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The Surge in Capital Flows: Analysis of 'Pull' and 'Push' Factors

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This paper uses an intertemporal optimizing model of a small open economy facing imperfect world capital markets to assess the effects of 'pull' and 'push' factors on capital flows, asset accumulation, and the real exchange rate. A positive money demand shock raises consumption and holdings of foreign assets and appreciates the real exchange rate in the long run; it has an ambiguous effect on real money balances on impact. A positive productivity shock in the traded goods sector also leads to a long-run real appreciation (the Balassa-Samuelson effect), but the impact effect on relative prices is ambiguous. An increase in government spending on home goods leads to a real appreciation in the long run, but it has an ambiguous effect on the economy's stock of net foreign assets. The dynamic effects associated with a reduction in the world interest rate depend on the degree of intertemporal substitution in consumption and the initial asset position of private agents.

KEY WORDS: capital flows; optimizing models; real exchange rate determination

SUMMARY

The surge in capital inflows to developing countries since the early l990s has been attributed in the recent literature to the existence of various 'pull' and 'push' factors. This paper examines the macroeconomic effects associated with several of these factors. The first part presents a two-sector, flexible-price intertemporal optimizing model of a small open economy facing imperfect world capital markets. A key feature of the model is the assumption that domestic private borrowers face an upward-sloping supply curve of funds on world capital markets, and internalize the effect of their portfolio decisions on the interest rate that they face. This approach does not require (as is the case with many standard, infinite-horizon optimizing models of small open economies under perfect capital mobility) equality between the domestic rate of time preference and the world interest rate to ensure a stationary steady-state level of consumption—an assumption that appears to be quite arbitrary if one is considering shifts in the world interest rate.

The second and third parts of the paper examine the role of 'pull' and 'push' factors in the behaviour of capital flows. It is shown, in particular, that a positive shock to money demand raises consumption and holdings of foreign assets and

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appreciates the real exchange rate in the long run, but has an ambiguous effect on real money balances on impact. A positive productivity shock in the traded good sector also leads to a long-run real appreciation (the Balassa-Samuelson effect), but the impact effect on the real exchange rate is ambiguous. An increase in government spending reduces private consumption, both on impact and in the long run. But it has ambiguous effects on the stock of net foreign assets in the long run, as well as on the real exchange rate in the short run. The lower the reduction in private spending (that is, the lower the degree of intertemporal substitution), the more likely it is that domestic absorption will increase, and the higher the likelihood that the real exchange rate will appreciate on impact.

A reduction in the world interest rate—a key factor behind the surge in capital flows to developing countries, according to a large number of authors—leads to a long-run real depreciation if the country is a net creditor, but has an ambiguous impact effect on consumption as a result of conflicting wealth and intertemporal substitution effects. The higher the degree of intertemporal substitution, the more likely it is that the intertemporal effect will dominate the wealth effect (entailing an increase in consumption), and the higher the likelihood that the real exchange rate will appreciate. If the country is a net debtor, the long-run effects are also a fall in consumption and a real depreciation. On impact, private consumption increases and the real exchange rate appreciates, because wealth and intertemporal effects operate in the same direction: a reduction in the cost of foreign borrowing not only encourages agents to save less today, but it also lowers the external debt burden-thereby generating a positive wealth effect.

The main policy lesson of the analysis is thus that, in contrast to popular views, capital inflows do not necessarily lead to real exchange rate appreciation and a deterioration in external competitiveness. Much depends on the nature of the shock that drives capital flows, its duration, the time frame of the analysis (whether one is concerned with short- or long-term effects), the initial asset position of the economy, and the nature of the policy regime.

INTRODUCTION

A large literature has attempted to determine the main factors underlying the surge in capital inflows recorded by developing countries since the early 1990s.[1] Various authors (notably Fernandez-Arias, 1996) have emphasized in that context the distinction between 'pull' and 'push' factors. The first category generally refers to improvements in the domestic economy's prospects, associated notably with inflation stabilization and structural reform. It has been noted, for instance, that in a number of countries downward shifts in inflationary expectations (associated with improved credibility of stabilization policies or the liberalization of domestic financial markets) have led to sharp increases in the demand for domestic money balances, which have been accommodated by capital inflows. Positive productivity shocks in the tradable sector, which have been viewed as reflecting improved efficiency in the use of the domestic capital stock, have also been considered as a prime example of a 'pull' factor in the determination of capital inflows to developing countries.

The second category of factors underlying the surge in capital inflows refers mostly to external shocks and other regulatory changes in the world economy. Among these 'push' factors, a prominent role has been attributed to the cyclical reduction in interest rates and asset returns in the US and other industrial countries in the early 1990s. Calvo *et al*. (1996), and Frankel and Okongwu (1996)—in a study of the determinants of portfolio capital flows in seven Latin American and East Asian countries over the period 1987–1994—have provided econometric evidence suggesting that low interest rates prevailing in the US in the early 1990s had a very significant effect on capital flows to developing countries. Fernandez-Arias (1996) has also argued that improvements in the creditworthiness of some highly-indebted countries, driven mainly by reductions in international interest rates, have played a significant role in explaining the surge in capital inflows towards middle-income developing economies between 1989 and 1993.

The relative importance of 'pull' and 'push' factors continues to be debated. In particular, each set of factors appears to vary significantly across countries, as illustrated by Corbo and Hernandez (1996), who compare the experience of four Latin

American countries (Argentina, Chile, Colombia and Mexico) and five East Asian countries (Indonesia, Korea, Malaysia, the Philippines, and Thailand) with capital inflows since the early l990s. The contribution of this paper to the ongoing debate is to provide a conceptual analysis of the macroeconomic effects of various 'pull' and 'push' factors in the determination of capital flows, with particular emphasis on the real exchange rate and asset accumulation.

The analysis is based on a two-sector intertemporal optimizing model of an economy operating under a predetermined exchange rate regime. A key feature of the model is the assumption of imperfect word capital markets—an assumption which appears to be particularly relevant here for two reasons. First, although the degree of capital mobility appears to have increased substantially in recent years (in line with financial sector reforms and the dismantling of capital controls in many countries), imperfect capital mobility remains a fairly common characteristic in the developing world (see Agénor and Montiel, 1996). The approach followed here allows domestic interest rates to be determined by the equilibrium condition of the money market, and thus to respond to both domestic and foreign factors—such as changes in transactions motives and the money supply, induced by fluctuations in official reserves. Second, the model does not require the rate of time preference to be equal at all times to the world interest rate, as is the case in some standard, infinite-horizon optimizing models of small open economies.[2] This is particularly important when analyzing the effect of permanent changes in the world interest rate, since the arbitrary assumption that such shifts are accompanied by an equal change in the rate of time preference is not required.

The section 'The Analytical Framework' presents the model. The section 'Pull Factors' examines the short- and long-term effects of 'pull' factors on capital flows, asset accumulation, and the real exchange rate. The section 'Push Factors' focuses on the role of 'push' factors-namely, a reduction in the world interest rate. 'Summary and Conclusions' summarizes the main results of the analysis and offers some suggestions for further research.

THE ANALYTICAL FRAMEWORK

Consider a small open economy in which perfect foresight prevails and four types of agents operate: households, producers, the government, and the central bank. The nominal exchange rate E (defined as the home-currency price of foreign currency) is depreciated by the central bank at a constant rate, ε. The economy produces both traded and nontraded goods. The capital stock in each sector is fixed, and labour is homogeneous and perfectly mobile across sectors. The foreign-currency price of the traded good is constant and normalized to unity.

Households supply labour inelastically, consume both traded and nontraded goods, and hold three categories of financial assets in their portfolios: domestic money (which bears no interest), domestic government bonds and foreign bonds. Domestic and foreign bonds are intrinsically perfect substitutes, but imperfections on world capital markets lead to imperfect capital mobility. The government consumes traded and nontraded goods, collects lump-sum taxes on households, and pays interest on its domestic debt. It finances its budget deficit by issuing bonds.

Households

Consumption decisions follow a two-step process: households first determine the optimal level of total consumption, and then allocate that amount between consumption of the two goods. Assuming that government expenditure does not yield direct utility, the representative household's discounted lifetime utility can be written as

$$\int_0^\infty \frac{c^{1-\eta}}{1-\eta} + \chi \frac{m^{1-\phi}}{1-\phi}\, \mathrm{e}^{-\rho t}\, \mathrm{d}t, \quad \rho, \chi > 0 \tag{1}$$

where ρ denotes the rate of time preference (assumed constant), c total consumption expenditure, and m real money balances, measured in terms of the price of the consumption basket, P. The parameters η and ϕ are positive and different from unity. The instantaneous utility function is assumed to be additively separable in consumption and real money balances.[3] The parameter χ is introduced here to capture autonomous shifts in money demand, as discussed below.

Real wealth of the representative household a is defined as

$$a = m + b + b^*, \qquad (2)$$

where b denotes real holdings of government bonds, and b^* real holdings of foreign bonds, both measured in terms of the price of the consumption basket. Specifically, $b^* \equiv EB^*/P$, where B^* represents holdings of foreign bonds measured in foreign-currency terms. The flow budget constraint is given by[4]

$$\dot{a} = q + ib - c - \tau + (i^* + \theta + \varepsilon)b^* - \pi a, \qquad (3)$$

where q denotes net factor income (derived below), τ the real value of lump-sum taxes, i the domestic nominal interest rate, and π the domestic inflation rate. The term πa accounts for capital losses on total wealth resulting from inflation, while the term εb^* represents capital gains on the stock of foreign bonds resulting from exchange rate depreciation. The rate of return on foreign assets consists of a 'base' (or risk-free) interest rate i^* and a premium, θ. The premium is assumed to be negatively related to the private agent's level of foreign assets; specifically, the linear approximation $\theta \simeq -\gamma b^*/2$, where $\gamma > 0$, is assumed to hold. Thus, domestic private agents are able to borrow (lend) more on world capital markets only at a higher (lower) rate of return. This formulation differs in two important ways from the approach followed in optimizing models emphasizing the role of country risk on the country-specific world interest rate (see for instance Pitchford, 1989). The first is that there is no sovereign risk (only individual risk), so that the premium depends only on private holdings of foreign assets, and not on the economy's stock of foreign assets. Second, as shown below, private agents internalize the effect of their decisions on θ.[5]

In the first stage of the consumption decision process, households treat π, ε, q, i, i^* and τ as given, internalize the effect of their portfolio decisions on θ, and maximize (1) subject to (2) and (3) by choosing a sequence $\{c, m, b, b^*\}_{t=0}^{\infty}$. Let $r = i - \pi$ denote the domestic (consumption-based) real rate of interest and $\sigma = 1/\eta$ the intertemporal elasticity of substitution. The optimality conditions are given by:

$$\chi c^{\eta}/m^{\phi} = i, \;\Rightarrow\; m = \left\{\frac{\chi c^{\eta}}{i}\right\}^{1/\phi}, \qquad (4)$$

$$b^* = (i^* + \varepsilon - i)/\gamma, \qquad (5)$$

$$\dot{c}/c = \sigma(r - \rho), \qquad (6)$$

together with the transversality condition $\lim_{t\to\infty}(\mathrm{e}^{\rho t} a_t) = 0$. Equation (4) is the money demand function, and is derived by equating the marginal rate of substitution between consumption and real money balances to the opportunity cost of holding money, the domestic nominal interest rate. Equation (5) indicates that holdings of foreign bonds (measured in domestic-currency terms) depend positively on the difference between the domestic interest rate and the rate of return on foreign assets calculated as the sum of the risk-free interest rate and the devaluation rate. When $\gamma \to 0$, Equation (5) yields the uncovered interest parity condition $i = i^* + \varepsilon$.[6] Equation (6) shows that total consumption rises or falls depending on whether the domestic real interest rate exceeds or falls below the rate of time preference. With a high degree of intertemporal substitutability, incentives to smooth consumption are limited. Conversely, when the intertemporal elasticity is small ($\sigma \to 0$), consumption smoothing effects operate strongly. Since the desired path for real money balances depends in part on the desired degree of consumption smoothing, the intertemporal elasticity of substitution plays a prominent role in determining the dynamics of the real money stock and domestic interest rates, as further discussed below.

In the second stage of the consumption decision process, the representative household maximizes a Cobb-Douglas sub-utility function $v(c_N, c_T)$, where c_N denotes purchases of nontraded goods, and c_T expenditure on traded goods, subject to the budget constraint $P_N c_N + E c_T = Pc$, where P_N denotes the price of the home good. The solution to this program yields the familiar result according to which the representative household sets the marginal rate of substitution between home and traded goods equal to their relative price $z \equiv E/P_N$, that is, the real exchange rate:

$$c_N/c_T = \delta z(1 - \delta), \qquad (7)$$

where δ denotes the share of home goods consumption in total consumption expenditure, which is allocated according to

$$c_{\mathrm{N}} = \delta z^{1-\delta} c, \quad c_{\mathrm{I}} = (1-\delta) z^{-\delta} c. \tag{8}$$

The appropriate definition of the consumer price index, P, is thus:

$$P = P_{\mathrm{N}}^{\delta} E^{1-\delta}, \quad 0 < \delta < 1 \tag{9}$$

so that

$$\pi = \varepsilon - \delta \dot{z}/z. \tag{10}$$

Supply Side

Technology for the production of both traded and nontraded goods is characterized by decreasing returns to labour. In the traded good sector, in addition, output depends positively on a productivity parameter, α:

$$q_{\mathrm{N}} = q_{\mathrm{N}}(\overset{+}{n}_{\mathrm{N}}), \qquad q_{\mathrm{T}} = q_{\mathrm{T}}(\overset{+}{n}_{\mathrm{T}}, \overset{+}{\alpha}), \tag{11}$$

where q_h denotes output of good h, and n_h the quantity of labour employed in sector h. From the first-order conditions for profit maximization, the labour demand functions can be derived as

$$n_{\mathrm{T}}^{\mathrm{d}} = n_{\mathrm{T}}^{\mathrm{d}}(\bar{w}_{\mathrm{T}}, \overset{+}{\alpha}), \qquad n_{\mathrm{N}}^{\mathrm{d}} = n_{\mathrm{N}}^{\mathrm{d}}(z\bar{w}_{\mathrm{T}}), \tag{12}$$

where w_{T} is the product wage in the traded goods sector. Nominal wages are perfectly flexible. w_{T} is thus determined by the equilibrium condition of the labour market:

$$n_{\mathrm{T}}^{\mathrm{d}}(w_{\mathrm{T}}, \alpha) + n_{\mathrm{T}}^{\mathrm{d}}(z w_{\mathrm{T}}) = n^{\mathrm{s}}$$

where n^{s} denotes the (exogenous) supply of labour. This equation implies that the equilibrium real wage (measured in terms of traded goods) is negatively related to the real exchange rate and positively related to the productivity shock:

$$w_{\mathrm{T}} = w_{\mathrm{T}}(\bar{z}, \overset{+}{\alpha}). \quad |\partial w_{\mathrm{T}}/\partial z|$$

Substituting this result in Equation (12), and noting that $\mathrm{d}(z w_{\mathrm{T}})/\mathrm{d}z > 0$ yields the supply equations:

$$q_{\mathrm{N}}^{\mathrm{s}} = q_{\mathrm{N}}(\bar{z}, \bar{\alpha}), \qquad q_{\mathrm{T}}^{s} = q_{\mathrm{T}}(\overset{+}{z}, \overset{+}{\alpha}). \tag{13}$$

Government and the Central Bank

In this economy, the only function of the central bank (in addition to devaluing the exchange rate at a constant rate) is to engage in nonsterilized intervention, that is, to ensure the costless conversion at any given moment in time of domestic currency holdings into foreign currency (and vice versa) at the prevailing exchange rate. Since there is no credit, the real money stock is equal to

$$m = z^{\delta} R, \tag{14}$$

where R is the central bank's stock of net foreign assets, measured in foreign currency terms. Real profits of the central bank consist of interest on its holdings of foreign assets $i^* z^{\delta} R$, and capital gains on reserves, $\varepsilon z^{\delta} R$. All profits are transferred to the government.

In addition to transfers from the central bank, the government levies lump-sum taxes on households. It consumes both home and traded goods. It finances its budget deficit by issuing bonds. For simplicity, the government is also assumed to compensate private agents for the loss in interest income incurred as a result of capital market imperfections.[7] The budget constraint of the government is thus

$$\pi m + \dot{b} = z^{\delta}(g_{\mathrm{T}} + g_{\mathrm{N}}/z) + rb - (\tau + \theta b^*) \\ - z^{\delta}(i^* + \varepsilon - \pi) R, \tag{15}$$

where g_{N} and g_{T} denote government spending on home and traded goods, respectively. Equation (15) indicates that primary government expenditure plus net interest payments on government debt, minus lump-sum taxes (net of the subsidy to households) and real interest income on reserves (inclusive of capital gains), must be financed by the inflation tax or issuance of bonds.

Market-Clearing Conditions

To close the model requires specifying the equilibrium conditions for the home goods market and the money market. The equilibrium condition of the home goods market is given by

$$q_{\mathrm{N}}^{\mathrm{s}} = \delta z^{1-\delta} c + g_{\mathrm{N}}. \tag{16}$$

Using Equation (4), the equilibrium condition of the money market can be solved for the market-clearing interest rate:

$$i = i(\overset{+}{c}, \bar{m}, \overset{+}{\chi}), \tag{17}$$

which shows that the nominal interest rate depends positively on consumption expenditure and the shift parameter, and negatively on real money balances.

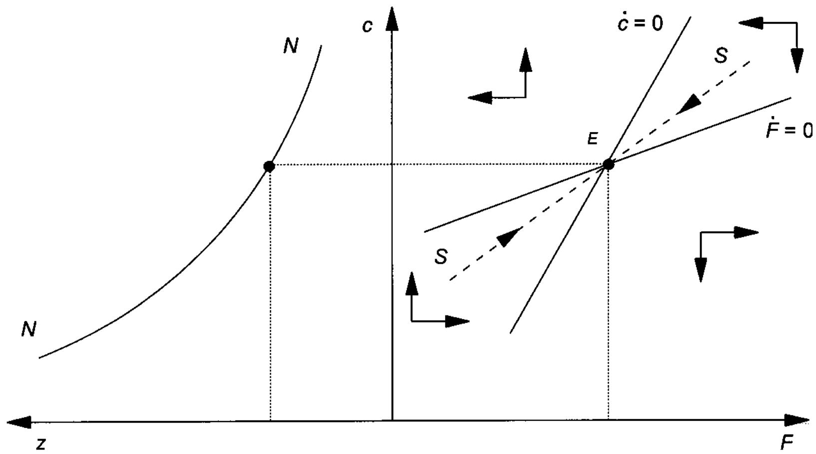

Figure 1. Steady-state equilibrium.

The dynamic structure of the model is described in Appendix A. Assuming that the government varies lump-sum taxes (instead of issuing bonds) to balance the budget, the dynamics of the economy can be described by a system involving two variables: private consumption c (which may jump in response to new information) and total holdings of foreign bonds measured in foreign currency terms, $F = R + B^*$.[8] Although total foreign assets evolve only gradually over time, both official reserves and the private stock of foreign bonds will jump in response to shifts in domestic or foreign interest rates. A discrete adjustment in private holdings of foreign bonds must be accompanied by an offsetting movement (at the given official exchange rate) in the stock of foreign reserves held by the central bank, in order to leave the overall stock of foreign assets F constant on impact.[9]

The steady-state equilibrium of the model is depicted in Figure 1. The curve NN in the North-West panel of the figure shows the combinations of consumption and the real exchange rate that are consistent with equilibrium in the market for non-traded goods. In the North-East panel in the figure, the locus $[\dot{F} = 0]$ gives the combinations of c and F for which the current account is in balance, whereas the locus $[\dot{c} = 0]$ depicts the combinations of c and F for which consumption does not change over time. Saddlepath stability requires that the $[\dot{c} = 0]$ curve be steeper than the $[\dot{F} = 0]$ curve. The saddlepath SS slopes upward, implying that a current account deficit must be accompanied by falling consumption and a depreciating exchange rate, and a current account surplus by rising expenditure and an appreciating exchange rate. The lower the degree of intertemporal substitution σ, the flatter SS will be. The steady-state equilibrium is obtained at point E. As shown in Appendix A, in the steady state the overall inflation rate and the rate of inflation in the price of home goods are equal to the devaluation rate ε, the real interest rate is equal to the rate of time preference ρ—so that the domestic nominal interest rate is equal to $\rho + \varepsilon$—and the current account is in equilibrium. Real holdings of foreign bonds are proportional to the difference between the world interest rate and the rate of time preference. This result can be interpreted as indicating that in the long run domestic private agents are net creditors (debtors) if their pure rate of time preference is lower (greater) than the foreign discount rate.

'PULL' FACTORS

The above framework can be used to study the effects of various 'pull' and 'push' factors on capital flows, asset accumulation, and the real exchange rate. The focus of this section is on the former group of variables, which are analyzed as unanticipated and permanent shocks to money demand, productivity in the tradable goods sector, and government spending on home goods. The reason for examining the effects of a fiscal expan-

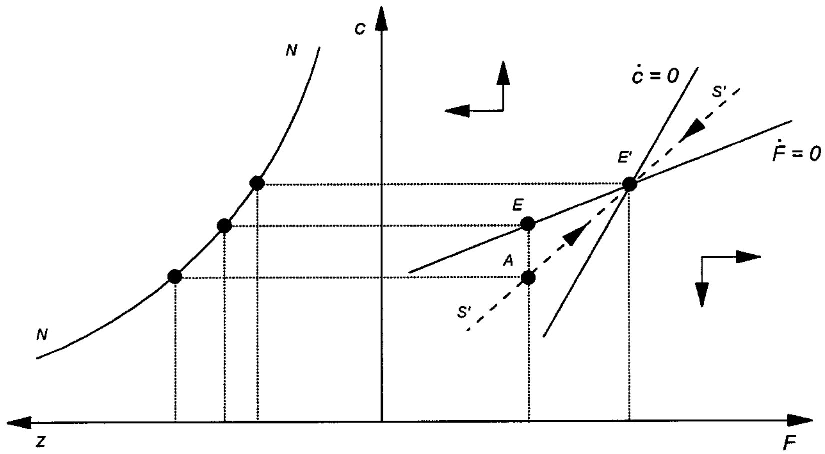

Figure 2. Positive money demand shock.

sion in this context needs some explanation. In practice, it is fiscal adjustment (a reduction in government expenditure and budget deficits) that has been identified as a 'pull' factor in some countries (notably Thailand, as documented by Corbo and Hernandez, 1996). However, there are also instances where it is a sharp increase in government spending and large fiscal imbalances, coupled with a relatively tight monetary policy stance (and consequent pressures on domestic real interest rates), that have led to short-term speculative capital inflows. Notable examples are Brazil and Turkey (Agénor *et al.*, 1996).

Positive Money Demand Shock

As indicated earlier, a positive money demand shock (captured by an increase in χ) may result from a downward shift in inflationary expectations associated with improved credibility of an inflation stabilization plan, or the liberalization of domestic financial markets. The dynamics of this shock are illustrated in Figure 2, and are formally derived in Appendix B. In the long run, a positive shock to money demand has no effect on nominal and real interest rates, and no effect on private holdings of foreign bonds. The economy's holdings of foreign assets (or, equivalently here, the stock of net foreign assets held by the central bank) rises. The increase in permanent income raises private consumption (at the initial level of the real exchange rate) and requires a real exchange rate appreciation (an increase in the relative price of home goods) to maintain equilibrium in the market for nontraded goods. Since consumption rises, and the nominal interest rate does not change, real money balances unambiguously increase in the new steady state.

On impact, the money demand shock tends to raise domestic interest rates. The reason is that since total financial wealth cannot change instantaneously, an increase in real money balances can result only from a reduction in holdings of foreign assets (that is, a capital inflow); for this to happen requires an increase in the rate of return on domestic assets. At the same time, however, consumption must fall initially to allow the economy to accumulate foreign assets during the transition and finance a higher level of expenditure in the new steady state. The reduction in private spending tends to lower the demand for money and thus to put downward pressure on domestic interest rates. If the degree of intertemporal substitution σ is not too large (so that consumption smoothing effects operate strongly and private expenditure does not fall by much), real money balances as well as domestic interest rates will increase on impact. The reduction in spending on both categories of goods generates a current account surplus on impact, and requires a depreciation of the real exchange rate to maintain equilibrium in the market for nontraded goods. As shown in Figure 2, the $[\dot{c}=0]$ curve shifts to the right, and consumption jumps downward from

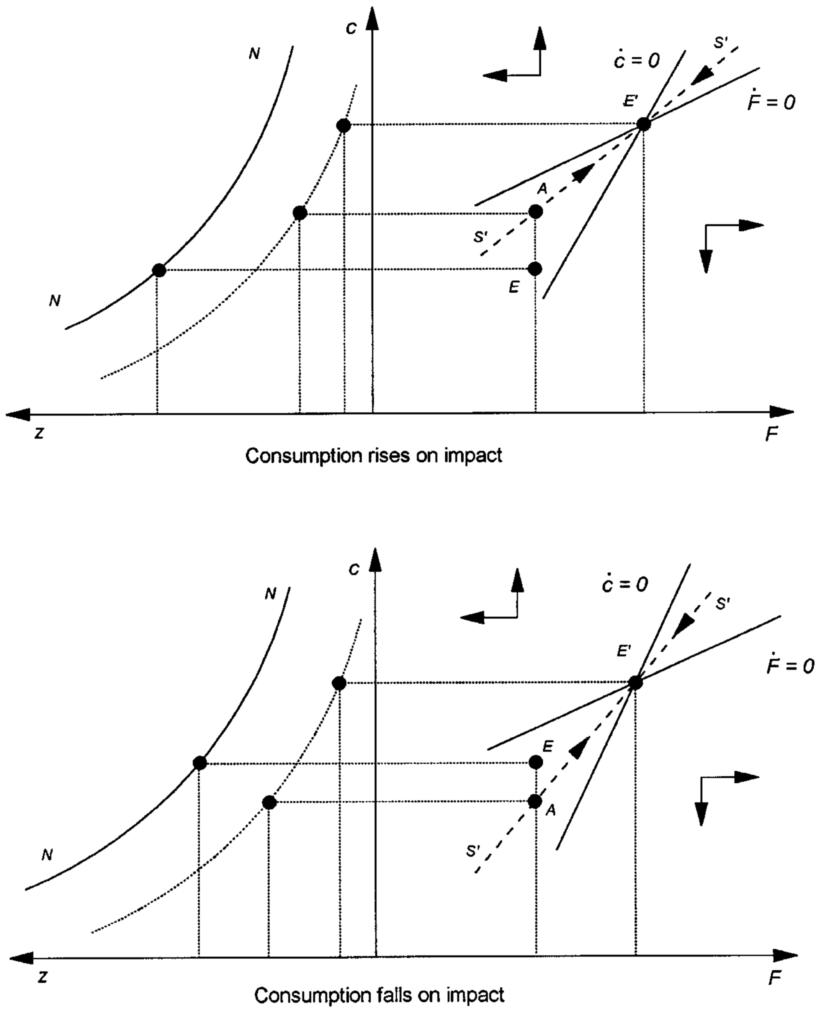

Figure 3. Positive productivity shock in the tradables sector.

point E to point A. During the transition, and since the initial depreciation stimulates output of traded goods (while lowering the demand for these goods), the current account remains in surplus. Consumption rises continuously from point A to point E', and the real exchange rate appreciates—thereby stimulating output of nontraded goods and dampening consumption of these goods. Thus, on impact, domestic interest rates are likely to increase and the economy will experience an inflow of private capital. By contrast, during the transition to the new steady state, because the domestic interest rate must return to its initial equilibrium value (which has not changed), the economy will register private capital outflows.

Positive Productivity Shock

A positive productivity shock in the tradable sector is captured by a increase in the shift parameter α, and can be viewed as reflecting a higher productivity of the capital stock. As shown in Appendix B, an increase in α leads to a steady-state increase in consumption, real money balances, and in the economy's stock of net foreign assets—or, equivalently here, households' net worth—and to a real exchange rate appreciation. It has no effect on private holdings of foreign assets, real and nominal interest rates. Figure 3 illustrates the dynamic effects of this shock. In both panels, the $[\dot{c} = 0]$curve in the North-East quadrant shifts to the right, and the $[\dot{F}=0]$ curve shifts to the left. The *NN* curve in the North-West panel shifts inward. Intuitively, at the initial levels of the real exchange rate and the economy's stock of foreign assets, the productivity shock raises the demand for labour and the supply of traded goods. Private consumption must therefore increase to maintain current account balance. In turn, this requires a real appreciation to maintain equilibrium of the home goods market.[10] The increase in consumption raises the demand for real money balances; because domestic interest rates cannot change, the real money stock must increase—implying that official reserves and the stock of net foreign assets rise in the long run. Thus, in the present model—and as also derived by, for instance, Montiel (1996)—a positive productivity shock in the traded goods sector leads to a real appreciation, consistent with the Balassa-Samuelson effect.

However, the short-run effects of the productivity shock on consumption, the real exchange rate, real money balances and domestic interest rates are ambiguous. In the upper panel of Figure 3, consumption rises on impact—jumping upward from point *E* to point *A* located on the new saddlepath $S'S'$. The real exchange rate unambiguously appreciates in this case: on the one hand, the productivity shock in the tradable sector tends (by raising wages) to reduce the supply of nontraded goods, and on the other the increase in total spending raises the demand for these goods. Both effects lead to a real appreciation. The lower panel of the figure, by contrast, illustrates the case where private consumption falls on impact. In that case, because the supply- and demand-side effects operate in opposite directions, the net effect on the real exchange rate is ambiguous. If the degree of intertemporal substitution is sufficiently small (so that aggregate consumption changes little), the real exchange rate will also appreciate. This is the case illustrated in the North-West quadrant of the lower panel in Figure 3. Thus, whether the economy experiences capital inflows or outflows on impact cannot be determined *a priori*. As shown in Appendix B, if consumption rises on impact, the movement in real money balances will be ambiguous, but the domestic interest rate will always rise. By contrast, if consumption falls, real money balances will also fall but the movement in domestic interest rates will remain ambiguous. Regardless of the initial movement in private expenditure, consumption rises during the transition, the real exchange rate appreciates, and the economy accumulates foreign assets. But the key result here is worth emphasizing: whether the economy experiences capital inflows in the short run as a result of a favorable productivity shock in the tradable sector cannot be ascertained *a priori*, in contrast to what is commonly assumed in the literature.

Increase in Government Spending on Home Goods

An increase in g_N leads to a steady-state reduction in consumption and real money balances, and (as is the case with the shocks examined previously) has no long-run effect on private holdings of foreign assets and interest rates. It also leads to an appreciation of the real exchange rate, because the fall in private consumption does not exceed the increase in government expenditure. But the shock has an ambiguous effect on the economy's stock of net foreign assets or, equivalently here, households' net worth. Figure 4 illustrates the dynamic effects of this shock. The upper (lower) panel of the figure shows the case where the level of foreign assets rises (falls) in the new steady state. In both cases, the $[\dot{c}=0]$ and $[\dot{F}=0]$ curves in the North-East panel shift to the right, and the *NN* curve in the North-West panel shifts inward. Private consumption always falls on impact, and jumps downward from point *E* to point *A* located on the new saddlepath $S'S'$. The real exchange rate may either appreciate or depreciate on impact, depending on the extent to which private spending falls. If total domestic spending on home goods, or absorption, rises (falls), an appreciation (depreciation) of the real exchange rate will be required to maintain equilibrium of the market for nontraded goods. The outcome illustrated in the two panels in the figure shows a real appreciation on impact, and corresponds to a situation in which consumption smoothing effects are strong and the degree of intertemporal substitution is low—so that private consumption changes relatively little on impact. Real balances also fall initially. Since both private consumption and real money balances fall, the domestic nominal interest rate may either rise or fall on impact; with a low degree of intertemporal substitution, it tends to rise. Hold-

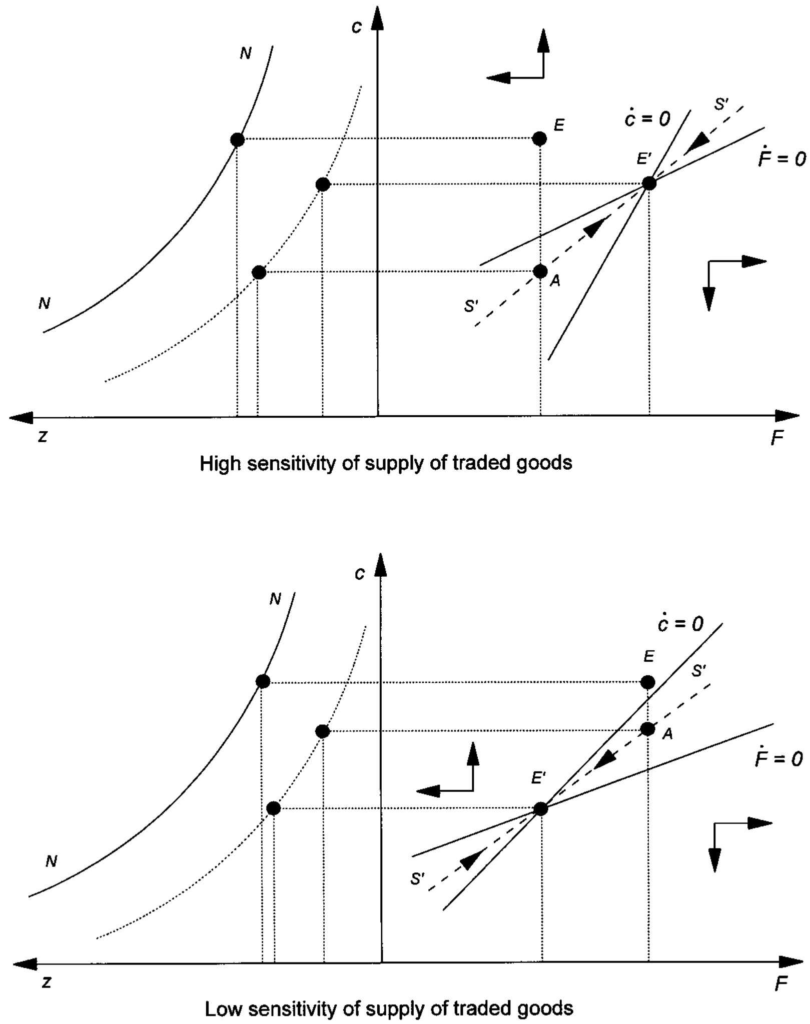

Figure 4. Increase in government spending on home goods.

ings of foreign bonds must fall in this case, so that the economy experiences private capital inflows. As a consequence of the monotonicity of the dynamic adjustment path to the new equilibrium, the stock of net foreign assets continuously rises or falls during the adjustment process according to whether $\tilde{F}$ rises or falls in the new steady state. During the transition, consumption rises (falls), and the real exchange rate appreciates (depreciates), if net foreign assets increase (decline). If domestic interest rates rise on impact, the economy will experience capital outflows during the transition to the new long-run equilibrium, as the equality between the real interest rate and the (unchanged) rate of time preference is gradually restored.

The reason for the ambiguity of the steady-state effect on the stock of foreign assets can be intuitively explained as follows. At the initial level of the real exchange rate, a rise in government spending on home goods requires a fall in private consumption to maintain equilibrium in the market for home goods. Because the reduction in private expenditure does not match the increase in public spending, equilibrium in the market for home goods must be maintained by an adjustment in relative prices. The real appreciation reduces output of traded goods and stimulates output of nontraded goods. But since both production and consumption of traded goods fall, the net effect on the long-run value of the economy's stock of foreign assets cannot be ascertained *a priori*.

If the sensitivity of output in the traded goods sector with respect to real exchange rate movements is very low, the decline in output of traded goods will fall short of the decline in the consumption of these goods. The improvement in the trade balance implies that lower interest income is needed to support the lower steady-state level of consumption. Maintaining external balance hence implies a lower steady-state level of foreign assets. The current account must therefore move into deficit, and (because of the monotonicity of the adjustment process) will remain in deficit during the transition—as shown in the lower panel in Figure 4.

By contrast, if the production of traded goods is highly sensitive to changes in relative prices, a real appreciation will lead to a reduction in the production of traded goods that exceeds the fall in private consumption of these goods, and the trade balance will deteriorate. Maintaining external balance would then require a higher level of interest income, and thus an accumulation of foreign assets through a sequence of current account surpluses. This is the case depicted in the upper panel of Figure 4.[11]

'PUSH' FACTORS

As indicated in the introduction, many economists have attributed a large role to the cyclical reduction in interest rates in major industrial countries in explaining the surge in capital inflows to developing countries in the early 1990s. The effects of an unanticipated, permanent reduction in i^* are illustrated in Figures 5 and 6, which correspond respectively to the case of a net creditor and a net debtor country.[12]

Net Creditor Case

Consider first the case of a net creditor country ($\tilde{F} > 0$). The long-run effects in this case are a reduction in aggregate consumption, a depreciation of the real exchange, and a reduction in total holdings of foreign assets. At the initial level of the real exchange rate, the reduction in the world interest rate lowers interest income. To maintain external balance, consumption must therefore fall. At the same time, the reduction in the rate of return on foreign assets reduces private demand for foreign bonds. Since consumption falls, real money balances—given that the nominal interest rate does not change across steady states—must also fall. Thus, at the initial structure of relative prices, the economy's stock of foreign assets falls—compounding the initial negative effect on interest income. The reduction in consumption expenditure lowers demand for nontraded goods and leads to a depreciation of the real exchange rate, together with an increase in output of traded goods. The improvement in the trade balance brought about by the reduction in consumption and the expansion of output of tradable exactly offsets the deterioration in the service account balance.

Since the steady-state stock of foreign assets falls, the transition (given the permanent nature of the shock and the monotonic nature of the adjustment path) must involve a sequence of current account deficits. The initial effect of a reduction in the rate of return on foreign assets is a fall in interest income (since overall holdings of foreign assets cannot change on impact), a reduction in private demand for foreign bonds, and an increase in money demand. This instantaneous portfolio shift takes place through an inflow of capital (a discrete reduction in private holdings of foreign bonds) and an offsetting movement in central bank holdings of foreign assets, which leads (given the unsterilized intervention rule) to a discrete increase in the real money stock. However, whether domestic interest rates rise or fall to maintain equilibrium in the money market cannot be ascertained *a priori*, because private consumption—and thus the real exchange rate—may rise or fall on impact.

This ambiguity emerges as a result of conflicting wealth and intertemporal substitution effects on consumption. On the one hand, the expected future reduction in interest income (induced by the reduction in the world interest rate *and* the level of financial wealth) tends to reduce (at the initial real exchange rate) private expenditure and to increase saving. On the other hand, a reduction in i^* encourages agents to save less (and consume more)

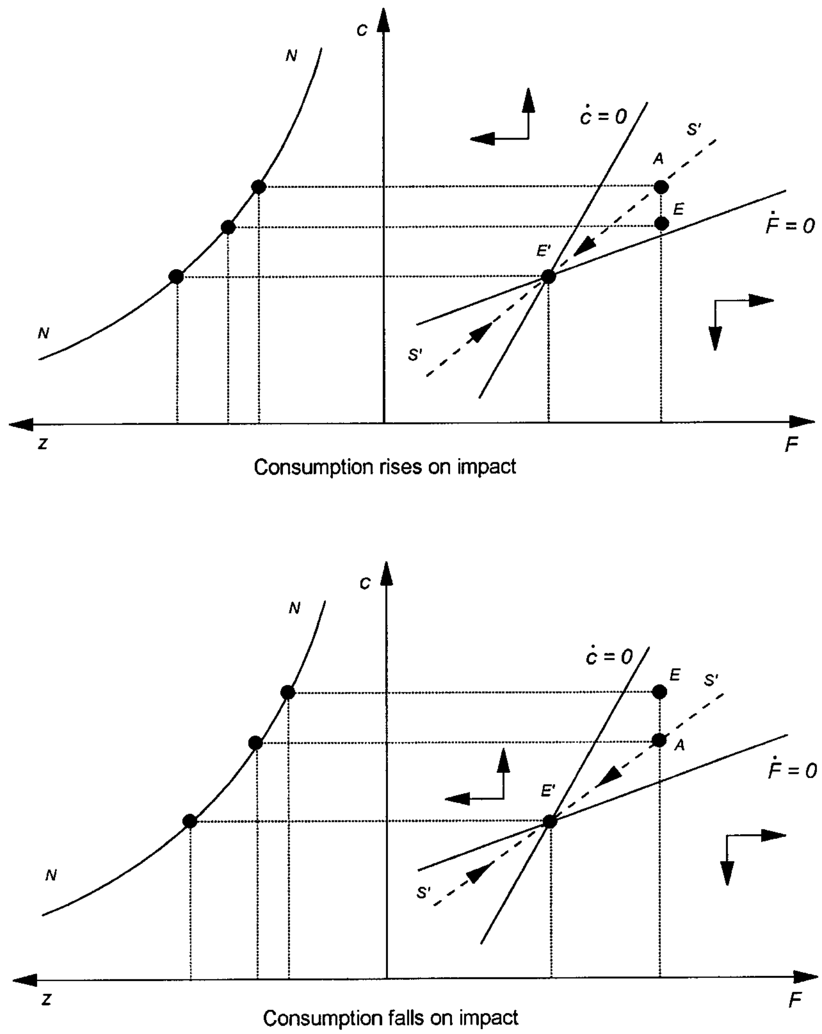

Figure 5. Reduction in the world interest rate (net creditor country).

today, since the rate of return on foreign assets has fallen (intertemporal effect).

The upper panel in Figure 5 illustrates the case where the intertemporal effect dominates the wealth effect, aggregate consumption rises on impact, and the real exchange rate appreciates to maintain equilibrium of the market for home goods. The trade balance (which, in the initial equilibrium, is characterized by a deficit equal in absolute value to interest income on net foreign assets) tends therefore to deteriorate. The real appreciation leads to a reduction in output of traded goods, which compounds the effect of the increase in consumption on the trade deficit. Since interest income received on the initial stock of assets falls, the economy generates a current account deficit on impact. Graphically, consumption jumps upward from point E to point A. Real money balances unambiguously increase whereas private holdings of foreign bonds—assuming that valuation effects are not too large—fall and the economy registers a capital inflow. The increase in the domestic money stock (induced by the discrete portfolio adjustment) tends to lower the domestic interest rate, but the expansion in consumption tends to raise it. If the intertemporal effect is large, the net effect will be positive and will further stimulate capital inflows.

The transition (along $S'S'$ towards E') is characterized by a continuous fall in consumption, a

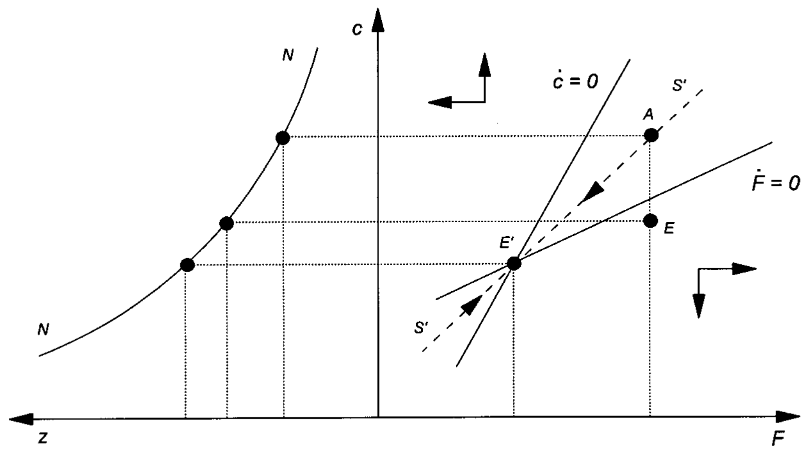

Figure 6. Reduction in the world interest rate (net debtor country).

depreciation of the real exchange rate, current account deficits, and a reduction in the stock of foreign assets. The fall in consumption and the expansion in output of traded goods (resulting from the real depreciation) tend to reverse over time the adverse effect of the initial appreciation on the trade balance. The trade deficit falls over time, eventually turning into a trade surplus. However, because interest payments continue to fall with the reduction in the stock of assets, improvements in the trade balance are not large enough to prevent the current account from remaining in deficit until the new steady state is reached. Since the devaluation rate does not change, an initial increase in the nominal interest rate must be followed by a subsequent decline toward the initial steady-state value $(\rho + \varepsilon)$ and ensure equality between the real interest rate and the rate of time preference. And if the domestic interest rate falls, holdings of foreign assets by the private sector must increase during the transition, thereby leading to capital outflows and lower reserve accumulation by the central bank. The domestic money stock is thus falling during the transition.

The lower panel in Figure 5 illustrates the case where the negative wealth effect outweighs the intertemporal effect. Consumption falls on impact (from point E to point A) and the real exchange rate depreciates. Although the fall in consumption of traded goods and the expansion of output of these goods (resulting from the real depreciation) lead initially to an improvement in the trade balance, the reduction in interest income is large enough to generate a current account deficit. The net effect on the domestic interest rate is now unambiguously negative, since consumption falls. However, since both the world interest rate and the domestic interest rate fall, whether the net effect on the demand for foreign bonds—and thus real money balances—is positive or negative cannot be determined *a priori*. Thus, the economy may experience either capital inflows or capital outflows. If the world interest rate falls by more than the domestic interest rate, holdings of foreign bonds will fall and the economy will experience capital inflows on impact. Real money balances in this case will rise. During the transition period, as before, the economy moves up along $S'S'$ toward E'. Despite the reduction in private expenditure on both categories of goods and the depreciation of the real exchange rate (which stimulates output of traded goods), the fall in interest income ensures that the current account remains in deficit. The domestic interest rate rises gradually toward its initial steady-state level, stimulating further capital inflows. With consumption falling and domestic interest rates increasing, real money balances tend to fall over time.

Net Debtor Case

Consider now the case of a net debtor country $(\tilde{F} < 0)$. The long-run effects of a permanent reduction in the world interest rate are again a reduction in consumption, a depreciation of the real exchange rate, and a reduction in total holdings of foreign assets—that is, an increase in foreign debt. The initial effect of the reduction in the cost of borrowing on world capital markets, as can be inferred from Equation (A18) in Appendix A, is an increase in private foreign indebtedness, which results in higher interest payments and a deterioration of the service account. To maintain external balance in the long run, the initial trade surplus (which is just equal, in absolute terms, to the initial deficit in the service account) must increase. Consumption must therefore fall. This leads to a depreciation of the real exchange rate, which in turn stimulates output of traded goods and further improves the trade balance. Since the nominal interest rate remains constant at $\rho + \varepsilon$, real money balances—and thus official reserves—fall also (see Equation (A19) of Appendix A). With foreign borrowing by private agents increasing, and net foreign assets held by the central bank falling, the economy's external debt unambiguously rises.

The impact effects of a permanent reduction in the world interest rate on private spending and relative prices are an increase in consumption and an appreciation of the real exchange rate. The reason why the ambiguity obtained previously disappears is that now the wealth and intertemporal effects operate in the same direction: the reduction in i^* not only encourages agents to save less (and consume more) today, but it also lowers the debt burden and generates a positive wealth effect. Although the trade balance and the service account move in opposite direction (the former deteriorates, whereas the latter improves), the net effect is a current account deficit on impact.

Figure 6 illustrates the dynamic path associated with a reduction in i^*. As shown in the figure, both curves $[\dot{c} = 0]$ and $[\dot{F} = 0]$ shift to the left, but the former shifts algebraically by more than the latter. Consumption jumps upward from point E to point A. Because of the permanent nature of the shock and the monotonic nature of the adjustment process, the current account remains in deficit throughout the transition period, with consumption falling towards its new, lower steady-state level, and the real exchange rate depreciating—with both effects contributing to a gradual reversal of the initial deterioration in the trade deficit. If the degree of intertemporal substitution is sufficiently low, the domestic interest rate will rise on impact, and the economy will experience a capital inflow.

SUMMARY AND CONCLUSIONS

The surge in capital inflows to developing countries since the early 1990s has been attributed in the recent literature to the existence of both 'pull' (domestic) and 'push' (external) factors. This paper has examined the macroeconomic effects associated with several of these factors. The first part presented an intertemporal optimizing model of a small open economy facing imperfect world capital markets. A key feature of the model is the assumption that domestic private borrowers (lenders) face an upward- (downward-) sloping supply curve of funds on world capital markets, and internalize the effect of their portfolio decisions on the interest rate that they face. An important aspect of the modeling approach adopted here is that it does not require (as is the case with many standard, infinite-horizon optimizing models of small open economies under perfect capital mobility) equality between the domestic rate of time preference and the world interest rate to ensure a stationary steady-state level of consumption—an assumption that appears to be quite arbitrary if one is considering permanent shifts in the world interest rate.

The second and third parts of the paper examined the role of 'pull' and 'push' factors in the behaviour of capital flows and the real exchange rate.

It was shown, in particular, that a positive shock to money demand raises consumption and holdings of foreign assets and appreciates the real exchange rate in the long run, but has an ambiguous effect on real money balances on impact. A positive productivity shock in the traded goods sector also leads to a long-run real appreciation (the Balassa-Samuelson effect), but the impact effect on the real exchange rate is ambiguous. An increase in government spending reduces private consumption and leads to a real appreciation in the long run, but has ambiguous effects on the economy's holdings of net foreign assets in the long run, as well as on the real exchange rate in the short run. A reduction in the world interest rate leads to a long-run real depreciation if the country is a net creditor, but has an ambiguous impact effect in the short run—because private consumption may either rise or fall, depending on the relative strength of conflicting wealth and intertemporal substitution effects. If the country is a net debtor, the real exchange rate depreciates in the long run and always appreciates on impact.

The main policy lesson of the analysis is thus that, in contrast to popular views, capital inflows do not necessarily lead to real exchange rate appreciation and a deterioration in external competitiveness. Much depends on the nature of the shock that drives capital flows, its duration, the time frame of the analysis (whether one is concerned with short-term, transitional, or long-term effects), the initial asset position of the economy, and the nature of the policy regime.

The analysis developed here can be extended in a variety of directions. First, the above setup could be used to examine the trade-off between policy instruments (such as a restrictive monetary policy, a tightening of controls over capital movements, and a reduction in government expenditure), when the policymakers' objective is to maintain the real exchange at its initial steady-state level—because, as illustrated in the net debtor case, the real appreciation that is associated with a reduction in world interest rates and capital infiows is considered undesirable. For instance, in such a case a tight fiscal policy (a cut in government spending on tradable goods, for instance) would reduce inflows by easing pressures on domestic interest rates and the trade deficit, while a restrictive monetary policy would tend to increase inflows. Second, although accounting for the portfolio effects of capital flows (as emphasized here) may be sufficient to explain why, in some countries, the real exchange rate underwent a sizeable appreciation in recent years, modeling the direct or indirect supply-side effects of these flows on productivity and capital accumulation—through, for instance, the financial system—may provide additional insight.

ACKNOWLEDGEMENTS

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APPENDIX A: DYNAMIC FORM AND STEADY STATE

Let $\dot{b} = 0$ and τ be endogenous in Equation (15). Setting the constant level of domestic bonds to zero yields

$$\tau = z^{\delta}(g_I + g_N/z) - \theta b^* - z^{\delta}(i^* + \varepsilon)R. \tag{A1}$$

Real factor income q is given by $z^{\delta-1}(q_{\mathrm{N}} + zq_{\mathrm{T}})$. Substituting Equations (14), (16), and (A1) in (3) yields

$$\dot{R} + \dot{B}^* = i^*(R + B^*) + q_{\mathrm{T}}^{\mathrm{s}} - c_{\mathrm{T}} - g_{\mathrm{T}}, \tag{A2}$$

which represents the consolidated budget constraint of the economy.[13]

Substituting Equations (8) and (13) in (A2) yields

$$\dot{R} + \dot{B}^* = i^*(R + B^*) + q_{\mathrm{T}}^{\mathrm{s}}(z,\alpha) - (1-\delta)z^{-\delta}c - g_{\mathrm{T}}. \tag{A3}$$

From Equations (13) and (16), the short-run equilibrium real exchange rate is obtained as

$$z = z(\bar{c}; \bar{\alpha}, \bar{g}_{\mathrm{N}}), \tag{A4}$$

where

$$z_c = \delta/[q_{\mathrm{N}}^{\mathrm{s}'} - \delta(1-\delta)\tilde{c}],$$

$$z_{g_{\mathrm{N}}} = 1/[q_{\mathrm{N}}^{\mathrm{s}'} - \delta(1-\delta)\tilde{c}],$$

which implies that $|z_c| < |z_{g_{\mathrm{N}}}|$.

The evolution of the economy is described by Equations (5), (6), (10), (14), (17), (A3), and (A4), which can be written as

$$z^{\delta}B^* = [i^* + \varepsilon - i(c, m, \chi)]/\gamma, \tag{A5}$$

$$\dot{c}/c = \sigma[i(c, m, \chi) - \varepsilon + \delta\dot{z}/z - \rho], \tag{A6}$$

$$z = z(c; \alpha, g_{\mathrm{N}}), \tag{A7}$$

$$R + B^* = i^*(R + B^*) + q_{\mathrm{T}}^{\mathrm{s}}(z, \alpha) - (1-\delta)z^{-\delta}c - g_{\mathrm{T}}, \tag{A8}$$

$$m = z^{\delta}R, \tag{A9}$$

with Equation (A1) determining residually lump-sum taxes.

To write the model in a more compact dynamic form, note that, from Equation (A9),

$$m = z^{\delta}(R + B^* - B^*) = z^{\delta}F - b^*,$$

or, using equation (A5):

$$m = z^{\delta}F - [i^* + \varepsilon - i(c, m, \chi)]/\gamma. \tag{A10}$$

Substituting (A7) in (A10) yields

$$m = \{\gamma z(c; \alpha, g_{\mathrm{N}})^{\delta}F - (i^* + \varepsilon) + i_c c + i_{\chi}\chi\}/(\gamma - i_m),$$

so that

$$m = m(\overset{\pm}{c}, \overset{+}{F}, \overset{-}{i^*}, \overset{-}{g}_{\mathrm{N}}, \overset{+}{\chi}, \overset{+}{\alpha}), \tag{A11}$$

where $m_c = (\gamma\delta z_c\tilde{F} + i_c)/(\gamma - i_m)$, where a '~' is used to denote steady-state values.[14] I assume in what follows that the initial level of assets is not too large, so that $m_c > 0$. Substituting (A11) in (A6) yields

$$\dot{c}/c = \sigma\{i[c, m(c, F; i^*, g_{\mathrm{N}}, \chi, \alpha), \chi] - \varepsilon + \delta\dot{z}/z - \rho\}. \tag{A12}$$

Assuming that changes in g_{N} and α occur only in discrete fashion, Equation (A7) implies that $\dot{z} = z_c\dot{c}$, with $z_c < 0$. Substituting this result in (A12) yields

$$\dot{c} = G(\overset{+}{c}, \overset{-}{F}; \overset{+}{i^*}, \overset{+}{g}_{\mathrm{N}}, \overset{+}{\chi}, \overset{+}{\alpha}) \tag{A13}$$

where, in particular:

$$G_F = (1/\sigma\tilde{c} - \delta z_c)^{-1}\gamma i_m/(\gamma - i_m) < 0,$$

$$G_c = (1/\sigma\tilde{c} - \delta z_c)^{-1}(i_c + i_m m_c) > 0,$$

since $i_c + i_m m_c = \gamma(i_c + i_m\delta z_c\tilde{F})/(\gamma - i_m) > 0$.[15]

Equation (A8) can be writtenas

$$\dot{F} = i^*F + \Psi(\bar{c}; g_{\mathrm{N}}, \overset{+}{\alpha}) - g_{\mathrm{T}}, \tag{A14}$$

where

$$\Psi_c = z_c[\partial q_{\mathrm{T}}^{\mathrm{s}}/\partial z + \delta(1 - \delta)\tilde{c}] - (1 - \delta),$$

$$\Psi_{g_{\mathrm{N}}} = z_{g_{\mathrm{N}}}[\partial q_{\mathrm{T}}^{\mathrm{s}}/\partial z + \delta(1 - \delta)\tilde{c}],$$

$$\Psi_{\alpha} = z_{\alpha}[\partial q_{\mathrm{T}}^{\mathrm{s}}/\partial z + \delta(1 - \delta)\tilde{c}] + (\partial q_{\mathrm{T}}^{\mathrm{s}}/\partial\alpha).$$

Although Ψ_{α} is in general ambiguous, it is here taken to be positive—so that the direct effect of α on output of tradables dominates the indirect effect through the real exchange rate. Linearizing Equations (A13) and (A15) around the steady state gives

$$\begin{bmatrix} \dot{c} \\ \dot{F} \end{bmatrix} = \begin{bmatrix} G_c & G_F \\ \Psi_c & i^* \end{bmatrix} \begin{bmatrix} c - \tilde{c} \\ F - \tilde{F} \end{bmatrix}. \tag{A15}$$

c is a jump variable, whereas F is a predetermined variable which evolves continuously from its initial level F_0. Saddlepath stability requires therefore one unstable (positive) root. For this condition to hold, the determinant of the matrix of coefficients in (A15) must be negative: $\Omega = G_c i^* - G_F\Psi_c < 0$. This condition requires the slope of the $[\dot{c} = 0]$ curve to be steeper than the slope of the $[\dot{F} = 0]$ curve, as shown in Figure 1, and can be seen as holding continuously as long as the world interest rate is sufficiently small. The saddlepath solution to the system is given by

$$F = \tilde{F} + (F_0 - \tilde{F})\,\mathrm{e}^{\nu t}, \tag{A16}$$

$$c - \tilde{c} = \kappa(F - \tilde{F}), \tag{A17}$$

where $\kappa \equiv (\nu - i^*)/\Psi_c = G_F/(\nu - G_c) > 0$ and ν denotes the negative root of the system.[16]

The steady-state solution is obtained by setting $\dot{c} = \dot{F} = 0$. From Equation (4), $\tilde{\pi} = \pi_{\mathrm{N}} = \varepsilon$. From Equation (6), $\tilde{r} = \tilde{i} - \varepsilon = \rho$. Substituting this result in (A5) yields

$$\tilde{b}^* = (i^* - \rho)/\gamma. \tag{A18}$$

From (4) and $\tilde{i} = \rho + \varepsilon$, long-run real money balances are given by

$$\tilde{m} = m(\tilde{c}, \rho + \varepsilon, \chi). \tag{A19}$$

APPENDIX B: EFFECTS OF ALTERNATIVE SHOCKS

From the results in Appendix A, it can be shown that

$$\mathrm{d}\tilde{c}/\mathrm{d}\chi = -i^*G_{\chi}/\Omega > 0, \tag{B1}$$

$$\mathrm{d}\tilde{F}/\mathrm{d}\chi = \Psi_c G_{\chi}/\Omega > 0, \tag{B2}$$

which indicate that a positive money demand shock leads to an increase in both consumption and the stock of net foreign assets.

Using (B1) and the equilibrium condition of the home goods market gives

$$d\tilde{z}/d\chi = z_c\ d\tilde{c}/d\chi < 0,$$

and from (A19),

$$d\tilde{m} = m_c\ d\tilde{c}/d\chi + m_\chi.$$

Since $m_c > 0$ and $m_\chi > 0$, and since $\tilde{c}$ rises, $\tilde{m}$ also rises.

The impact effect of an increase in χ on consumption is given by, using Equation (A17) and noting that $dF_0/d\chi = 0$:

$$dc_0/d\chi = d\tilde{c}/d\chi - \kappa(d\tilde{F}/d\chi),$$
$$= -\nu G_\chi/\Omega < 0,$$

which implies that $dz_0/d\chi = z_c\ dc_0/d\chi > 0$. From Equation (A11),

$$dm_0/d\chi = m_c\ dc_0/d\chi + m_\chi \gtreqless 0 \tag{B3}$$

The lower σ is, the lower ν and the lower the increase in consumption will be; the more likely it is that real money balances will increase on impact.

From Equation (17),

$$\frac{di_0}{d\chi} = i_c\frac{dc_0}{d\chi} + i_m\frac{dm_0}{d\chi} + i_\chi.$$

Using (B3) yields

$$\frac{di_0}{d\chi} = \{i_c + i_m m_c\}\frac{dc_0}{d\chi} + (i_m\, m_\chi + i_\chi), \tag{B4}$$

where the expression in brackets is positive (as shown above) and the expression in parentheses—noting that $m_\chi = i_\chi/(\gamma - i_m)$—is equal to $\gamma i_\chi/(\gamma - i_m) > 0$. Thus, since consumption falls on impact ($dc_0/d\chi < 0$), the net effect on the domestic interest rate is ambiguous. If the increase in consumption is not large, the net effect will be positive.

From Equation (A5) and $dF_0/d\chi = 0$, $dB_0^*/d\chi = -dR_0/d\chi$. Consequently,

$$db_0^*/d\chi = -dm_0/d\chi + \delta\tilde{F}(dz_0/d\chi) = -\gamma^{-1}(di_0/d\chi), \tag{B5}$$

so that if the domestic interest rate rises on impact, private holdings of foreign assets must fall.

Establishing the effects of an increase in α proceeds as above. First,

$$d\tilde{c}/d\alpha = (\Psi_\alpha G_F - i^* G_\alpha)/\Omega > 0, \tag{B6}$$

$$d\tilde{F}/d\alpha = (\Psi_c G_\alpha - G_c\Psi_\alpha)/\Omega > 0, \tag{B7}$$

which show that an increase in α leads to an increase in private consumption and in the stock of net foreign assets.

From (A19) and (B6), $d\tilde{m}/d\alpha = m_c\ d\tilde{c}/d\alpha > 0$. From the equilibrium condition of the nontraded goods market, the steady-state effect on the real exchange rate is given by, with z_c, $z_\alpha < 0$:

$$d\tilde{z}/d\alpha = z_c\ d\tilde{c}/d\alpha + z_\alpha < 0,$$

which shows that the real exchange rate appreciates. Using (A17) and noting that $dF_0/d\alpha = 0$:

$$dc_0/d\alpha = d\tilde{c}/d\alpha - \kappa(d\tilde{F}/d\alpha),$$
$$= -\nu G_\alpha/\Omega + \Psi_\alpha(G_F + \kappa G_c)/\Omega,$$

or, equivalently, since $G_F + \kappa G_c = \kappa\nu$:

$$dc_0/d\alpha = -\nu(G_\alpha - \kappa\Psi_\alpha)/\Omega \gtreqless 0.$$

Consequently:

$$dz_0/d\alpha = z_c\ dc_0/d\alpha + z_\alpha \gtreqless 0,$$

which shows that if consumption rises on impact, the real exchange rate always appreciates; by contrast, if consumption falls, the effect on z remains ambiguous. In general, the lower σ is, the lower the change in private consumption, and the more likely it is that the real exchange rate will appreciate on impact.

From Equation (A11):

$$dm_0/d\alpha = m_c\ dc_0/d\alpha + m_\alpha \gtreqless 0, \tag{B8}$$

where $m_\alpha < 0$. Since by assumption $m_c > 0$, real money balances fall on impact if consumption falls; but if consumption rises, the net effect on m is ambiguous.

From Equations (17) and (B8), and since $i_c + i_m m_c > 0$:

$$di_0/d\alpha = (i_c + i_m m_c)(dc_0/d\alpha) + i_m m_\alpha \gtreqless 0.$$

If consumption rises, i also rises; if consumption falls, the net effect on i is ambiguous. If σ is small, the nominal interest rate is likely to rise.

From equation (A5),

$$db_0^*/d\alpha = -\gamma^{-1}(di_0/d\alpha),$$

so that, if the domestic interest rate rises on impact, private holdings of foreign assets must decrease. In summary, the effects of g_N are given by

$$\mathrm{d}\tilde{c}/\mathrm{d}g_{\mathrm{N}} = (\Psi_{g_{\mathrm{N}}} G_F - i^* G_{g_{\mathrm{N}}})/\Omega < 0,$$

$$\mathrm{d}\tilde{z}/\mathrm{d}g_{\mathrm{N}} = z_c \; \mathrm{d}\tilde{c}/\mathrm{d}g_{\mathrm{N}} + z_{g_{\mathrm{N}}} < 0,$$

$$\mathrm{d}\tilde{F}/\mathrm{d}g_{\mathrm{N}} = (\Psi_c G_{g_{\mathrm{N}}} - G_c \Psi_{g_{\mathrm{N}}})/\Omega \gtreqless 0.$$

Indeed, for $\mathrm{d}c/\mathrm{d}g_{\mathrm{N}}$ to be negative requires $\Psi_{g_{\mathrm{N}}}/i^* > G_F/G_{g_{\mathrm{N}}} = \delta z_{g_{\mathrm{N}}} \tilde{F}$, or equivalently $[\delta^{-1}(\partial q_{\mathrm{T}}^{\mathrm{s}}/\partial z) + (1-\delta)\tilde{c}] > i^* \tilde{F}$. Since, from the current account equilibrium condition, $i^* \tilde{F} = (1-\delta)\tilde{c} - \tilde{q}_{\mathrm{T}}^{\mathrm{s}}$, the previous inequality always holds.

To show that $\mathrm{d}\tilde{z}/\mathrm{d}g_{\mathrm{N}} < 0$ proceeds in two steps. First, as indicated above, saddlepath stability requires $\Omega < 0$ so that $i^* < G_F \Psi_c / G_c$. Using the current account equilibrium condition given above, this condition can be shown to be equivalent to

$$-i^* i_c / i_m > (1-\delta) - z_c[(\partial q_{\mathrm{T}}^{\mathrm{s}}/\partial z) + \delta \tilde{q}_{\mathrm{T}}^{\mathrm{s}}] > 0. \tag{B9}$$

Second, $\mathrm{d}\tilde{z}/\mathrm{d}g_{\mathrm{N}} < 0$ requires that

$$\frac{z_c(\Psi_{g_{\mathrm{N}}} G_F - i^* G_{g_{\mathrm{N}}})}{\Omega} < -z_{g_{\mathrm{N}}},$$

or

$$\frac{z_c}{z_{g_{\mathrm{N}}}} \Psi_{g_{\mathrm{N}}} - \Psi_c < -i^* i_c / i_m,$$

so that

$$-i^* i_c / i_m > 1 - \delta. \tag{B10}$$

Comparing Equations (B9) and (B10) shows that, since the second term in (B9) is positive, condition (B10) always holds.

For $\mathrm{d}F/\mathrm{d}g_{\mathrm{N}}$ to be, say, negative requires that $\Psi_c G_{g_{\mathrm{N}}} - G_c \Psi_{g_{\mathrm{N}}} > 0$. This condition can be written as

$$\Psi_c / \Psi_{g_{\mathrm{N}}} - G_c / G_{g_{\mathrm{N}}} > 0. \tag{B11}$$

From the definitions of these partial derivatives, it canbe shown that

$$\frac{\Psi_c}{\Psi_{g_{\mathrm{N}}}} = \frac{z_c}{z_{g_{\mathrm{N}}}} - \frac{1-\delta}{z_{g_{\mathrm{N}}}[\partial q_{\mathrm{T}}^{\mathrm{s}}/\partial z + \delta(1-\delta)\tilde{c}]},$$

$$\frac{G_c}{G_{g_{\mathrm{N}}}} = \frac{i_c + \delta i_m z_c \tilde{F}}{\delta i_m z_{g_{\mathrm{N}}} \tilde{F}} = \frac{z_c}{z_{g_{\mathrm{N}}}} + \frac{i_c}{\delta i_m z_{g_{\mathrm{N}}} \tilde{F}},$$

so that, for (B11) to hold,

$$-\frac{i_c}{\delta i_m \tilde{F}} < \frac{1-\delta}{[\partial q_{\mathrm{T}}^{\mathrm{s}}/\partial z + \delta(1-\delta)\tilde{c}]}.$$

This expression shows that the lower $\partial q_{\mathrm{T}}^{\mathrm{s}}/\partial z$ is, the more likely this inequality will hold and thus the more likely that $\mathrm{d}\tilde{F}/\mathrm{d}g_{\mathrm{N}} < 0$. Conversely, the higher $\partial q_{\mathrm{T}}^{\mathrm{s}}/\partial z$ is, the more likely that $\mathrm{d}\tilde{F}/\mathrm{d}g_{\mathrm{N}} > 0$. Finally, we also have

$$\mathrm{d}c_0/\mathrm{d}g_{\mathrm{N}} = -\nu(G_{g_{\mathrm{N}}} - \kappa \Psi_{g_{\mathrm{N}}})/\Omega < 0,$$

$$\mathrm{d}z_0/\mathrm{d}g_{\mathrm{N}} = z_c \; \mathrm{d}c_0/\mathrm{d}g_{\mathrm{N}} + z_{g_{\mathrm{N}}} \gtreqless 0,$$

with other results derived along the lines described before. Agénor (1996) establishes the effects of a reduction in the world interest rate.

NOTES

1. Much interest has also focused on analyzing the implications of large capital flows for macroeconomic management. See Calvo *et al*. (1996), Corbo and Hernandez (1996), and Fernandez-Arias and Montiel (1996).
2. The assumption that the rate of time preference is equal to the world interest rate in this type of model is necessary to get a finite and positive consumption level in the steady state. Of course, alternative approaches, such as those based on Uzawa preferences or finite lifetimes (as in the Blanchard-Yaari framework) could be adopted.
3. The money-in-the-utility-function approach adopted here is actually less restrictive than it may appear; it is, in particular, functionally equivalent to a shopping-time model (Croushore, 1993). The specification chosen here permits a separation of the consumption elasticity from the interest elasticity of money demand, in contrast with the case where $\eta = \phi$.
4. Except otherwise indicated, partial derivatives are denoted by corresponding subscripts, while the total derivative of a function of a single argument is denoted by a prime. A sign over a variable refers to the sign of the corresponding partial derivative. Also, by definition, $\dot{x} \equiv \mathrm{d}x/\mathrm{d}t$.
5. The negative externality that would result from borrowing if individual agents behaved as if they did not affect the world interest rate is thus not present here. Of course, the focus here on individual risk as opposed to country risk does not mean that the latter is irrelevant; rather, I have chosen to ignore it, to avoid unduly complicating the analysis.
6. An early paper by Turnovsky (1985) provides a specification of households' portfolio decisions that leads to a result analytically similar to Equation (5).
7. Evidently, to argue that households are subsidized in this way by the government, and to assume at the same time that they fail to internalize the fiscal policy rule when making their portfolio decisions, is artificial. However, the fiscal rule considered here serves essentially to simplify the algebra, and does not affect the main implications of the analysis. Agénor (1996) considers the more general case.

8. Note that here, as a result of the assumption that the central bank and the government maintain continuously balanced budgets, the economy's net foreign asset position (measured in terms of the price of the consumption basket) is equal to the private sector's net worth.
9. Offsetting movements between domestic money and private holdings of foreign assets occur in the present setting because by assumption the central bank does not engage in sterilized intervention. As noted by various authors—see, for instance, Calvo *et al*. (1996), and Corbo and Hernandez (1996)—attempts to sterilize the monetary effects of capital inflows have often not been very effective and may have in fact exacerbated the problem.
10. The increase in labour demand in the traded goods sector raises the market-clearing wage (measured in terms of traded goods) and tends, at the initial level of the real exchange rate, to reduce output in the home goods sector. The real appreciation induced by the increase in consumption mitigates the fall in activity in that sector.
11. Penati (1987) has also shown (in a two-sector optimizing model with a time-varying rate of time preference) that an increase in government spending on nontraded goods may either lead to a current account deficit on impact and a fall in the steady-state level of assets (the ''conventional'' result), or a current account surplus on impact coupled with an increase in the steady-state level of assets.
12. The reason for considering the case of a net creditor country is because the focus here is on the net foreign asset position of the economy as a whole (which may be positive or negative in many developing countries, as a result of capital flight and portfolio diversification by private agents) rather than the asset position of the public sector alone, which is often negative. The analysis in this section draws largely on Agénor (1996), who also analyzes the dynamics associated with a temporary reduction in the world interest rate.
13. Integrating Equation (A2) yields the economy's intertemporal budget constraint, which requires that the current level of foreign assets be equal to the discounted stream of the excess of domestic absorption of traded goods over future production of exports.
14. In linearizing the model, all derivatives are calculated at an initial steady-state value of z equal to unity.
15. Note that G_c is positive regardles,s of the sign of m_c. Note also that $i_m m_\alpha > 0$, $i_m m_{g_N} > 0$, and that $i_m m_\chi + i_\chi > 0$.
16. It can be established that the lower σ, the lower v and the flatter the saddlepath SS will be. Thus, the lower the degree of intertemporal substitution, the smaller the initial jump in consumption induced by any given shock.

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