the two goods determines the response of the current account. For the particular preference structure used here, it may easily be checked that Sign $U_{21} = -\text{Sign}\,[1 - (1/\sigma)]$. Thus the results of Greenwood are reaffirmed for our more restrictive preference assumption and relate to the value of the intertemporal elasticity of substitution.[6]

We have concentrated on current temporary fiscal spending shocks. From equation (13) it is apparent that anticipated future shocks will have the reverse effects on both market and consumer real interest rates. An announced future

6 Kimbrough (1985) also shows that a temporary increase in government spending on non-traded goods has an ambiguous effect on the current account in an equilibrium business cycle model, for reasons related to those given here.

expansion on traded goods will reduce the current market interest rate and consumer real interest rates in both countries. A future expansion on non-traded goods will reduce the market interest rate when $\alpha > 0$, reducing both domestic and foreign consumer real interest rates, while in the case where $\alpha < 0$ the market interest rate rises, the consumer real interest rate at home falls, while that in the foreign country rises.

The welfare effects of the transmission of fiscal spending have been ignored in the above discussion. In fact, given the assumption of initial current account balance, it must be the case that at the margin foreign welfare is unaffected by a domestic fiscal expansion. This is true because the only source of international transmission in the model is the market interest rate, and with a zero current account balance, welfare is independent of movements in the interest rate.[7] If the foreign economy was running a current account surplus in the first period, a rise in the market interest rate following a home fiscal expansion would raise foreign welfare and vice versa. Because home consumers are taxed to finance the fiscal expansion, home welfare will fall.

THE EFFECTS OF INTERSECTORAL SUPPLY ELASTICITIES

The model is now extended to allow for intersectoral factor movements within countries. Competitive behaviour of firms will ensure that output for each sector in any given period will depend only on the relative price of non-traded goods for that period. Thus we may write the supply relationships as follows:

$$N_i = N_i(P_i) \qquad Y_i = Y_i(P_i) \qquad N_i' > 0,\ Y_i' < 0 \tag{18}$$

$$N_i^* = N_i^*(P_i^*) \qquad Y_i^* = Y_i^*(P_i^*) \qquad N_i^{*\prime} > 0,\ Y_i^{*\prime} < 0 \tag{19}$$

$$i = 1, 2.$$

The equilibrium conditions (6)–(10) apply as before, except for the inclusion of (18) and (19). When output levels depend directly upon relative prices, the simple recursive structure of the solution used in the last section no longer holds. However, we can make use of the fact that non-traded goods market-clearing conditions in each country are independent of the other country's relative prices. For the home economy (6) and (8) now become (we drop the argument of supply functions for ease of notation)

$$P_1N_1(\cdot) + \rho P_2N_2(\cdot) = \beta/(1 - \beta)[Y_1(\cdot) + \rho Y_2(\cdot)] \tag{6'}$$

$$N_1(\cdot) = [N2_1(\cdot) + \rho\tau N_2(\cdot)]/(1 + \delta' R). \tag{8'}$$

We can differentiate (6') and (8') to derive restrictions on $\hat{P}_1$ and $\hat{P}_2$ in terms of $\hat{\rho}$, dG_{n1}, and dG_{y1}. Doing the same for the foreign economy, we may then substitute into (13) to get the final value of $\hat{\rho}$ as a function of dG_{n1} and

7 In a model with endogenous terms of trade this would no longer be the case.

dG_{y1}. The mechanics of this operation are similar to the last section and are left to the appendix. Here we may simply write down the expression for $\hat{\rho}$. This is given as[8]

$$\hat{\rho} = -\{[(1-\phi)\theta/\Delta'](dG_{y1}/N_1)\} - \{[\theta(1-\phi)(\epsilon_y + \alpha\beta)/\Delta'(1+\epsilon_n - \alpha\beta)](dG_{n1}/Y_1)\}, \quad (20)$$

where

$$\Delta' = \{[\theta(1-\alpha)(1-\phi)(1+\epsilon_n+\epsilon_y)]/(1+\epsilon_n-\alpha\beta)\} + \{[(1-\theta) \times (1-\alpha^*)(1-\phi^*)(1+\epsilon_n^*+\epsilon_y^*)]/(1+\epsilon_n^*-\alpha^*\beta^*)\} > 0$$

$\epsilon_n = (N'_i P_i/N_i) > 0$, and $\epsilon_y = -(Y'_i P_i/Y_i) > 0$, are supply elasticities.

$\phi = (Y_1/Y_1 + \rho Y_2) = (P_1N_1/P_1N_1 + \rho P_2N_2)$[9]

$\phi^* = (Y_1^*/Y_1^* + \rho Y_2^*) = (P_1^*N_1^*/P_1^*N_1^* + \rho P_2^*N_2^*)$.

The effect of a temporary fiscal expansion on traded goods is as before. The market interest rate is pushed up and it is easy to show that consumer real interest rates rise in both countries. Likewise the effects on the current accounts are qualitatively equivalent to those of the last section. Allowing intersectoral supply movements affects the magnitude of response to fiscal expansion on traded goods, but has no effect on the direction of movements.

Now take a temporary fiscal expansion on non-traded goods. From (20) the market interest rate will rise (fall) as $(\epsilon_y + \beta\alpha) > 0$ (< 0). Since $\epsilon_y > 0$, an elasticity of substitution greater than unity $(\alpha < 0)$ is still a necessary but no longer a sufficient condition for the market interest rate to fall in response to a fiscal expansion. When $(\epsilon_y + \beta\alpha) > 0$, $\hat{\rho} > 0$, and consumer real interest rates rise in both countries. The home country's current account moves as follows:

$$dCA/Y_1 = -\{(1-\phi)(\epsilon_y+\alpha\beta)[(1-\theta)(1-\alpha^*)(1-\phi^*) \times (1+\epsilon_n^*+\epsilon_y^*)]/(1+\epsilon_n-\alpha\beta)\Delta'(1+\epsilon_n^*-\alpha^*\beta^*)\}(dG_{n1}/N_1).$$

Thus when $(\epsilon_y + \alpha\beta) > 0$, the home current account deteriorates.

Alternatively when $(\epsilon_y + \beta\alpha) < 0$ (involving a combination of a high intertemporal elasticity of substitution and a low elasticity of supply in the traded goods sector), $\hat{\rho} < 0$, and consumer real interest rates will move in opposite directions across countries. The home country current account then improves.

The importance of the supply elasticity of traded goods is quite intuitive.

8 We assume that this differentiation takes place around an initial level of zero government spending. We also continue to assume an initial position of current account balance for each country.

9 The second equality follows from the assumption of initial current account balance.

When $\alpha < 0$, a fiscal expansion in the non-traded goods sector again reduces home consumer demand for traded goods through a ceteris paribus rise in the home consumer real interest rate, thus causing an ex ante excess supply in the traded goods sector. However, the fiscal expansion also raises P_1 directly. This causes a shift of resources out of traded goods production and into non-traded goods, thus reducing output and causing an ex ante excess demand for traded goods. When the supply effect dominates, $(\epsilon_y + \beta\alpha) > 0$, and the market interest rate rises. When the demand effect dominates, $(\epsilon_y + \beta\alpha) < 0$, and the market interest rate falls. The consequent effects on consumer real interest rates and the current account follow, given the condition on the sign of $(\epsilon_y + \beta\alpha)$.

CONCLUSIONS

This paper has extended some previous work on the determinants of the international transmission of fiscal policy, concentrating on the effect of fiscal expansion on real interest rates in different countries. The general message is that the real interest rate effects of a fiscal expansion depend not only on the timing of policy as emphasized by Frenkel and Razin (1985), for instance, but also on the composition of spending and the intertemporal elasticity of substitution. Intertemporal movements in the real exchange rate are important determinants of the cross-country movements in real interest rates.

The model might be extended in a number of ways. The absence of investment is a drawback. Investment is important for two reasons. First, the response of investment would be an important part of any current account movements. Secondly, investment decisions (depending on the sector) would depend upon a separate set of real interest rate definitions, opening the way for a series of cross-country investment dynamics in response to a fiscal shock.

Another possible extension to the model would be to examine the consequences of government budget deficits rather than pure spending policies in a model where the strict 'Ricardian equivalence' proposition did not hold, as is done in Frenkel and Razin (1986a, b). A provocative question would be whether, in this extended model, current budget deficits unambiguously raised real interest rates across countries.

APPENDIX

Differentiating equations (6′) and (8′) of the text gives

$$\hat{P}_1 = \frac{(1-\alpha)(1-\phi)\hat{\rho}}{(1+\epsilon_n-\alpha\beta)} + \frac{[(1-\phi)(1+\epsilon_n+\epsilon_y)+\phi(1+\epsilon_n-\alpha\beta)]}{(1+\epsilon_n+\epsilon_y)(1+\epsilon_n-\alpha\beta)} \times \frac{dG_{n1}}{N_1} - \frac{\phi dG_{y1}}{(1+\epsilon_n+\epsilon_y)Y_1} \qquad \text{(A1)}$$

$$\hat{P}_2 = \frac{-(1-\alpha)\phi\hat{\rho}}{(1+\epsilon_n-\alpha\beta)} - \frac{\phi[(1+\epsilon_n+\epsilon_y)-(1+\epsilon_n-\alpha\beta)]}{(1+\epsilon_n+\epsilon_y)(1+\epsilon_n-\alpha\beta)} \times \frac{dG_{n1}}{N_1} - \frac{\phi dG_{y1}}{(1+\epsilon_n+\epsilon_y)Y_1}. \quad \text{(A2)}$$

The notation is explained in the text. The equivalent conditions for the non-traded goods market in the foreign economy are

$$\hat{P}_1^* = (1-\alpha^*)(1-\phi^*)\hat{\rho}/(1+\epsilon_n^*-\alpha^*\beta^*) \quad \text{(A3)}$$

$$\hat{P}_2^* = -(1-\alpha^*)\phi^*\hat{\rho}/(1+\epsilon_n^*-\alpha^*\beta^*). \quad \text{(A4)}$$

Using (A1)–(A4) along with (13) (amended to take account of supply functions), we get equation (20) of the text.

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