CAN A FISCAL CONTRACTION STRENGTHEN A CURRENCY? SOME DOUBTS ABOUT CONVENTIONAL MUNDELL-FLEMING RESULTS

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Federal Reserve Bank of New York
Research Paper No. 9629

August 1996

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Revised April 1996

*The views expressed in this paper reflect those of its authors and not necesssarily those of the Federal Reserve Bank of New York or the Federal Reserve System.

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Abstract

In this article, we demonstrate that a fiscal expansion can induce *both* a short- and long-run depreciation of a currency and, by parallel arguments, fiscal contraction can induce short- and long-run appreciation. This possibility hinges on a country being a debtor with at least some of its debt servicing costs reset periodically in response to changes in its domestic interest rates. In the simpler version of our model, we show that a fiscal expansion can lead to an instantaneous depreciation and a current account deficit, causing the currency to continue to depreciate over time. The current account deficit develops despite the currency depreciation because debt service payments increase due to the higher interest rates induced by the fiscal stimulus. The second version of our model assumes the trade deficit responds with a lag to relative prices. This model implies that expansionary fiscal policy may induce not only a currency depreciation and a current account deterioration, but a widening of the trade deficit as well. In both models, an instantaneous depreciation following a fiscal expansion becomes more likely if a country's net external debt is large.

I. Introduction

Fiscal contractions are currently being undertaken or contemplated by a large number of countries, and the effect of fiscal policy on exchange rates has once again become a focal point of macropolicy discussions. According to the standard view, espoused by academicians such as Feldstein (1995), Krugman (1995), and the writers of the IMF *World Economic Outlook* (1995), a fiscal contraction causes a currency depreciation in the short run, followed by a long-run appreciation. This view is consistent with intertemporal optimizing models (Frenkel and Razin 1987) as well as dynamic versions of the standard Mundell-Fleming model (Sachs and Wyplosz 1984, IMF 1995). Moreover, the story is consistent with the broad movements of U.S. dollar since 1980.

In contrast, finance ministers, central bankers, and market particpants have recently claimed that a fiscal contraction might strengthen a currency[1]. The recent exchange rate experiences of a large number of countries are often cited as favorable evidence for this view. Eight OECD countries underwent major fiscal expansions over the last fifteen years and, in five cases, their exchange rates depreciated around the same time (see Table 1). Moreover, the two countries that underwent the largest fiscal contractions during this period, Denmark and Ireland in the mid-1980s, experienced currency appreciations.

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[1]See the June 3rd-9th 1995 issue of *The Economist*, p.72.

Table 1

Exchange Rate Performance Around Fiscal Expansions

Country	Time Frame	Exchange Rate
USA	Early 1980s	Appreciation
Germany	1989-1992	Appreciation
Japan	1990-4	Appreciation
Finland	Early 1990s	Depreciation
Italy	Early 1990s	Depreciation
Sweden	Early 1990s	Depreciation
France	Early 1980s	Depreciation
Canada	Mid-1980s	Depreciation

Source: IMF (1995, p. 76).

Why does the standard model correctly predict the exchange rate experiences of the United States, Germany, and Japan but fail for all these other countries? Surely it cannot be the size differences--the Mundell-Fleming model is supposed to be most relevant for small open economies. One explanation, articulated in the IMF *World Economic Outlook* (1995) and by others[2], claims that changes in fiscal policy induce shifts in risk premia not captured in the standard model. For example, a country that undergoes a fiscal consolidation might experience a currency appreciation if investors sufficiently reduce the risk premium they require to hold that country's external liabilities. However, despite apparently widespread agreement about this potential transmission mechanism, we are

[2]Feldstein (1995), for example, mentions but dismisses as irrelevant for a country like the United States, the possibility that fiscal contraction could induce a reduction in inflation or default risk premia that might strengthen the domestic currency. In contrast, Dornbusch (1995) and various commentators in a discussion on "What do Budgets Do?" in *Budget Deficits and Debt: Issues and Options* (1995, pp. 139-49) appear more receptive to this story.

unaware of any attempt to incorporate it into a formal model.[3] Moreover we think a formalization consistent with rational expectations may prove difficult: the exchange rate appreciation induced by a country's fiscal consolidation should itself lead to a worsening of its current account position that would undermine the original basis for the lowering of the risk premium.

A second explanation claims that the increased investment and productivity growth associated with a fiscal contraction will strengthen the domestic currency. The evidence on productivity growth and exchange rates, though, is ambiguous (see, for example, Rogoff (1996)).

A third explanation notes that fiscal contractions reduce domestic income, which in turn reduces the current account deficit. The currency then appreciates immediately to restore exchange-market equilibrium. While this explanation is accepted and predicted by a variety of models such as the Wharton model of the late 1980's, it is beside the point in terms of the central policy issue at hand. What policy makers are debating is whether or not a fiscal contraction will strengthen a currency *even if* the central bank pursues a monetary policy that maintains full employment.

A fourth explanation suggests the possibility that a fiscal contraction would expand aggregate demand. Giavazzi and Pagano (1990) and Bertola and Drazen (1993) develop macroeconomic models in which fiscal contractions might stimulate aggregate demand and output. If these models were imbedded in an open economy setting, a fiscal contraction might also induce short-run currency appreciation. In the long run, the exchange rate would nonetheless depreciate because of the likely buildup in external debt induced by the initial appreciation.

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[3]Many models (e.g., Sachs and Wyplosz 1984) incorporate imperfect asset substitution and predict that a decline in a country's current public debt outstanding can cause its currency to appreciate. This effect, however, is quite different from an exogenous shift in the risk premium in anticipation of a decline in public debt in the future.

A final explanation suggests the anomolous result could occur because of the lagged response of trade flows to exchange-rate changes, the so-called "J-curve effect." This view suggests that a fiscal contraction, that is, an increase in national savings, could improve the current account with an appreciation, since the Marshall-Lerner conditions are reversed in the short run. The dynamics of this story are not fully explored, though.

Rather, we propose an alternative explanation for differences in short-run exchange rate experiences in reaction to similar fiscal policies, an explanation that depends upon countries' net external debt positions. According to the OECD (1995, p. A56) the United States, Germany, and Japan were all net external creditors at the time of their fiscal expansions; whereas, the other countries cited were all net debtors as they underwent the shifts in their fiscal policies. Their external debt service payments therefore rose (fell) as their interest rates rose (fell) in response to their fiscal expansions (contractions). As we show below, such changes in debt service payments can potentially reverse the short-run predictions of the dynamic version of the Mundell-Fleming model, without reversing its long-run predictions.

II. The Model

A. Overview

Sachs and Wyplosz (1984) and Kole (1988), among others, have demonstrated--in the context of what Krugman (1995) calls the modified Mundell-Fleming (MMF) model--that a fiscal expansion usually leads to an instantaneous currency appreciation that is followed over the long run by depreciation.[4] Our purpose is to show that when explicit

[4]Frenkel and Razin (1987) show that these predictions are also implied by intertemporal optimizing models in which the interest on external debt is determined by world interest rates. Barro (1974) and Evans (1986) also argue that government spending in intertemporal optimizing models have real exchange rate effects.

account is taken of a country's net foreign asset position, the same type of model predicts that a fiscal expansion can induce a short- and long-run depreciation.

We specify the simplest possible dynamic version of the MMF model that permits this demonstration. To this end, we abstract from monetary policy considerations by assuming the economy's output is fixed at its full employment level and the price level is also fixed and normalized to unity.[5] The four essential specifications of the model are (1) the goods market equilibrium, (2) asset market equilibrium, (3) exchange rate expectations, and (4) a balance of payments constraint which governs the dynamics of foreign indebtedness. The model shares with Dornbusch and Fischer (1980), Sachs and Wyplosz (1984) and Kole (1988) an emphasis on dynamics driven by external debt. In all of these models, the current account affects net debt accumulation through the balance of payments constraint. These changes in net debt feed back into aggregate demand through a wealth effect. Aggregate demand then affects interest rate determination which in turn affects exchange rate determination, completing the feedback loop to the current account.

We present two versions of our basic model. In the first version, the response of trade flows to relative prices is assumed to occur instantaneously and to satisfy the Marshall-Lerner condition. The second version introduces a lagged response of trade flows to relative prices. This version permits coexistence of "twin deficits" and emphasizes that the J-curve is neither necessary nor sufficient to overturn the conventional wisdom. That is, even with the J-curve, a fiscal contraction still only leads to currency appreciation when a country is a net creditor.

B. The Building Blocks

[5]Our model is consistent with a traditional Mundell-Fleming framework in which money demand is a function of income and interest rates, output is demand-determined, with aggregate demand depending on income, the interest rate, real wealth, and the real exchange rate, price-level changes depend on the gap between current output and full-employment output, and where the monetary authorities target the domestic interest rate to keep the prices and output at their full employment levels (see our 1995 paper for an example with specific functional forms).

In the goods market, aggregate demand is the sum of absorption and net exports. Absorption is a function of income, y, interest rates, r, net foreign indebtedness measured in units of domestic output, f, and a fiscal policy variable, g.[6] The trade surplus is a function of income and the exchange rate, e, which is measured in foreign currency units per dollar so that an increase in e is a depreciation. (Omitting r, y, f and g from the determination of the trade balance is not critical but further simplifies the analysis.)

$$\begin{aligned} &y = A(y,r,f,g) + T(e); \\ (1) \quad &A_y, A_g, T_e > 0; \quad A_r, A_f < 0. \end{aligned}$$

Since y is constant we ignore its potential effect on the trade balance, and the goods market equilibrium can be used to solve implicitly for the interest rate as a function of just e, f, and g:

$$\begin{aligned} &r = R(e,f,g); \\ (2) \quad &R_e = \frac{-T_e}{A_r} > 0;\ R_g = \frac{-A_g}{A_r} > 0;\ R_f = \frac{-A_f}{A_r} < 0. \end{aligned}$$

Currency depreciation or a fiscal expansion place upward pressure on interest rates whereas, an increase in foreign indebtedness, via its wealth effect on consumption, tends to reduce interest rates.

[6]Our fiscal policy variable is constructed to focus attention on the role of fiscal policy in affecting national savings. It can be related to the government budget constraint if, in the spirit of Sachs and Wyplosz (1984) we assume the fiscal balance is a specific function of the level of net indebtedness. An alternative approach, followed by Kawai and Maccini (1995), has the fiscal balnce constant for an interval of time, after which taxes are adjusted to eliminated the deficit.

In asset markets, domestic and foreign bonds are assumed to be perfect substitutes, so that the domestic interest rate, r, equals the foreign interest rate, r^*, plus expected currency depreciation. For simplicity, and to highlight that our results do not depend upon expectational error, we assume perfect foresight. Thus, the uncovered interest rate parity condition can be written as,

$$(3) \quad \frac{\dot{e}}{e} = r - r^* = R(e, f, g) - r^*.$$

To complete the model, we write out the balance-of-payments constraint (BOPC) that simply states that additions to the existing stock of net foreign indebtedness equal the current account deficit, which in turn consists of debt service payments minus the trade surplus:

$$(4A) \quad \dot{f} = rf - T(e).$$

Some elaboration of the link between gross and net assets may be useful. Let f^d be foreign holdings of domestic issued debt, measured in units of domestic output. Let f^* be domestic holding of foreign debt, measured in units of foreign currency[7]. Net indebtedness f, is thus $f^d - ef^*$. The balance of payments constraint can then be written as

$$(4B) \quad \dot{f}^d - e\dot{f}^* = rf^d - r^*ef^* - T(e)$$

[7] f^d and f^* could be negative if debt is issued in other than the home-country currency.

Substituting (3) for r^*, noting that $\dot{f} = \dot{f}^d - e\dot{f}^* - \dot{e}f^*$ and rearranging yields (4A). The net creditor or zero net debtor case is the "standard" one considered by Sachs and Wyplosz (1984) and Kole (1988).

C. Long-Run Effects of Fiscal Policy

Equations (2), (3) and (4A) together comprise the model we use to solve for the dynamic responses of e, f, and r to changes in g. First, we consider the long-run behavior of the model during which the exchange rate and the stock of debt must stabilize, or $\dot{f} = \dot{e} = 0$. The long-run equilibrium is summarized by

(5) $\bar{r} = r^* - R(\bar{e}, \bar{f}, \bar{g})$

(6) $r^* \bar{f} = T(\bar{e})$

where "bars" are used to denote the long-run values associated with $g = \bar{g}$. In the long run, the domestic interest rate must equal the foreign interest rate and the current account must be in balance. We will denote (6) as the long-run balance-of-payments constraint (LRBOPC).

Equations (5) and (6) imply that a permanent increase in g will raise both $\bar{e}$ and $\bar{f}$. Expansionary fiscal policy, reflecting lower domestic savings, leads to higher levels of indebtedness, which restores domestic savings by depressing consumption demand. In the long run, the exchange rate depreciates because a larger trade surplus is needed to finance increased debt service payments. The weaker currency also offsets some of the decline in domestic savings by depressing import demand.

Since the exchange rate will depreciate in the long-run, it seems reasonable to ask why some of the depreciation cannot occur at impact, offsetting some of the domestic demand stimulus from g, yet still justifying expectations of further depreciation. The answer is that this possibility hinges on whether a country is a sufficiently large net debtor. To see this, we now move to an explicit analysis of the dynamic adjustments to a one-time, unanticipated permanent increase in g.

D..Dynamic Effects of Fiscal Policy

Equations (3) and (4A) constitute a coupled system of differential equations in f and e. A neccessary and sufficient condition for saddlepath stability of the linear approximation to this system is that $-A_f > r^*$. We assume this holds.[8]

Preparatory to the full dynamic analysis, we lay the groundwork for construction of the phase diagrams of (3) and (4A). First consider the $\dot{e} = 0$ locus constructed from setting $\dot{e} = 0$ in (3). This locus represents the combinations of f and e that assure equilibrium in both international capital and domestic goods markets with a stable exchange rate. It has positive slope equal to $\frac{-R_f}{R_e}$ because, in order to offset the weakening of domestic demand caused by an increase in external debt, the exchange rate must depreciate to raise net exports.

Now consider the $\dot{f} = 0$ locus derived from equation (4A). It represents the combinations of f and e that equate debt service to the trade surplus, so that external debt is stable. It has slope equal to $\frac{r^* - fR_f}{T_e + fR_e}$. Since debt service payments depend on the domestic interest rate, the growth of foreign debt depends on the exchange rate not only

[8]This condition is identical to that found in Dornbusch and Fischer (1980) and Sachs and Wyplosz (1984) and is implied by Blanchard's constant-probability-of-death consumption function (Blanchard 1983).

through the trade balance but also through the interaction between the exchange rate and the domestic interest rate. Hence, the slope of the $\dot{f} = 0$ curve differs from the slope of the long-run balance-of-payments constraint curve. If the country is a net creditor ($f < 0$), the slope is positive, less than the slope of the $\dot{e} = 0$ locus, but greater than $\frac{r^*}{T_e}$, the slope of the LRBOPC. If the country is a "modest" net debtor ($0 > f > -A_r$), the slope that is less than the slope of the LRBOPC and may even be negative. If the country has a large debt ($f > -A_r$), the curve has a steeper slope than the curve $\dot{e} = 0$ curve.

Figure 1 depicts the $\dot{e} = 0$ locus, the LRBOPC (the dashed line denoted $r^* f = T(e)$), and the three regions in which the $\dot{f} = 0$ locus may fall. If $f < 0$, the $\dot{f} = 0$ locus falls in region A. If $0 > f > -A_r$, the $\dot{f} = 0$ locus falls in region B. If $f > -A_r$, the $\dot{f} = 0$ locus falls in region C.

insert figure 1

We can now trace out the dynamic adjustments to an increase in g. First consider the net creditor case as depicted in Figure 2. At the initial equilibrium, the economy is at point A, with $e = e_0$ and $f = f_0$. Following the instantaneous increase in g, the $\dot{e} = 0$ and $\dot{f} = 0$ curves shift out from point A to point C. The arrows of motion for e and f associated with the new $\dot{e} = 0$ and $\dot{f} = 0$ curves can be determined by considering $\frac{\partial \dot{e}}{\partial e}$ from (3) and $\frac{\partial \dot{f}}{\partial e}$ from (4A):

$$(7) \quad \frac{\partial \dot{e}}{\partial e} = R_e > 0; \ \frac{\partial \dot{f}}{\partial e} = (\frac{-T_e}{A_r})[\bar{f} + A_r] < 0 \text{ for } \bar{f} < 0.$$

$\frac{\partial \dot{e}}{\partial e}$ is positive because an increase in e holding f constant, creates excess demand in the goods market that must be offset by a higher interest rate. The higher interest rate must be matched by a higher expected depreciation to maintain equality between foreign and domestic rates of return.

$\frac{\partial \dot{f}}{\partial e}$ reflects both a direct and an indirect effect. Holding f constant, an increase in e creates a trade surplus, reducing $\dot{f}$ directly. An increase in e also calls forth an increase in r via the goods market, as outlined above. This change in r then affects debt service payments. If f is negative, this indirect effect of a higher e affecting $\dot{f}$ through debt service payments reinforces the direct trade-balance effect.

From the direction of the phase diagram arrows, we see that the stable arm of the saddlepath trajectory, depicted as the heavy arrowed line, must pass between the $\dot{e} = 0$ and $\dot{f} = 0$ lines. By standard arguments, following the change in g, e and f must immediately jump to a point on this saddlepath. The question is to what point on this saddlepath do e and f jump?

For the net creditor case, we can immediately rule out a depreciation, that is, an increase in e above e_0. If e were to go up, f, which is negative in the net creditor case, would instantaneously go down, since f^d and f^* cannot move, and $f = f^d - ef^*$. That is, the increase in e would increase the value of the existing domestic holdings of foreign debt, thus decreasing domestic net indebtedness[9]. From Figure 2, we see that there is no point on the saddlepath where, from point A, e could go up and f could go down. The only possibility, then, is an instantaneous jump to a point where e has gone down and f has gone up. This means that the instantaneous jump from point A must be to a point on the

[9] In addition to assuming f<0, we are also assuming $f^* \geq 0$. That is, the domestic country is not issu.ing foreign-currency-denominated debt.

saddlepath southeast of A, such as B. Following this instantaneous jump, *e* and *f* gradually increase, moving along the saddlepath to the new long-run equilibrium at C.

insert figure 2

Now consider the net debtor case. The phase diagram for the "moderate" debtor case is displayed in Figure 3, and for the "large" debtor in Figure 4. In both cases, $\frac{\partial \dot{e}}{\partial e} > 0$. For the "moderate" debtor case, $\frac{\partial \dot{f}}{\partial e} < 0$, but for the "large" debtor case, $\frac{\partial \dot{f}}{\partial e} > 0$ (see equation (7)). For both cases, the phase diagram arrows indicate that the slope of the stable arm of the saddlepath may be greater than or less than or equal to the slope of the LRBOPC. In Figure 3, we display a case with the saddlepath flatter than the LRBOPC, and in Figure 4 we display a case with the saddlepath steeper than the LRBOPC.

For the case depicted in Figure 3, the instantaneous jump from point A must be a depreciation along with a fall in *f*, to a point like B. We can rule out an appreciation, since a fall in *e* increases *f* by devaluing domestic holdings of foreign assets. As can be seen from Figure 3, there is no place on the saddlepath where, from point A, *e* can fall and *f* fall as well. Hence, the initial jump must involve devaluation. Following the instantaneous jump, *e* and *f* gradually increase along the saddlepath to the new long-run equilibrium at point C.

insert figure 3

For the case depicted in Figure 4, the instantaneous jump must be an appreciation along with an increase in *f*. Again, depreciation is ruled out since an increase in *e* decreases net indebtedness by revaluing domestic holdings of foreign assets. After the jump, both e and f gradually increase along the saddlepath.

insert figure 4

Whether the initial jump entails appreciation or depreciation thus hinges on whether the slope of the saddlepath is steeper or flatter than the slope of the LRBOPC, which is $\frac{T_e}{r^*}$.

What we need to do, then, is compute the path of the stable arm of the saddlepath and compare its slope to that of the LRBOPC. We will investigate the slope of the saddlepath by examining its linear approximation near the long-run equilibrium $(\bar{e},\bar{f})$. Consider the following linear approximations of equations (3) and (4A)

(8) $\dot{e} = \bar{e}R_e(e-\bar{e}) + \bar{e}R_f(f-\bar{f})$

(9) $\dot{f} = \bar{f}R_e(e-\bar{e}) + \bar{f}R_f(f-\bar{f}) + r^*(f-\bar{f}) - T_e(e-\bar{e})$

The stable arm of the saddlepath associated with (8) and (9) will be a linear relationship between e and f:

(10) $f = K + ke$

where K and k are constants to be determined. Time differentiating (8) yields

(11) $\dot{f} = k\dot{e}$

Substituting (8) and (9) into (10) and equating k to the slope of the resulting linear relationship between F and e yields the following equation for k:

$$(12)\quad k^2 = \frac{\{[A_f\bar{f} + r^* - R_e\bar{e}]k + R_e\bar{f} - T_e\}}{R_f\bar{e}}$$

Call k^* the value of k that satisfies (12). The question is whether k^* is greater than, less than, or equal to $\frac{T_e}{r^*}$. If $k^* > \frac{T_e}{r^*}$, fiscal expansion will lead to instantaneous depreciation. To determine the condition under which $k^* > \frac{T_e}{r^*}$, denote the left-hand side of (12) as $g(k)$ and the right-hand side as $f(k)$. Denote $\bar{k}$ as $\frac{T_e}{r^*}$. If $g(\bar{k}) < f(\bar{k})$, then $k^* > \bar{k}$. This is illustrated in Figure 4.

[Insert Figure 5 here]

Substituting $\bar{k}$ into $g(k)$ and $f(k)$, the condition that $g(\bar{k}) < f(\bar{k})$ is given by

$$(13)\quad [\frac{T_e}{r^*}]^2 < \frac{\{\frac{[A_f\bar{f} + r^* - R_e\bar{e}]T_e}{r^*} + R_e\bar{f} - T_e\}}{R_f\bar{e}}$$

or, upon simplification using the definitions of R_e and R_f from (2) and using the long-run equilibrium condition given by (6),

(14) $\bar{f} > \frac{T_e \bar{e}}{r^*}$

This condition suggests that, the larger a country's external debt, the more likely that a fiscal expansion will lead to an instantaneous depreciation.

This interpretation, however, needs to be qualified somewhat because the inequality also depends on $\bar{e}$, the equilibrium exchange rate. A more useful representation of (14) can be obtained by substituting $T(\bar{e})$ for r^*F in (4A) and rearranging to yield

(14') $\frac{T_e \bar{e}}{T(\bar{e})} < 1.$

That is, following a fiscal expansion, the exchange rate instantaneously depreciates or appreciates for a debtor nation depending on whether the elasticity of the trade balance is less or greater than one. By parallel arguments, one can show that a contractionary fiscal policy will be followed by both short-and long-run currency appreciation if a country is a net debtor and the trade balance elasticity is less than one.

E. Interpreting the Importance of the Trade Balance Elasticity

Why does the impact effect of a fiscal expansion on the exchange rate depend upon the trade balance elasticity? The following example which explains why the exchange rate does not jump if the trade balance elasticity is unity should provide the necessary intuition. Suppose a country that is a net debtor initially at $(\bar{e}, \bar{f})$ increases its government spending so that a ten percent depreciation will be required over the long run (represented by the intersection of the new $\dot{e} = 0$ curve with the LRBOPC). If the exchange rate does not jump, then using (3) to eliminate r in (4A) yields

$$(15)\quad \dot{f} = \frac{\dot{e}}{e}\bar{f} + r^{*}\bar{f} - T(\bar{e}) = \frac{\dot{e}}{e}\bar{f}$$

Ignoring second-order effects, the stock of external debt grows ten percent if the exchange rate falls ten percent. Moreover, after these changes, the stock of foreign debt will also be stable since once the interest rate returns to r^*, debt service payments will be permanently ten percent higher and the trade surplus will be ten percent higher due to the unitary elasticity.

If, however, the trade elasticity is less than one, then a ten percent currency depreciation and a ten percent growth in foreign debt would leave the country with a current account deficit. Hence, the ten percent growth in f was "excessive" to restore long-run equilibrium. If instead, the exchange rate instantaneously depreciated some after the fiscal expansion, the subsequent expected depreciation $(\frac{\dot{e}}{e})$ and growth in f would be less than ten percent even though the overall depreciation would be ten percent. If the trade elasticity were greater than one, the fiscal expansion is an instantaneous currency appreciation as in the "standard" case.

The actual magnitude of the trade balance elasticity is of course an empirical question. In the neighborhood of a small trade surplus, however, the elasticity is likely to be greater than one: a 100% currency depreciation would almost surely double an existing small trade surplus. For countries with large external debts, their trade balance elasticities are very likely to be less than one.[10]

[10]By this reasoning, the United States would experience an instantaneous currency appreciation following a fiscal contraction. At first glance, this model might not seem to apply to the United States because the country currently has a large external *debt* and a large trade *deficit*. According to our model, the United States has not reached the long-run equilibrium consistent with its current fiscal stance. Over time, the dollar can be expected to continue to fall until it eventually achieves a large trade surplus that offsets its debt service payments. In a context of forward looking expectations, a current fiscal contraction might reduce the required long-run trade surplus in a range of surplus for which the trade elasticity is less than one.

III. A Model With a J-Curve Effect

In the previous section, the assumptions that imply a fiscal expansion induces an instantaneous currency depreciation also implies that the trade balance will improve in the short-run. The novel exchange rate results, therefore, appear inconsistent with the twin deficit phenomenon, the common observation that fiscal and trade deficits tend to move in the same direction. On the contrary, however, we, in this section, show that by introducing a trade balance J-curve effect into the model we can describe circumstances under which a fiscal expansion will generate a short-run depreciation, a short-run trade deficit, and a long-run depreciation. Moreover, the conditions under which a fiscal expansion causes an instantaneous currency depreciation become less restrictive than those derived in the previous section.

To capture the J-curve effect, we borrow from a model developed by Krugman (1989). The trade balance is assumed to depend positively on z, an exponentially weighted average of past values of the exchange rate, and negatively on e, the current exchange rate, due to the effects of long-term contracting and foreign currency invoicing. In particular, let the trade balance T be given by

(16) $T = T((1+\alpha)z - \alpha e);\ T' > 0, \alpha > -1,$

where z is defined as

(17) $z = \rho \int_{-\infty}^{t} e(\tau) \exp\{-\rho(t-\tau)d\tau$

In the short-run, z is fixed and a currency appreciation causes a trade surplus.

Time differentiating (17) yields

(18) $\dot{z} = \rho(e - z)$.

In the long-run, $e = z$, and the speed of adjustment to this long-run equilibrium is governed by the parameter ρ. As $\rho \to \infty$, z becomes arbitrarily close to e at all times. Our particular specification of the argument of the $T(\cdot)$ function ensures that, in the long run, the J-curve trade balance function reverts to the function presented in the model without the J-curve. Figure 8 depicts the behavior of the trade balance in response to a one-time permanent increase in e.

[Insert Figure 6 here]

The model's remaining structure is the same as that presented in the previous section, except, for analytical convenience, we limit the analysis to the case where the goods market equilibrium condition (1) is linear

(1') $A_r r + A_f f + A_g g + \{(1+\alpha)z - \alpha e\}T' = C_0$,

where C_0 and the partial derivatives are all constants.

This model has the same long-run properties as the model without the J-curve: $r = r^*$ and $r^*\bar{f} = T(\bar{e})$. Using these conditions and (1'), we can solve for the long-run responses of $\bar{e}$ and $\bar{f}$ to changes in g:

$$\text{(19)} \quad \frac{\partial \bar{e}}{\partial g} = \frac{-A_g r^*}{[r^* + A_f]T'} > 0$$

$$\text{(20)} \quad \frac{\partial \bar{f}}{\partial g} = \frac{-A_g}{r^* + A_f} > 0$$

which are both positive since we continue to assume $r^* + A_f < 0$. Again, the long-run response to a fiscal expansion is a currency depreciation and increase in external debt.

Our primary concern is to determine when a fiscal expansion induces a short-run currency depreciation. The addition of another state variable, z, complicates the analysis. As developed in the appendix, a linear approximation of the system's solution in the neighborhood of the long-run equilibrium can be expressed simply as a function of e, f, $\bar{e}$ and $\bar{f}$.

$$\text{(21)} \quad \frac{\dot{e}}{e} = \theta_e(\bar{e} - e) - \theta_f(\bar{f} - f) + C_1 \quad ,$$

where and the solutions for θ_e and θ_f are given in the appendix.

We are now ready to analyze the impact effect on e of a change in g. Differentiating (1') with respect to g, while recalling that f^d and f^* and z are fixed in the short-run and $r = r^* + \frac{\dot{e}}{e}$, we get

$$(22)\quad \frac{de}{dg} = \frac{\{A_g + A_r\theta_e \frac{d\bar{e}}{dg} - A_f\theta_f \frac{d\bar{f}}{dg}\}}{\{\alpha T' + A_r\theta_e - f^*(A_f - A_r\theta_f)\}}$$

Using (19), (20), and (21) and the solutions for θ_e and θ_f, we find that $\frac{de}{dg}$>0 if and only if,

$$(23)\quad \bar{f} > \frac{[\bar{e}T'(\rho + r^*)]}{r^*(\rho - \alpha r^*)}$$

or expressed in terms of the trade balance elasticity

$$(23')\quad \frac{T'\bar{e}}{T} < \frac{\frac{\rho}{r^*} - \alpha}{\rho + r^*}$$

Note that this condition is less stringent than inequalities (13) and (13'), so that the J-curve effect increases the likelihood that a fiscal expansion will induce an instantaneous currency depreciation. Moreover, because of the J-curve effect, the trade balance initially responds negatively to a currency depreciation. Since the currency will continue to depreciate over time and z will gradually increase, a trade surplus will eventually develop.

IV. Conclusion

Could a fiscal contraction strengthen the domestic currency both in the short and long run? Our answer is yes, if a country is a sufficiently large net debtor. The key to understanding this result is the asymmetric effects of changes in interest rates on net creditors and net debtors. For net creditors, the lower path of interest rates following a fiscal contraction (or, in general, an increase in national savings) reduces the debt service flow they receive on their assets. Since a fiscal contraction leads to higher domestic wealth, over the adjustment path wealth must be transferred from foreigners to domestic residents. How is this transfer accomplished? In part by the trade balance, and in part by debt service flows. For creditor countries, the interest-rate effects of a fiscal contraction on debt service flows put more of a burden of adjustment on the trade balance, requiring a currency appreciation to create a larger current account surplus. For debtors, the interest rate effects put less of a burden of adjustment on the trade balance. Hence, the currency can appreciate both in the short run and the long run.

Appendix

To investigate the model's dynamics, time differentiate (1'),

$$\text{(A1)}\quad A_r\dot{r} + A_f\dot{f} + T'\{(1+\alpha)\dot{z} + \alpha\dot{e}\} = 0$$

This model has four endogenous variables--*e, f, r* and *z*--but its dimensionality can be reduced by "eliminating" *r* and *z*. First, solve equation (A1) for $\dot{z}$. Then substitute this expression into equation (18) to obtain an expression for *z*, which can then be eliminated from (1') to yield,

$$\text{(A2)}\quad A_r r + A_f f + A_g g + T'e + \frac{A_r\dot{r} + A_f\dot{f} - \alpha T'\dot{e}}{\rho} = C_2$$

where C_2 is a constant.

Now assume the dynamic solution for the exchange rate depreciation is approximately linear in the neighborhood of the long-run equilibrium $(\bar{e}, \bar{f})$ and given by equation (21). The uncovered interest rate parity condition and equation (21) imply that *r* approximately equals the right-hand side of (21) plus *r**, and $\dot{r}$ is simply $-\theta_e\dot{e} + \theta_f\dot{f}$. Substituting these expressions into (A2) and recalling $\dot{f}$'s definition (equation (4A)) yields the following coupled system of differential equations:

$$\text{(A3)}\quad \frac{\dot{e}}{\bar{e}} = e\frac{\{A_r\theta_e[\rho + A_f + A_r\theta_f] - \rho T' + \theta_e\bar{f}[A_f + A_r\theta_f]\}}{-\alpha T' - A_f\theta_e} + f\frac{\{[A_r\theta_f + A_f][\rho + r^* + A_f + \theta_f(\bar{f} + A_r)]}{\alpha T' + A_r\theta_e} + C_3$$

$$\text{(A4)}\quad \dot{f} = e\left[(\bar{f} + A_r)\theta_e\right] + f[r^* + A_f + \theta_f(\bar{f} + A_r)] + C_4 \quad ,$$

where C_3 and C_4 are constants.

If expectations are rational, then $-\theta_e$ and θ_f must equal the coefficients on e and $-f$ in equation (A3) divided by $\bar{e}$, respectively.

$$\text{(A5)}\quad \bar{e}\theta_e = \frac{\{A_r\theta_e[\rho + A_f + A_r\theta_f] - \rho T' + \theta_e\bar{f}[A_f + A_r\theta_f]\}}{\alpha T' + A_r\theta_e}$$

$$\text{(A6)}\quad \bar{e}\theta_f = \frac{\{[A_r\theta_f + A_f][\rho + r^* + A_f + \theta_f(\bar{f} + A_r)]\}}{\alpha T' + A_r\theta_e}$$

Dividing (A5) by (A6) and rearranging terms yields the following relationship between θ_e and θ_f,

$$\text{(A7)}\quad \theta_e = \frac{\rho T'\theta_f}{\{-\rho A_f - [r^* + A_f][A_r\theta_f + A_f]\}}$$

The critical values of θ_e and θ_f, $\overline{\theta}_e$ and $\overline{\theta}_f$, at which the exchange rate does not jump following a change in g can be found by substituting from (19) and (20) into the right-hand side of (22) and setting this term to zero,

(A8) $\overline{\theta}_e = \dfrac{\rho T'}{A_r r^*} > 0$.

Substituting this expression into (A7) yields a solution for θ_f,

(A9) $\overline{\theta}_f = \dfrac{-[\rho + r^* + A_f]}{A_f} > (<) 0 \text{ if } [\rho + r^* + A_f] > (<) 0$

Inserting $\overline{\theta}_e$ and $\overline{\theta}_f$ into (A6) yields critical values of $\bar{f}$ and $\bar{e}$ at which the exchange rate exhibits no instantaneous movement in response to a change in fiscal policy.

(A10) $\bar{f} = \dfrac{T'[\frac{\rho}{r^*} - \alpha]}{\bar{e}(\rho + r^*)}$

One can easily show that as $\bar{f}$ and $\bar{e}$ increase above the critical values implied by (A10), the exchange rate immediately depreciates in response to a fiscal expansion ($\frac{de}{dg} > 0$).

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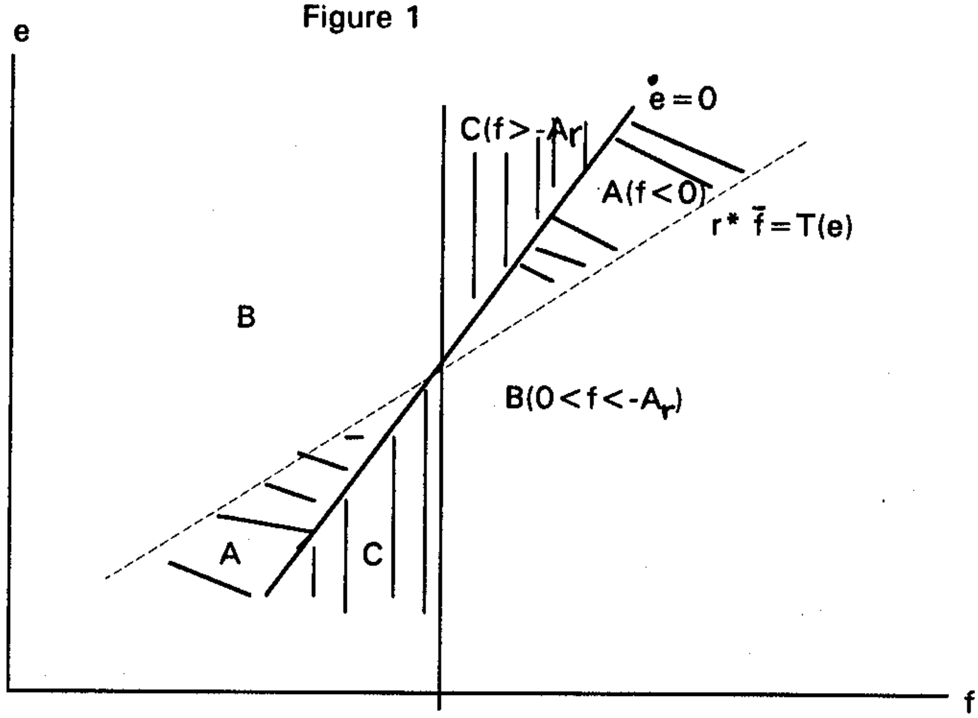
Figure 1



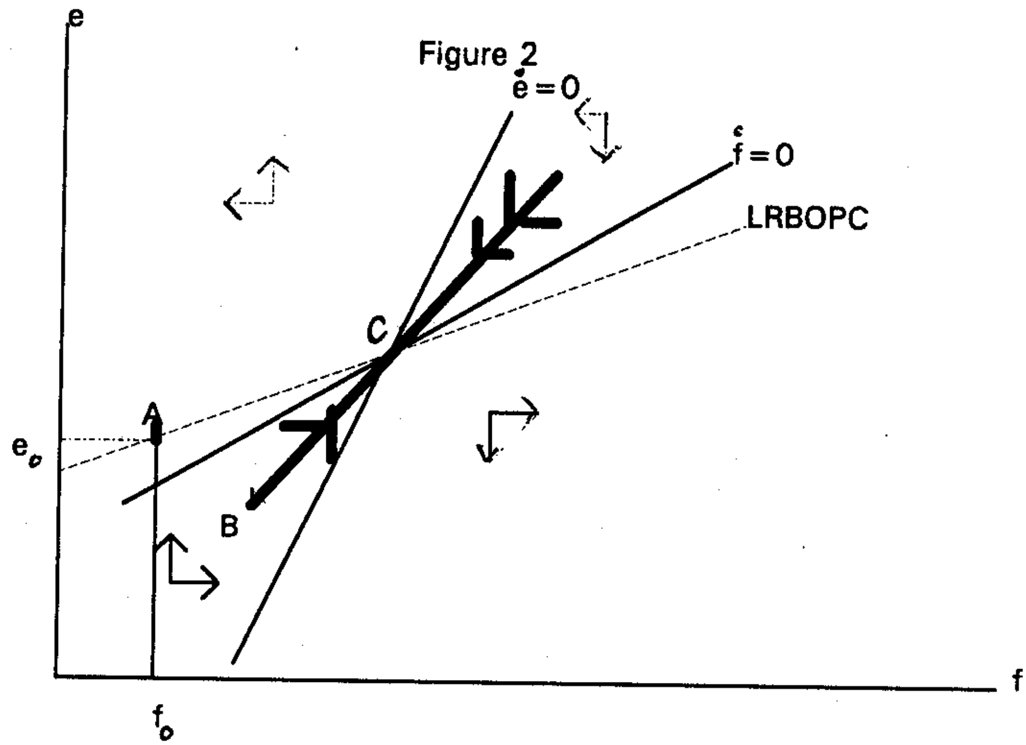
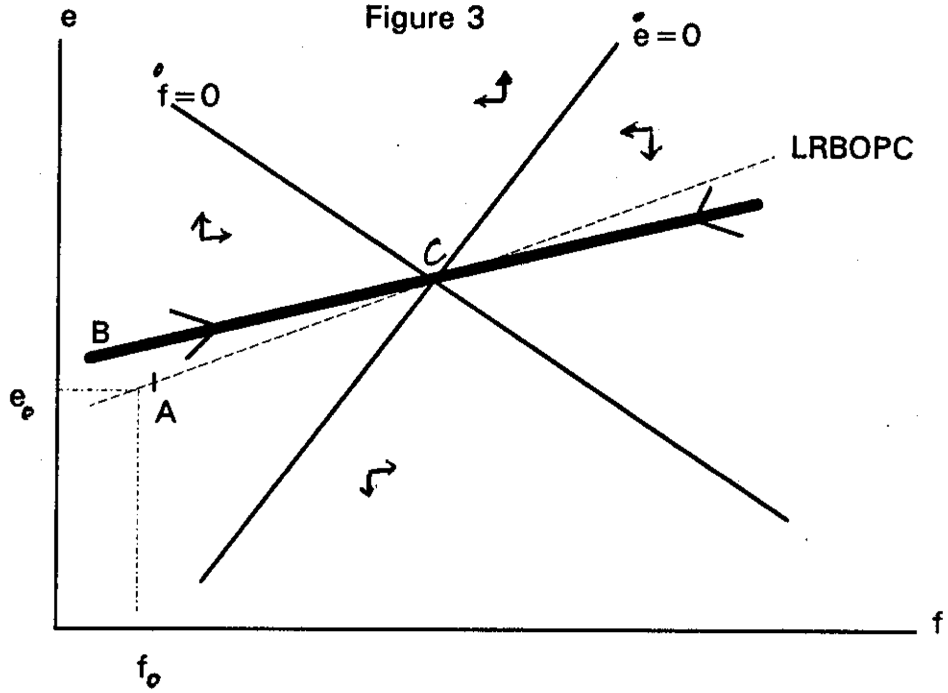


Figure 2

Figure 3



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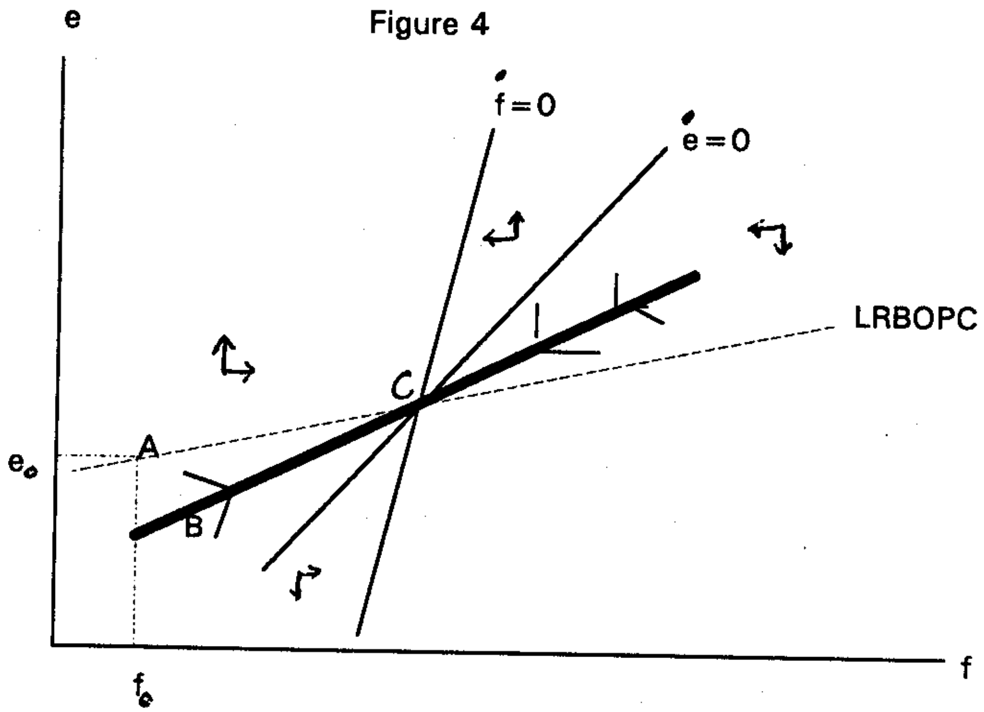

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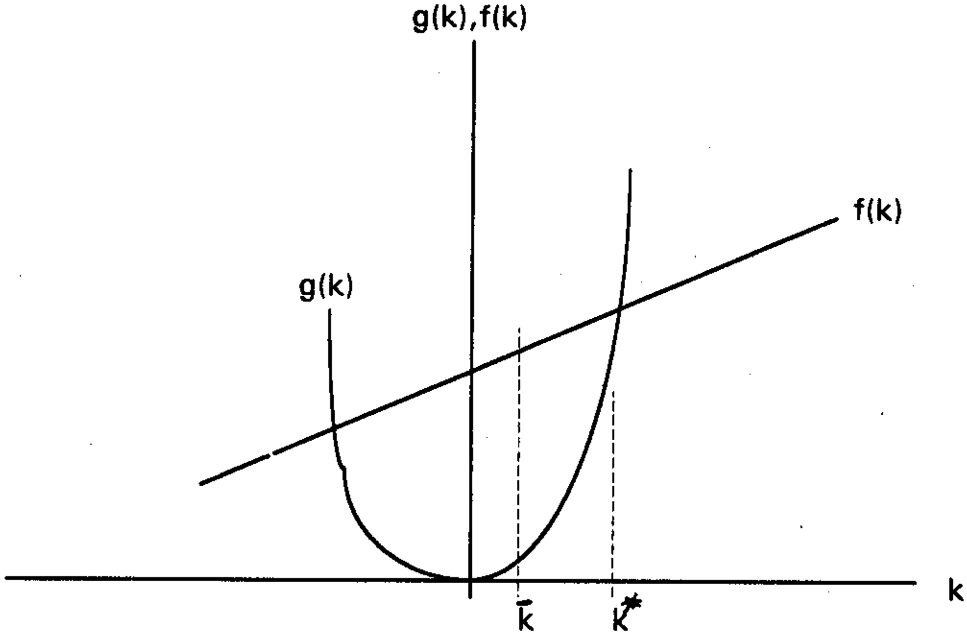

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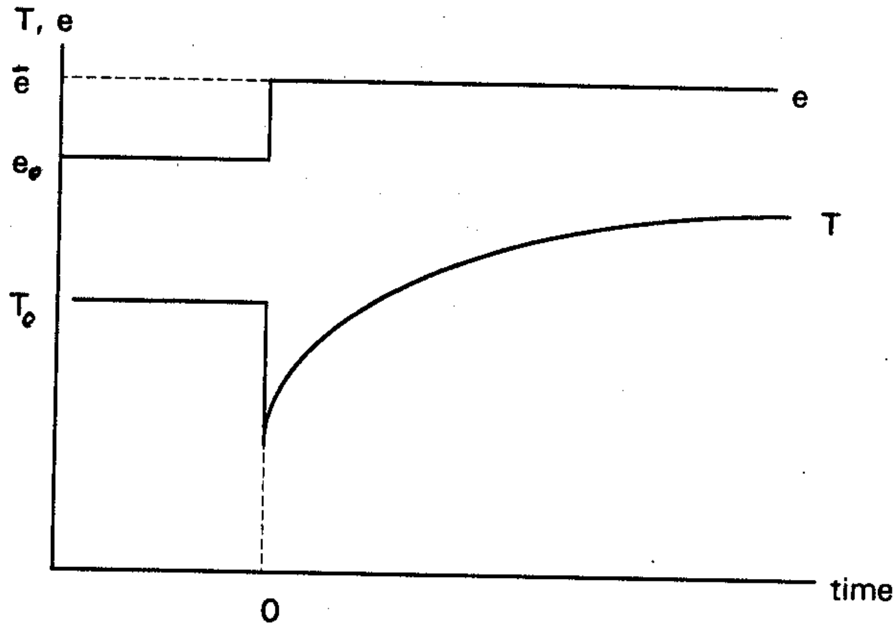

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