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Internationalization, Exchange Rates, and Fiscal Policy: A Portfolio Balance Approach

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I. Introduction

Recently, it has been argued that actions by Japan to deregulate its capital markets would lead to a stronger, less volatile yen and would lower Japanese trade surpluses. 1/ Inspired by this debate, this paper presents a model of capital market internationalization which can be used to examine the theoretical basis for these contentions. Analysis based on the model suggests that, at least in the short run, there is no theoretical presumption that deregulation would lead to a less volatile exchange rate, but that there is a theoretical presumption for expecting it to cause lower trade surpluses and a stronger home country currency--so long as there is a shift of habitat of funds favoring the internationalizing country. (Actual effects, of course, may differ from those predicted by the model, which is highly simplified.) Fiscal policy is also considered in pre- and post-internationalized states, to see how the effects of government expenditure policy on interest rates and foreign asset holdings are changed by internationalization. It is found that deregulation will unequivocally dampen the impact of expansionary fiscal policy on domestic interest rates and intensify the decumulation of foreign assets.

Note: This paper was begun while the author was at M.I.T. and is based on a model drawn from the author's doctoral dissertation. The author would like to thank J. Boorman, H. Feldman, P. Heller, H. Kanemitsu, and P. Masson for comments on earlier drafts of this paper. All errors and opinions are solely those of the author.

1/ See, for example, Greenwald (1983).

II. The Model

The model is a general equilibrium financial market model; assets are imperfect substitutes, and the degree of substitution is critical in assessing the consequences of capital market internationalization.

There are four sectors in the basic model; a fifth, the rest of the world, is added when the capital market is internationalized (Table 1). The central bank holds a single asset, government bonds (so the possibility of exchange market intervention by the central bank is excluded), a single liability, and high-powered money. These quantities are exogenous. The government sector supplies a primary and exogenous liability, bonds, holding no offsetting financial assets. There are two nonofficial domestic sectors, banks and individuals. The assets of banks are high-powered money (i.e., reserves), government bonds, and foreign exchange. 1/ Deposits are the only liability of the banks. Individuals also hold high-powered money (as currency), bonds, and foreign exchange; but they also hold deposits. Their only liability is net worth, which is the sum of government debt outstanding, and the domestic currency value of foreign exchange. Ideally, the market value of government debt should be included in the net worth calculation. But if the market value of debt is approximated by a linear function decreasing in the interest rate, the clearing equation can be rearranged and the coefficient on the bond interest rate interpreted as summarizing both the demand-increasing and supply-reducing effects of a rise in that rate. This interpretation is adopted in the analysis.

In the noninternational model that omits the rest of the world column, the row sums of Table 1 are all zero, except for foreign exchange assets, where the total, if positive, is the domestic currency value of the accumulated current account surplus. If the value is negative, it indicates cumulated deficits. Individuals and banks would then hold foreign currency liabilities instead of assets. This change of sign has no effect on the theoretical results. The row sums and the column sums together generate the identity that total net worth equals the sum of government debt and the domestic currency value of the accumulated current account.

The capital market is internationalized by adding the rest of the world sector, which holds domestic bonds as assets, obtained in return for foreign exchange. The row and column sums do not change because of the addition of the new sector, but the rates of return at which markets clear do adjust, because demand for the given quantity of bonds has increased, while supply of foreign exchange has expanded at the original level of demand.

1/ On the balance sheets of banks and individuals, foreign exchange is measured in domestic currency equivalent. The supply of foreign exchange, i.e., the accumulated current account, is measured in foreign currency, and converted at the spot exchange rate.

Table 1. Balance Sheets 1/

	Rates of Return	Sectors					
		Central Bank	Banks	Individuals	Government	Rest of World	Total
High-powered money (H)	0	$-\bar{H}$	H^b	H^i	0	0	0
Deposits (D)	r_d	0	-D	D^i	0	0	0
Bonds (B)	r	$\bar{B}^{cb}$	B^b	B^i	$-\bar{B}$	(B^r)	0
Foreign exchange (FX)	$r^*+k(\frac{\bar{e}}{e}-1)$ 2/	0	FX^b	FX^i	0	$(-FX^r)$	eACA 3/
Total		0	0	-NW 4/	$-\bar{B}$	0	eACA

1/ Negative signs denote liabilities. Entries in parentheses vanish in the non-internationalized model.

2/ r^* = given foreign interest rate; $k(\frac{\bar{e}}{e}-1)$ = expected percentage rate of appreciation of foreign currency during the period.

3/ e = spot exchange rate; ACA is the foreign currency value of accumulated current accounts. Thus eACA is the domestic currency value of foreign exchange.

4/ NW = net worth.

The rates of return on these assets are as follows. High-powered money earns no nominal return. Deposits earn a fixed return, determined by the authorities. Banks are assumed to accept all deposits made by the public. Government bonds earn a free market rate. The rate of return on foreign assets is a given foreign interest rate, suppressed here, plus the expected rate of appreciation of the foreign currency. 1/

It is assumed in the analysis that the percentage appreciation of the foreign currency expected during the current period is proportional to the total deviation of the spot rate from its long-term equilibrium level ($\bar{e}$), which is the level at which the nation ceases accumulating foreign assets (i.e., the level at which the current account balances). The expected appreciation of the foreign currency in the current period is taken to be a proportion, k, of the total required appreciation, $e^* = \bar{e}/e$, where e is the spot rate. Because $\bar{e}$ is defined by current account parameters, and because k is fixed by assumption, the spot rate must adjust to bring e^* to the market clearing level. That is, if investors are unwilling to hold the supply of foreign exchange at the current ratio, then they will sell foreign exchange, causing the foreign currency to depreciate (e to fall)--and of course the home currency to appreciate. As e falls at a given level of $\bar{e}$, the ratio $\bar{e}/e$ rises, making remaining investors more willing to hold foreign exchange. The ratio $\bar{e}/e$ will adjust to the level at which investors are just willing to hold the accumulated current account surplus plus the amount of foreign exchange supplied by the rest of the world (which is also sensitive to the ratio $\bar{e}/e$). (The accumulated current account is assumed to be positive, for ease of exposition.)

Each sector has linear demand curves for its assets. Demand for each asset rises with higher own rates of return, and falls with higher rates on the other assets. Since this is true for the demand of each sector, it is true of the aggregate demand. For the individual sectors, the demand curves are:

$$(1)\quad \begin{aligned} H^i &= -h^i_d r_d - h^i_r r - h^i_e k(e^*-1) + h^i_Y Y + h^i_N NW \\ D^i &= d^i_d r_d - d^i_r r - d^i_e k(e^*-1) - d^i_Y Y + d^i_N NW \\ B^i &= -b^i_d r_d + b^i_r r - b^i_e k(e^*-1) - b^i_Y Y + b^i_N NW \\ FX^i &= -x^i_d r_d - x^i_r r + x^i_e k(e^*-1) - x^i_Y Y + x^i_N NW \end{aligned}$$

where Y is income and NW net worth.

1/ The analysis does not require the explicit inclusion of the foreign interest rate. If included, another element would enter the constant term of the clearing equations.

These equations are subject to the adding-up constraints:

$$-h^i_d + d^i_d - b^i_d - x^i_d = 0$$

$$-h^i_r - d^i_r + b^i_r - x^i_r = 0$$

$$-h^i_e - d^i_e - b^i_e + x^i_e = 0$$

$$h^i_Y - d^i_Y - b^i_Y - x^i_Y = 0$$

$$h^i_N + d^i_N + b^i_N + x^i_N = 1$$

For banks, the deposits supplied to them are demand-determined, from the D^i equation given above. Their asset demand equations are:

(2) $$H^b = -h^b_r r + h^b_D D - h^b_e k(e^*-1) + h^b_Y Y$$

$$B^b = b^b_r r + b^b_D D - b^b_e k(e^*-1) - b^b_Y Y$$

$$FX^b = -x^b_r r + x^b_D D + x^b_e k(e^*-1) - x^b_Y Y$$

These differ from the individual sector equations in two ways. First, the deposit rate is excluded as a determinant of bank portfolio preferences. This implies an assumption that banks allocate their asset portfolios without thought to overall costs on the liability side. 1/ A change in r_d affects bank demands only through inflows and outflows of deposits, i.e., changes in individual portfolio preferences between deposits and other assets. The second difference is related: any change in individual behavior vis-à-vis deposits causes deposit flows which affect the banks. That is, the quantity D^i is a determinant of bank demands for other assets. Bank demand equations are also subject to their own adding-up constraints, which are:

$$-h^b_r + b^b_r - x^b_r = 0$$

$$h^b_D + b^b_D + x^b_D = 1$$

$$-h^b_e - b^b_e + x^b_e = 0$$

$$h^b_Y - b^B_Y - x^b_Y = 0$$

Supplies and demands for assets and liabilities for the central bank and the government sector are all exogenous. This leaves only the rest of the world sector in the internationalized model to consider. We posit that price and "habitat" are the only factors which matter to the rest of the world, so that:

1/ If the level of the deposit rate also carries information about policy intentions, then r_d could well be an independent element in bank portfolio decisions.

(3) $B^r = b^r_r r - b^r_e k(e^*-1) + Z$

$FX^r = x^r_r r - x^r_e k(e^*-1) + Z$

where Z, the habitat factor, gives the part of foreigners' home country bond demand that is insensitive to rates of return.

Note that the latter equation is a supply curve of foreign exchange denominated in home country currency. The crucial cross-equation restrictions here are that $b^r_r = x^r_r$ and $b^r_e = x^r_e$; since demand for bonds is the mirror image of supply of foreign exchange, the change in the value of bonds demanded in response to a change in a rate of return must identically equal the change in the value of foreign exchange supplied.

There are four assets in the model, so the balance sheet constraints imply that three rates of return must be determined. But the deposit rate is set by fiat, and the quantity of deposits is assumed to be demand-determined--eliminating the need for one of the three to be determined by a clearing equation. But both the bond rate and the rate of expected appreciation of foreign currency are endogenous. Hence, two equations must be used to clear the financial markets. Bond market clearing and foreign exchange market clearing are chosen, implying that the market for high-powered money clears implicitly. Substituting $e = \bar{e}/e^*$ into the expression eACA for supply of foreign exchange, we use the two clearing equations (implicit from Table 1):

(4) $\bar{B} = \bar{B}^{cb} + B^b + B^i \; (+B^r)$

(5) $\frac{\bar{e}}{e^*} ACA + (FX^r) = FX^i + FX^b$

to determine r and e*; the terms in parentheses exist in the internationalized capital market model and vanish in the noninternationalized one.

Appropriate substitutions from equations (1), (2), and (3) into (4) and (5) yield the following equilibrium conditions:

(4') $\bar{B} - \bar{B}^{cb} = B_r r - B_d r_d - B_e(e^*-1) - B_Y Y + B_N NW + Z$

(5') $\frac{\bar{e}ACA}{e^*} = -G_r r - G_d r_d + G_e(e^*-1) - G_Y Y + G_N NW - Z$

where upper case coefficients are aggregates of coefficients in equations (1), (2), and (3) (see Table 2 for exact correspondences). The coefficients B_r, B_e, G_r, and G_e will differ, and the constant Z will exist or vanish between the internationalized model and the

Table 2. Clearing Equation Parameters

Noninternationalized Case	Internationalized Case
Bond market equation	
$B_r = b_r^b + b_r^i - b_D^b d_r^i$	$+ b_r^r \; (= x_r^r)$
$B_d = b_d^i - b_d^b d_d^i$	
$B_e = k(b_e^b + b_e^i + b_D^b d_e^i)$	$+ kb_e^r \; (= kx_e^r)$
$B_y = b_Y^i + b_Y^b + b_D^b d_Y^i$	
$B_N = b_N^i + b_D^b d_N^i$	
Foreign exchange market equation	
$G_r = x_r^b + x_D^b d_r^i + x_r^i$	$+ x_r^r \; (= b_r^r)$
$G_d = x_d^i - x_D^b d_d^i$	
$G_e = k(x_e^b + x_e^i - x_D^b d_e^i)$	$+ kx_e^r \; (= kb_e^r)$
$G_y = x_Y^b + x_D^b d_Y^i + x_Y^i$	
$G_N = x_N^i + x_D^b d_N^i$	

noninternationalized one. The differences are due to the inclusion of new sources of demand from the rest of the world in the aggregated parameters of these clearing equations and to the addition of the habitat shift. 1/

Equations (4') and (5') are the essential equations of the model. They will be used to determine how internationalization affects the level and volatility of equilibrium interest rates and expected appreciation. Adding an IS curve to these equations allows the analysis of how internationalization changes the effects of expansionary fiscal policy on financial market variables.

III. Internationalization and Rates of Return

Internationalization affects the equilibrium interest rate and the expected appreciation of foreign currency in both the short and the long runs. The difference lies in what is considered the equilibrating variable for the foreign exchange market. In the short run, the accumulated current account is constant, so expected appreciation must be the equilibrator. That is, quantity is constant (except for the habitat-shift effect) so price must adjust. In the long run, however, the expected appreciation of foreign exchange (e*) must approach unity; otherwise the exchange rate would never be at the level needed to balance the current account, and domestic residents would accumulate foreign exchange without limit. That is, in the long run price is given, so quantity must adjust.

1. Long-run solution

Equations (4') and (5') may be restated as

$$(4'') \quad \bar{B} = B_r r - B_e(e^*-1) - 0_b + Z$$

$$(5'') \quad \frac{\bar{e}ACA}{e^*} = -G_r r + G_e(e^*-1) - 0_e - Z$$

where 0_b and 0_e stand for "other" terms in equations (4') and (5'), which are not of direct relevance here. In the long run, expected appreciation of the foreign currency must be zero, so e* must be unity. With this substitution, the solutions for the interest rate and the accumulated current account are:

$$(6) \quad r = \frac{\bar{B} + 0_b - Z}{B_r}$$

1/ We assume the habitat shift is by foreigners into domestic bonds. But it could also work the other way, with suitable changes in domestic agents' demand curves to accommodate constant terms. In practice, habitat shift can be in either direction.

$$(7) \quad ACA = \frac{1}{e} \quad - \frac{Gr}{Br}\left[\overline{B} + 0_b\right] - 0_e - Z\left[1 - \frac{G_r}{B_r}\right]$$

Effects of internationalization on long-run values of the interest rate and accumulated current account are determined by examining equations (6) and (7) for how upward movements of B_r, G_r, and Z affect the solutions. In equation (6), there is unequivocal downward pressure on the interest rate as B_r and Z rise; that is, the supply of bonds (plus "other" factors reducing demand) satisfies less of the newly higher overall demand.

To see the effect of internationalization on the long-run value of the accumulated current account, the impact of internationalization on terms within equation (7) is first examined, and an analysis is then made of how changes in these terms affect the overall expression. The terms in question are G_r/B_r and Z.

The term G_r/B_r is always less than unity, both before and after internationalization. This may be seen by use of definitions from Table 2 and substitution of adding-up constraints. 1/ Internationalization also raises the ratio G_r/B_r toward unity, since identical quantities ($x^r_r = b^r_r$) are added to numerator and denominator. We also know that Z changes from zero to a positive value (assuming always that the habitat shift effect favors the internationalizing country). The new habitat shift effect is a direct substitute for the accumulated current account, so the latter must fall to accommodate it. Both of these effects work to lower the accumulated current account in the long run.

To summarize: internationalization of capital markets will unequivocally lower the domestic bond rate and the level of the accumulated current account in the long run, so long as the habitat shift effect is inward.

1/ With this procedure it is seen that:

$$\frac{G_r}{B_r} = \frac{x^b_r + x^i_i + x^b_D d^i_r}{x^b_r + h^b_r + x^i_r + h^i_r + x^b_D d^i_r}$$

for the noninternationalized model. This is less than unity so long as the coefficients h do not vanish--i.e., so long as money demand exists. Internationalization will add identical terms ($x^r_r = b^r_r$) to the numerator and denominator. The larger this addition the closer G_r/B_r comes to unity; but unity is the limit which G_r/B_r approaches as x^r_r approaches infinity.

2. Short-run solution

The short-run solution also uses equations (4'') and (5''), but here expected appreciation is not equal to unity. Instead, the exchange rate moves to generate an expected appreciation that clears the markets, while the accumulated current account is considered fixed.

The short-run solution for the expected appreciation of the foreign currency is derived by solving equation (4'') for the interest rate and substituting this equation into equation (5''). 1/

The result is:

$$(8) \quad \frac{\bar{e}ACA}{e^*} = G_e(1-f)\ e^* - J$$

where $f = (G_r/B_r)(B_e/G_e)$, which we call the feedback coefficient, 2/ and

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1/ This solution abstracts from the effect of changes in the exchange rate on net worth, effects which arise from the revaluation effect that an exchange rate change has on foreign exchange held in the portfolio. Had this effect been included explicitly, a rise in the expected appreciation of the foreign currency would cause a fall in net worth; this is due to the spot appreciation of the domestic currency needed currently to generate an appreciation of the foreign currency expected in the future. The fall in net worth would have the effect of decreasing demand for all assets. Thus, each rise in expected appreciation generates a negative wealth effect on demand for bonds and demand for foreign exchange. This is equivalent to saying that the coefficient B_e is enlarged and the coefficient G_e reduced in absolute value from the levels implied in the text. Explicit inclusion of this wealth effect would not alter any results.

2/ We call f the feedback coefficient for the following reason. Consider equations (4'') and (5''). Ignoring the e* term in the denominator of (5''), we see that changes in r and e* due to operation of the linear portion of the system are determined from

$$\begin{bmatrix} 1 & B_e/B_r \\ G_r/G_e & 1 \end{bmatrix} \begin{bmatrix} \Delta r \\ \Delta e^* \end{bmatrix} = \ldots\ldots$$

When the interest rate rises by 1 percent, the effect spills onto expected appreciation of the foreign currency, which rises by G_r/G_e percent. If expected appreciation rises by 1 percent, this effect would spill onto the interest rate, which would rise by B_e/B_r percent. Combining the two effects, we see that a 1 percent rise in the interest rate would feed back through expected appreciation onto the interest rate, with the total feedback effect of $(B_e/B_r)*(G_r/G_e) = (B_e/G_e)*(G_r/B_r) = f$ percent of interest rate on itself. If the feedback coefficient exceeds unity, then a 1 percent rise of the interest rate would generate more than 1 percent of further rise; thus, the system would be unstable.

$$J = O_e + (G_r/B_r)(\bar{B}+O_b) + Z\left[1-(G_r/B_r)\right] + G_e(1-f)$$

Equation (8) is quadratic in e*; terms (1-f) and J exceed zero by virtue of value of G_r/B_r described above and the fact that f is less than unity by assumption of stability. The solution is:

$$(9) \quad \hat{e}^* = \frac{+ J + \left[J^2 + 4\ G_e(1-f)\bar{e}ACA\right]^{1/2}}{2\ G_e(1-f)}$$

where we have excluded the negative root, because it leads to a negative value for e* which is impossible by definition.

Again, to see the effect of internationalization on the short-run value of expected appreciation, the effects of internationalization on terms within equation (9) are first determined, and then an examination is made of how changes in those terms affect the overall expression. As seen above, internationalization will raise G_e, and will cause Z to be positive. The feedback coefficient f also rises unequivocally, for the following reason. As the feedback coefficient is the product of G_r/B_r and B_e/G_e, we need to look at how these ratios move to see the effect of internationalization on f. We saw above that substitution of adding-up constraints into the value of G_r/B_r (calculated from Table 2) proves that this ratio begins below unity and approaches it with internationalization. Precisely the same operation may be applied to the ratio B_e/G_e, with precisely the same result; B_e/G_e starts below unity and rises toward it with internationalization. Hence, as both components rise, the feedback ratio itself rises. With both G_e and f rising, the term $G_e(1-f)$ may rise or fall. These facts taken together imply a presumption that the term J will rise with internationalization, as two of its components rise unequivocally, and the other may rise as well.

The effect of internationalization on equilibrium e* can be deduced from movements of J, f, and G_e, and from equations (8) or (9). The rise in f shrinks the coefficient on e*, and thus requires a higher value of e* to regain equilibrium. The rise of J acts as a fall in net demand, and thus also requires a higher return on foreign exchange to regain equilibrium. But the rise in G_e has the opposite effect from the rise in the feedback ratio, and hence requires a lower e*. Thus, the higher feedback and habitat shift aspects of internationalization tend to raise e* in the short run, but the own-rate sensitivity growth tends to lower e* (Table 3). The presumption is that expected appreciation will have to rise, as a very large increase in foreign exchange market own-rate sensitivity would be required to counter the feedback effect, habitat shift effect, and the tendency for ratios of cross- to own-price sensitivity (e.g., G_r/B_r) to rise.

Table 3. Short-Run Effects of Internationalization on Expected Appreciation of the Foreign Currency

a. Both G_r/B_r and Z	rise;
$G_e(1-f)$ may	rise or fall;
so J probably	rises,
and hence e* must	<u>rise</u> to restore equilibrium.
b. $f = (B_e/G_e)\cdot(G_r/B_r)$	rises,
so $G_e(1-f)$	falls at the original G_e,
and hence e* must	<u>rise</u> to restore equilibrium.
c. G_e	rises,
so $G_e(1-f)$	rises at the original f,
and hence e* must	<u>fall</u> to restore equilibrium.

Short-run effects of internationalization on the domestic interest rate can be deduced from the solution of equations (4'') and (5'') for the interest rate:

$$(10) \quad \hat{r} = \frac{\bar{B} + O_b - Z}{B_r} + \frac{B_e}{B_r}(\hat{e}^{*}-1)$$

where ^ denotes the equilibrium value.

There is unequivocal downward pressure on the domestic interest rate as habitat shift occurs and as internationalization raises the interest responsiveness of bond demand. However, the second term will tend to rise, as both the ratio of cross-price effect to own-price effect and equilibrium expected appreciation may be presumed to rise. 1/ The overall effect on the bond rate is therefore equivocal.

c. Summary of short-run effects

Internationalization may be presumed to cause appreciation of the foreign currency in the short run as long as the habitat shift effect is inward, but effects on the bond rate are equivocal.

IV. Volatility

Since shocks are by their nature short-term, volatility in the system is examined through the variances of the interest rate and expected appreciation of the foreign currency implied by short-term solutions for the bond rate and expected appreciation. The stochastic elements in the solutions are in the O_e and O_b terms, e.g., the stochastic portion of income or stochastic shifts in demand curves. Recalling the definition of J and noting that the stochastic elements are both included in it, we may call J the "stochastic factor." Restating equation (9) as:

$$(9') \quad \hat{e}^{*} = g(J)$$

the variance of e* around its equilibrium value is approximated by:

$$(11) \quad \text{var } \hat{e}^{*} \cong (g')^2 \text{ var } J$$

1/ Note that the feedback coefficient can be restated as $(B_e/B_r)(G_r/G_e)$, i.e., the product of ratios of cross- to own-price sensitivities for the two markets. Since the feedback ratio unequivocally rises with internationalization, we may presume that both these ratios rise. Otherwise, one would have to rise a great deal to offset the fall in the other.

Where var J = var $0_e + (G_r/B_r)^2$ (var 0_b) + 2 (G_r/B_r) cov $(0_b,0_e)$. 1/

To examine how internationalization affects the variance of expected appreciation, we need only examine how it affects the variance of the stochastic factor and how it affects the response of expected appreciation to changes in the stochastic factor (g'). Internationalization affects the value of the stochastic factor through the ratio of foreign exchange market sensitivity to the bond rate relative to bond market sensitivity to the bond rate (i.e., through G_r/B_r). This ratio rises with internationalization, as seen above, so that the variance of the stochastic factor rises with internationalization. 2/

A strong habitat effect will raise the stochastic factor and hence raise the responsiveness of expected exchange rate change to the stochastic factor (raise g'). But internationalization also raises the feedback coefficient and the exchange market's own-price sensitivity. Thus, the product $G_e(1-f)$ moves in an equivocal way, so that the change in g' is equivocal from this side.

Thus, the variance of the stochastic factor rises with internationalization (subject to the condition in footnote 1 below), but the factor which multiplies this variance may either rise or fall. Hence, no unequivocal statement is possible on how internationalization affects exchange rate volatility.

The variance of the interest rate in the short run is derived from equation (10):

$$(10') \quad \text{var}\ (r) = (1/B_r)^2 \text{var}\ 0_b + (B_e/B_r)^2 \text{var}\ \hat{e}* + 2\ (1/B_r)(B_e/B_r)\ \text{cov}\ (0_b, \hat{e}*)$$

1/ This approximation is based on a first order Taylor approximation of (9').

$$e* \cong \frac{g(J_0)}{0!} + \frac{g'}{1!}(J-J_0), \text{ where } g' = \left[\frac{1}{G_e(1-f)}\right]^2 \left[1 + \frac{J}{[J^2+4G_e(1-f)\bar{e}ACA]^{1/2}}\right]$$

Note that dg'/gJ > 0. The equation for the variance of J assumes the supply of bonds and the habitat effect are not stochastic.

2/ This is always true when cov $(0_e,0_b) > 0$, and remains true even when cov $(0_e,0_b) < 0$, as long as $(G_r/B_r)\cdot(\sigma_b/\sigma_e) > -\rho$, where ρ is the correlation coefficient of 0_e and 0_b.

Internationalization will cause one factor, the term $(1/B_r)^2$ to lower the variance of the interest rate, but movements of all other factors are ambiguous. The coefficient on var $\hat{e}^*$ may either rise or fall, as may var $\hat{e}^*$ itself. The same is true of the coefficient on cov $(O_b, \hat{e}^*)$ and the covariance itself. Once again, the critical factor is whether own-price sensitivity grows faster than cross-price sensitivity for both rates of return in the bond market.

V. Fiscal Policy and Internationalization

To examine the impact of internationalization on fiscal policy, an IS curve is added to the model, and the level of income, exogenous until now, is made endogenous. This change requires a modification in the equilibrium condition for the foreign exchange market: there is no longer a unique level of the exchange rate at which the current account will balance; when income rises in the long run, the domestic currency must weaken to counter the effects of rising imports, and thus balance the current account. That is, the long-run equilibrium exchange rate $(\bar{e})$ weakens as long-run income rises. The model now consists of the IS curve equation:

$$(12) \quad Y = a\,G$$

where a is the income multiplier and G exogenous demand, plus equations (4') and (5') from above. Only the long run is considered--considering the short run is problematical, since fiscal policy requires time to work (its effect in the short run is zero). Thus, equation (5') becomes:

$$(5''') \quad \bar{e}\,(Y)\,ACA = -G_r r - G_Y Y + G_N NW - G_d r_d - Z$$

by setting e* to unity (by definition of the long run) and using $\bar{e}(Y)$ as the functional form linking long-run income levels with long-run equilibrium exchange rates $(d\bar{e}/dY > 0)$.

Expansionary fiscal policy has several effects on the economy of equations (4'), (5'''), and (12). First, it raises the level of income, due to the IS curve of equation (12). Second, it raises the stock of government bonds outstanding, to the extent that higher income fails to generate enough tax revenue to cover the higher expenditure. 1/ Third, this rise in bonds outstanding raises net worth. 2/ All these effects

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1/ With no endogenous labor market, output is demand-determined; no supply-side factors can cause revenue to rise more than expenditure.

2/ We continue, however, to abstract from valuation effects of exchange rate movements on net worth.

can be tied to the rise of government spending. The rise of income is $a\Delta G$. The rise in the deficit equals the rise in spending less the rise in revenue; with revenue tied proportionally to income by income tax rate t, the rise in the deficit is $(1-ta)\Delta G$, where $1-ta > 0$. This equals the rise in net worth.

Equations (4'), (5'''), and (12) are differentiated, e* is set to unity for the long run, and ΔY is eliminated. The changes in the interest rate and the accumulated current account can then be derived by solving:

$$(13)\quad (1-ta)\Delta G = B_r\Delta r - [B_Y a - B_N(1-ta)]\Delta G$$

$$(14)\quad ACA_0\frac{d\bar{e}}{dY}a\Delta G + \bar{e}_0\Delta ACA = -G_r\Delta r - [G_Y a - G_N(1-ta)]\Delta G$$

for Δr and ΔACA. 1/ The resulting expression for the long-run change in the interest rate is:

$$(15)\quad \Delta r = \frac{1}{Br}[(1-ta) + B_Y a - B_N(1-ta)]\Delta G$$

The term in brackets is the excess supply of bonds caused by a unit rise in government spending. The first expression is the raw increase in bond supply; the second is the quantity of bonds liquidated by holders to fund the higher money demand generated by higher income; and the third term is the amount by which bond demand rises when net worth rises by the value of the new deficit. Although the third term is negative, the overall expression is positive, since $B_N < 1$ by balance sheet adding-up constraints.

The solution for the long-run change in the accumulated current account is:

$$(16)\quad \Delta ACA = \frac{1}{\bar{e}_0} - \frac{G_r}{B_r}[(1-B_N)(1-ta)+B_Y a] - [G_Y a-G_N(1-ta)] - ACA_0\frac{d\bar{e}}{dY}\quad \Delta G$$

The first term gives the fall in foreign exchange demand due to the rise in the interest rate on bonds. The second term gives the difference of the liquidity and wealth effects on foreign exchange demand; people will liquidate foreign exchange to fund higher domestic money holdings, but the wealth effect from higher net worth works in the opposite direction.

1/ The habitat shift effect disappears when we difference the equations. Moreover, since it is a one-shot effect which occurs at the instant of internationalization, it will not affect the sensitivity of the rate of return to changes in fiscal stimulus.

The final term is the revaluation effect. The long-run exchange rate will depreciate (i.e., $\bar{e}$ will rise) as income rises; hence each unit of foreign exchange will be worth more domestic currency, so that fewer units of foreign currency need to be held to satisfy a given demand. With three factors pushing the equilibrium level of accumulated current account downward and only one (the wealth effect) pushing it upward, there is a presumption that expansionary fiscal policy will lower the accumulated current account in the long run.

Internationalization of capital markets will change the magnitude of these effects of expansionary fiscal policy. The effects on both the interest rate and the long-run accumulated current account are unequivocal. Because internationalization raises the interest rate responsiveness of bond demand (i.e., raises B_r), internationalization will moderate the rise in the interest rate after expansionary fiscal policy. This is only natural, since internationalization means that there is a larger market in which to sell new bonds. Internationalization also causes the accumulated current account to fall more in response to fiscal stimulus, due to the higher proportional growth of foreign exchange demand responsiveness to the bond rate relative to that of bond demand itself (i.e., the rise in G_r/B_r).

Thus, the effects of internationalization on fiscal policy's influence on the economy may be summarized as follows: internationalization will moderate the long-run rise in the interest rate and intensify the decumulation of foreign assets which are generated by expansionary fiscal policy.

VI. Conclusion

Four unequivocal results emerge from the study of the effects of internationalization on the exchange rate, the trade account, and the impact of fiscal policy: internationalization (i) causes the bond rate to fall in the long run; (ii) causes the accumulated current account to fall in the long run; (iii) moderates the rise in the interest rate caused by expansionary fiscal policy; and (iv) intensifies the decumulation of foreign assets caused by expansionary fiscal policy. In the short run there is a presumption of a rise in expected appreciation, but no clear result on the bond market. The effects of internationalization on exchange rate volatility are ambiguous (Table 4).

If the model in this paper were to be empirically estimated, several factors would have to be considered. The first is how to test the hypothesis that internationalization has occurred between two periods--for this, the habitat shift effect and changes in the feedback coefficient must be determined. These can be isolated from the short-run version of the model by either of two estimation techniques:

Table 4. Summary of Effects of Internationalization

	Endogenous Variables		
	Interest Rate on Domestic Bonds	Accumulated Current Account	Expected Appreciation of the Foreign Currency 1/
1. Effect on level of endogenous variable			
Short run	?	--	Presumption of rise
Long run	fall	fall	--
2. Effect on volatility of endogenous variable	?	--	?
3. Effects on fiscal policy	$\frac{d_r}{d_G}$ falls	$\frac{dACA}{d_G}$ rises	--

1/ $e^* = \bar{e}/e$. A rise in e^* is generated by a fall in e, the spot rate, measured in units of home currency per unit of foreign currency. Thus, expected appreciation of the foreign currency is equivalent to spot appreciation of the home currency.

(i) use of the simultaneous system comprising equations (4') and (5'), or (ii) use of the full reduced form equation for the expected exchange rate change equation (9). The former has the advantage that the error structure for the simultaneous system is more straightforward--since combinations of potentially correlated errors occur in the full reduced form for expected appreciation. On the other hand, the large number of constraints and fewer parameters to be estimated in the latter would increase the confidence in conclusions. Nonlinear methods would have to be used for either method, since nonlinearity is an essential property of the exchange rate clearing equation.

In addition to these technical issues, there are two more basic issues. The first is how to determine the level of the equilibrium exchange rate. Current account balance has been very much the exception for most industrialized nations over the last 20 years, so that identifying the exchange rate at which the current account balances is difficult. One can make judgments about the band within which the equilibrium rate lies, but such a band would be quite wide. Thus, it would be necessary to estimate the model and test hypotheses for several assumed levels of the equilibrium exchange rate, and then determine if the results of the hypothesis tests are robust with respect to choice of equilibrium exchange rate.

The second underlying issue concerns the chronological nature of internationalization. The theoretical model considers it to be instantaneous; if this were the case, one could split the sample period into ex ante and ex post portions, and simply test for coefficient changes. However, internationalization is not, in fact, instantaneous; regulations, elasticities, and habitats change gradually over time. A more precise test of internationalization would require a scheme of time-dependent parameters. The existence of internationalization would be tested by looking for change from zero to nonzero values of the time-dependent parameters, and acceleration of internationalization would be tested by looking for changes in the values of the nonzero time-dependent parameters.

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