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Saving, Investment, and the U.S. External Balance

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The unprecedented rise in the U.S. external deficit in the 1980s was not only the result of large government budget deficits. A significant decline in the extent to which the private saving-investment balance adjusted to finance government budget deficits also contributed to the U.S. external deficit. It is hypothesized that the shift in U.S. monetary policy after 1979 reduced domestic financing of U.S. budget deficits in the 1980s by encouraging foreign capital inflows.

The size and persistence of the U.S. external deficit in recent years is unprecedented in this century, and has prompted extensive discussion and research on its underlying causes. Many observers have argued that large government budget deficits are primarily responsible for the U.S. external deficits. However, external deficits depend not only on government budget deficits, but on the private saving-investment balance, as well. This paper discusses the role of the private saving-investment balance in the growth of U.S. external deficits of the 1980s.

Prior to the 1980s, the private saving-investment balance varied negatively with the government budget balance, almost fully offsetting budget deficits. Thus, until the 1980s, budget deficits largely were not associated with external deficits. The extent of this offset decreased significantly in the eighties, thereby increasing the impact of budget deficits on the U.S. external position. This change in the behavior of the private saving-investment balance helps to explain why in the 1980s the external deficit rose in response to the increase in the government budget deficit.

This study argues that the change in the behavior of the private saving-investment balance may have been caused by the change in inflationary expectations associated with the shift in monetary policy that took place at the end of 1979. Specifically, after 1979, the change in monetary policy meant that higher budget deficits no longer would cause money growth, inflation, and inflationary expectations to rise automatically, thereby increasing the willingness of foreigners to finance such deficits.

The paper is organized as follows. Section I discusses the behavior of budget deficits, the private saving-investment balance, and the external balance between 1960 and 1987. It reviews the findings of recent empirical and simulation studies on the response of the private saving-investment balance to fiscal and monetary policy and identifies certain developments that may have changed this response over time. Section II investigates the empirical relationship between fiscal and monetary policy and the private saving-investment balance, and tests for changes in this relationship after 1974 and after 1980. Section III discusses some factors that may have contributed to the change in the response of the private saving-investment balance to fiscal policy. Section IV summarizes the findings of this paper and highlights some policy implications.

I. Saving, Investment, and the External Deficit—An Overview

Internal and External Balances

To set the context for the discussion that follows, consider the national income accounting identity:

$$Y = C + I + G + B = C + S + T \qquad (1)$$

where all variables are real and:

Y = gross national product;
C = domestic consumption;
I = domestic gross private investment;
G = domestic government expenditure;
B = exports minus imports of goods and services
= external balance;
S = private domestic saving; and
T = government receipts.

Dropping C from both sides, and re-arranging yields the following:

$$(S - I) + (T - G) = B = \text{Net capital flow} \qquad (2)$$

where the net capital flow is the difference between U.S. investment abroad and foreign investment in the United States.

Equation (2) describes the external balance of an economy as the sum of the saving of its private sector, or the private saving-investment balance (the difference between gross private saving and gross private investment), and of its public sector, or the government budget balance. The left hand side corresponds to the internal balance of the economy, the right hand side to the external balance.

Equation (2) also illustrates why the external balance may be interpreted as the saving of the economy as a whole. A country experiencing an external surplus is producing more than it spends, and its saving is used to finance excess foreign spending. Conversely, a country experiencing an external deficit is purchasing more goods than it produces, and foreign capital inflows finance excess domestic spending. There must be a correspondence between a country's external balance and the balance in its capital account.

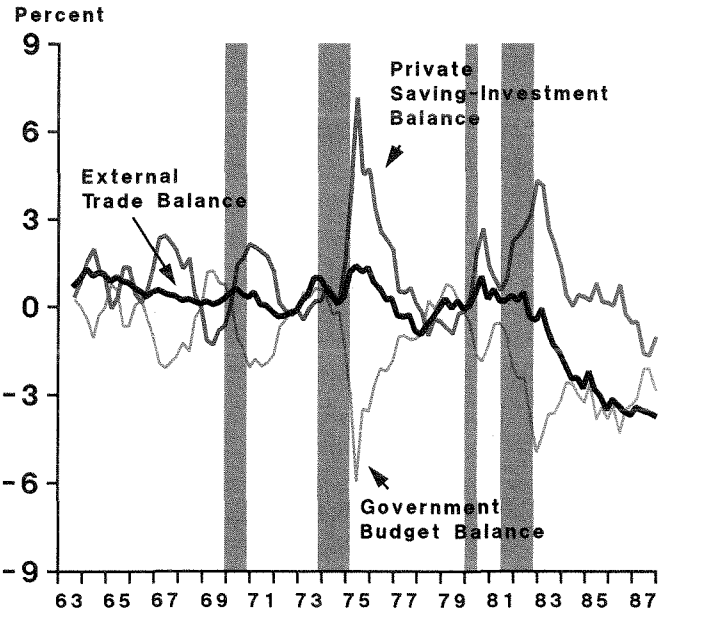
Chart 1 illustrates the path of the U.S. external balance since 1960.[1] The series is nominal (not adjusted for inflation), and shown as a proportion of the middle expansion trend of GNP.[2] As a net exporter of capital, the U.S. maintained a trade surplus averaging over two-fifths of a percent of GNP up to 1980. However, the U.S. external balance began falling sharply at the end of 1982. Between the last quarter of 1982 and the last quarter of 1987, the nominal U.S. external deficit averaged 2.5 percent of GNP, and peaked at 3.7 percent of GNP in the last quarter of 1987. The magnitude of the U.S. external deficit since 1982 is unprecedented in the twentieth century.

The duration of this external deficit also is unprecedented. Over five years have passed since the U.S. external balance went into deficit in the third quarter of 1982. In contrast, from the end of World War II until 1980, the U.S. experienced external deficits for more than one quarter on only four occasions, and the average duration was less than a year and a half.

Chart 1 also illustrates the two components of internal balance that together equal the external balance—the government balance and the private saving-investment balance, both as proportions of the middle expansion trend of GNP.[3] The chart shows that during contractions, the government balance tends to fall as tax revenues fall, and the private saving-investment balance tends to rise as investment declines. The reverse is true during expansions.[4]

However, the most recent economic expansion, which began in 1982, has not been accompanied by the typical reduction in the government deficit that has characterized earlier expansions. Given the typical cyclical reduction in

Chart 1
U.S. External and Internal Balance*



*Shaded areas indicate recessions as defined by the National Bureau of Economic Research.

the private saving-investment surplus as the recovery progressed, analysts point to these budget deficits as the primary cause of the unprecedented external deficits observed to date.

But a closer examination of Chart 1 also suggests that prior to the 1980s, the private saving-investment balance tended to vary opposite to budget deficits *even apart from cyclical influences,* thereby producing no discernible cyclical or secular trend in the trade balance until the 1980s. Thus a change in the behavior of the private saving-investment balance, as well as rising budget deficits, apparently has contributed to the external deficits of the 1980s.

The question whether external deficits in the 1980s are the result of budget deficits, a change in the behavior of the private saving-investment balance, and/or other factors cannot be resolved simply by looking at the accounting relationships embodied in Equation 2. These variables respond to exogenous changes in fiscal and monetary policy as well as to other autonomous factors. Thus, to determine the effect of any of these variables on the external balance of the U.S., it is important to examine how they have behaved in response to exogenous changes in policy. Because changes in the private saving-investment balance have received relatively less attention, this article focuses on the implications of this relationship for the U.S. external deficit.

Abstracting from cyclical effects, the response of the private saving-investment balance to fiscal and monetary policy may be expressed as follows:

$$S - I = a_0 + a_1(T - G) + a_2 M \qquad (3)$$

Where (T − G) and M now refer to the exogenous behavior of the budget balance and the money supply, and a_0 contains all other factors.[5] (Note that the observed budget balance in Chart 1 is the sum of the exogenous budget balance and the endogenous response of the budget balance to all exogenous disturbances.) Equation (3) may be interpreted as a reduced form. The underlying structure may be motivated in terms of a standard Keynesian macroeconomic model of an open economy.

With this framework in mind, consider first the effects of an expansionary fiscal policy. Such a policy tends to raise income and interest rates; the rise in income tends to increase domestic saving, and the rise in interest rates tends to discourage domestic investment. Consequently, budget deficits tend to produce an offsetting rise in the private saving-investment balance, suggesting that a_1 is likely to be negative.

An expansionary monetary policy tends to lower interest rates, stimulating investment and income. The increase in income, in turn, stimulates saving. (In an open economy with floating exchange rates, lower interest rates tend to cause the currency to depreciate, stimulating net exports and causing a further increase in income.) Since both saving and investment tend to rise, the net impact of an expansionary monetary policy on the private saving-investment balance (the sign of a_2) is ambiguous.

The Response of Private Saving-Investment

Equations (2) and (3) imply that it is the interaction of fiscal and monetary policy and the private saving-investment balance that determines the external balance. Thus, the magnitude of the response of the private saving-investment balance to fiscal policy—that is, the magnitude of a_1—determines whether fiscal policy affects the trade balance. If $a_1 = -1$, fiscal deficits generally will not be associated with external deficits; however, fiscal deficits will be reflected in external deficits if $a_1 > -1$.[6] Unfortunately, the literature provides conflicting evidence on the magnitude of a_1.

Two well-known structural simulation models (Taylor, and Sachs and Roubini), and a recent study by Benjamin Friedman that estimates a reduced form model suggest that the private saving-investment balance does not fully offset budget deficits (that is, $a_1 > -1$). Taylor (1987) estimates a multi-country version of the Mundell-Fleming model[7] and finds that five years after the start of a simulated cut in government purchases "virtually all of the cut generates a rise in [national] saving, and about 3/4 of this rise in saving [is reflected in] an increase in net exports."[8] This suggests that a cut in the government deficit does not produce a fully offsetting reduction in the private saving-investment balance and is thus reflected largely in a reduction in the external deficit.

Similarly, using a dynamic general equilibrium simulation model of a six-region world economy, Sachs and Roubini (1987) argue that the combination of sharply higher budget deficits in the U.S. and sharply reduced deficits in Japan goes far to explain the movements of the external balance and exchange rates of the two economies.[9] Friedman's (1986) reduced-form estimates also suggest that budget deficits largely are reflected in external deficits.

In contrast to these three studies, a well-known study by Feldstein and Horioka (1980) found that national saving (T − G + S) was positively associated with gross private investment (full crowding out) in a cross-section sample of industrial countries. Subsequent time series analysis by

Obtsfeld (1986) and Frankel (1985) found a similar positive correlation between national saving and gross private investment in the U.S.[10] The results of the studies by Feldstein and Horioka, Obtsfeld, and Frankel suggest that $a_1 = -1$, or close to it.

There is also no agreement on the direct impact of changes in the money supply on the private saving-investment balance. Friedman finds that an increase in the ratio of money to GNP increases the ratio of private saving to GNP more than it increases the ratio of private investment to GNP,[11] thus reducing the external deficit (this suggests that $a_2 > 0$). In contrast, Darby, Gillingham, and Greenless (1987) find that a rise in the real money supply in the 1980s has tended to *increase* the external deficit[12] through its negative impact on private saving (that is, $a_2 < 0$). Similarly, Taylor finds that in the short run, an expansionary monetary policy tends to increase the external deficit, and, by implication, to reduce the private saving-investment balance.[13]

Several reasons may be offered for the conflicting results, including different specifications for models, variables, and econometric methods. Omitted variables may explain the differences in some cases and simultaneous equations bias in others. An alternative explanation is a change in the response of the private saving-investment balance to fiscal and monetary policy. This possibility has received relatively little attention, although studies reported by Darby (1987) and Darby, Gillingham, and Greenless (1987) suggest that changes in the behavior of the private saving-investment balance may have contributed to the external deficits of the 1980s.[14]

A change in the relationship between the private saving-investment balance and budget deficits might be expected, in view of two major developments that occurred in the 1970s. First, industrial countries shifted to floating exchange rates[15] and liberalized capital controls[16] in the first half of the 1970s. This process largely was completed by 1974, although restrictions on capital movements in the U.K. and Japan were not removed until 1979. As discussed more fully below, increased capital mobility and floating exchange rates could be expected to lower the offsetting response of the private saving-investment balance to budget deficits.

The second major development was the decision by the Federal Reserve in October 1979 to change its operating procedures for implementing monetary policy from reliance on an interest-rate instrument to the use of an aggregates instrument. Dewald (1982) finds evidence that during the earlier period, monetary policy tended to "accommodate" fiscal policy, in the sense that there was a positive relationship between money growth and fiscal deficits in the U.S. In particular, the acceleration in money growth and inflation in the 1970s appears to have been directly related to the near tripling of fiscal deficits to over one percent of GNP in the 1970s.[17]

As a result, rising budget deficits in the 1970s may have produced rising inflationary expectations. As discussed below, this may have discouraged foreign capital inflows and raised the offsetting response of the private saving-investment balance to budget deficits in the 1970s. However, once monetary policy changed and money growth and inflation apparently ceased to respond to budget deficits in the 1980s, foreign capital was more likely to flow in, thereby lowering the offsetting response of the private saving-investment balance to budget deficits in the 1980s.

II. The Response of the Private Saving-Investment Balance to Fiscal and Monetary Policy

To determine whether the response of the private saving-investment balance to fiscal and monetary policy has changed, regressions of the following form were run using seasonally-adjusted quarterly data:

$$S-I = b_0 + b_1 \cdot (T-G)_t + \sum_{i=0}^{8} b_{2+i} \cdot M2_{t-i} \qquad (4)$$

$$+ b_{11} \cdot GNPGAP_t + b_{12} \cdot INVMET_t$$

$$+ b_{13} \cdot DUM \cdot (T-G)_t + \sum_{i=0}^{8} b_{14+i}$$

$$\cdot DUM \cdot M2_{t-i} + b_{23} \cdot DUM \cdot GAP_t$$

where $S-I$ is the private saving-investment balance, $T-G$ is the government budget balance, GNPGAP is the gap between the middle expansion trend of GNP and actual GNP (a negative gap indicates a strong economy) as defined by the Department of Commerce,[18] and INVMET is the reciprocal of the middle expansion trend of GNP. All variables are scaled by the middle expansion trend of GNP.[19] The variables prefaced by DUM are slope dummy variables, and they correspond to values of $T-G$, M2, and the GNPGAP. Significant coefficients for b_{12}, b_{14+i}, and b_{22} would indicate a change in the response of the private saving-investment balance to fiscal policy, monetary policy, and cyclical fluctuations, respectively.

M2 was selected as the proxy for monetary policy because of the severe instability characterizing the demand for M1 in the 1980s. In view of possible simultaneous equation bias, an instrumental variable was used for contemporaneous M2 as well as for the contemporaneous budget balance.[20] A correction for serial correlation also was performed.[21]

A regression first was run over the period 1963:3–1979:4,[22] with slope dummies beginning in the first quarter of 1974, to ascertain whether there was any change in the relationship between the budget balance and the private saving-investment balance following the liberalization of capital controls and the shift to floating exchange rates. The results are reported in the first column of Table 1.

Table 1

Response of the Private Saving-Investment Balance to Fiscal and Monetary Policy

Explanatory Variables	M2 & dummies lags 0–8 63:3–79:4	M2 & dummies lags 0–4 63:3–87:4	No M2 dummies lags 0–4 63:3–87:4
Government Balance(1)	−0.809***	−0.875***	−0.884***
	(.213)	(.118)	(.119)
M2 (coeff sum)	−0.021**	−0.013***/**(2)	−0.011***/**(2)
	(.009)	(.005)	(.005)
GNP Gap	0.085	0.214***	0.231***
	(.06)	(.049)	(.049)
INVMET	1820.99**	1600.88***	1527.71***
	(524.89)	(337.91)	(330.84)
Slope dummies	74:1 − 79:4	80:1 − 86:4	80:1 − 86:4
Government Balance	0.345	0.550***	0.433**
	(.457)	(.208)	(.126)
M2 (coeff sum)	0.017**/*(2)	0.005	—
	(.009)	(.009)	
GNP Gap	0.208	0.286***	0.261**
	(.167)	(.078)	(.076)
Rho	0.369	0.251	0.264
Adj RSQ	0.884	0.814	0.814
PC	.371	0.496	0.465
Sum of Coefficients Gov't balance plus dummy			−0.451***

*** significant at 1 percent
** significant at 5 percent
* significant at 10 percent
Figures in parentheses are standard errors.

(1) Cannot reject hypothesis that coefficients are equal to −1.
(2) F-test on block of coefficients/t-test on sum of coefficients.

A second regression then was run over the period 1963:3–1987:4, with slope dummies beginning in the first quarter of 1980, to examine whether the response of the private saving-investment balance changed with the shift in monetary policy in the last quarter of 1979 and the further liberalization of capital controls in the U.K. and Japan. (The slope dummies for 1974–1979 were not included in this regression.) The results are reported in the second column of Table 1. Four and eight quarter lags on M2 were tested in both the first and second regressions. To select the best specification, Amemiya's prediction criterion (PC) was used.[23]

As can be seen in Table 1, both the fiscal and monetary policy variables are significant. The extent to which the private saving-investment balance offsets fiscal deficits did not decline following the liberalization of capital flows in 1974, but did decline after 1980. In addition, the slope dummies on M2 are significant after 1974, but not after 1980. To improve the fit of the second regression, the slope dummies for M2 after 1980 were eliminated, and the second regression was re-run. The results are reported in the third column of Table 1.

One potential objection to all these regressions is that there may be a lag in the response of the private saving-investment balance to the government budget balance as well as to monetary policy. The regressions were therefore re-run over the period 1963:3–1987:4, with four and eight quarter lags on M2 and on the government budget balance, respectively. However, in all cases, the third regression of Table 1 was superior to the alternative regressions according to the PC criterion.

The results of the third regression in Table 1 suggest that a one point increase in the budget balance brings about a 0.88 decline in the private saving-investment balance. In addition, the hypothesis that the private saving-investment balance fully offset the government budget balance up to 1980 cannot be rejected. There was no change in this relationship after 1974, and exogenous increases in the fiscal deficit apparently did not translate into external deficits up to the 1980s. The extent of the private saving-investment offset weakened by nearly 50 percent after 1980, and budget deficits came to be reflected in external deficits. Since changes in the response of the private saving-investment balance to fiscal policy appear to account for a significant part of the deterioration of the external balance in the 1980s, these results are interpreted more fully in the next section.

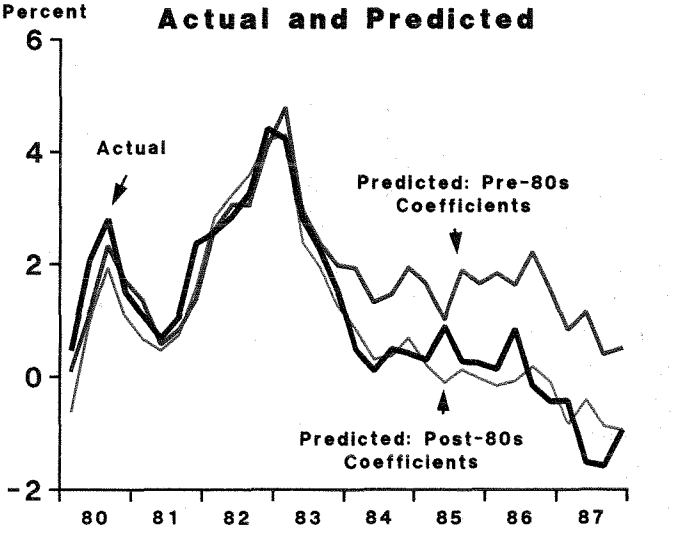
While these results assign a major role to the behavior of the private saving-investment balance in explaining the external deficits of the 1980s, they nevertheless imply that a reduction in budget deficits now would reduce the U.S. external deficit substantially, as long as the relation between the saving-investment and budget balance remains unchanged.

The results also indicate that cyclical effects were amplified in the 1980s. The private saving-investment balance appeared to be higher in the recessions of the 1980s and lower in the most recent expansion, which began in 1982, than was characteristic of earlier cycles. The stronger cyclical response is not easy to explain. It could reflect a stronger response of investment to income (a stronger accelerator effect) in the 1980s or the tendency for wealth effects to reduce private saving in the current expansion. Financial wealth has risen due to the accumulating government debt and the stock market boom of recent years.[24]

Finally, money exerts an independent influence on the private saving-investment balance. The sum of the coefficients on M2 consistently is negative and the t-statistic on this sum is significantly different from zero, indicating that an increase in the money-to-GNP ratio lowers the private saving-investment balance—and by this channel, the external balance. In particular, a rise in the M2/GNP ratio after 1982 has contributed to a lower private saving-investment balance, and therefore has tended to increase the external deficit.

As demonstrated in the Appendix, the significant and positive slope dummies on M2 after 1974 are consistent with the liberalization of capital flows in the early 1970s, although the net effect of the positive shift is apparently very small.[25] A greater degree of capital mobility will bring about a positive shift in the response of the private

Chart 2
Private Saving-Investment Balance: Actual and Predicted



saving-investment balance to monetary policy because it reduces the responsiveness of interest rates and investment to changes in the money supply, and increases the responsiveness of exchange rates, income, and therefore, saving to such changes.

To illustrate the implications of these results, Chart 2 compares the predicted path of the U.S. private saving-investment balance in the 1980s using the pre- and post-1980 coefficients. For reference, the actual path of the U.S. private saving-investment balance also is shown. Given the actual fiscal deficit, which averaged 3.1 percent of GNP between 1982:4 and 1987:4, the model predicts that the private saving-investment balance would have averaged two percent, rather than the 0.7 percent actually observed, had the pre-1980s' relationships prevailed. As a result, the external deficit would have averaged 1.3 percent of GNP over the period, rather than 2.5 percent.[26]

III. Interpreting the Results

The finding that the private saving-investment balance adjusted to fully offset changes in the budget balance until 1980 suggests a very limited degree of net international capital flows, which is in line with the results of the literature inspired by Feldstein and Horioka cited earlier. The absence of net international capital flows up to the early 1970s might be explained by restrictions on international capital movements, since such restrictions require the private saving-investment balance to adjust fully to cover the financing requirements of the public sector.[27] However, it is surprising that there was no change in the relationship between the private saving-investment balance and the budget balance after 1974 (that is, the slope dummy on the budget balance variable was not positive and statistically significant between 1974 and 1979).[28]

Theory suggests that liberalization of capital flows as well as the shift to floating exchange rates in the early 1970s should have reduced the offsetting response of the private saving-investment balance to fiscal policy. The reason is that in an open economy where capital flows freely and exchange rates float, the rise in domestic interest rates associated with government budget deficits should tend to attract foreign capital and limit the required adjustment in the domestic private saving-investment balance.

The adjustment in the private saving-investment balance should be muted by capital mobility for two reasons. First, foreign financing directly limits the extent to which government deficits reduce or "crowd out" investment. Second, under floating exchange rates, capital inflows cause the currency to appreciate. This increases the external deficit, which in turn reduces the stimulus budget deficits provide to income, thereby limiting the rise in saving. With capital mobility and floating rates, the limited response of the private saving-investment balance to budget deficits should ensure that the latter are reflected in external deficits.

However, if budget deficits raise inflationary expectations and thus increase uncertainty about the investment environment, increased capital mobility will not necessarily diminish the response of the private saving-investment balance to budget deficits. The positive correlation between money growth and budget deficits in the 1970s suggests that there also may have been a positive link between inflationary expectations and budget deficits. As demonstrated more formally in the Appendix, such a link has two effects that could influence the response of the private saving-investment balance to budget deficits.

First, an increase in inflationary expectations reduces money demand and could *lower* real interest rates even as budget deficits increase. In the standard analysis, such lower interest rates would discourage capital inflows and cause the dollar to depreciate. Huizinga and Mishkin (1986) provide evidence that rising inflationary expectations were in fact associated with falling *ex ante* real interest rates in the 1970s. The real trade-weighted value of the dollar also depreciated almost continuously between 1971 and 1980.

As in the case of a direct increase in the money supply, however, the currency depreciation stimulates income and saving, while the interest rate decline stimulates investment, so the net impact of excess money demand on the private saving-investment balance must be determined empirically. The negative coefficients for monetary policy in the previous regression suggest that the stimulus to investment from an excess demand for money is stronger than the stimulus to saving. Thus, the tendency for rising inflationary expectations to lower money demand apparently does not explain why the behavior of the private saving-investment balance did not change in the 1970s.[29]

However, rising inflationary expectations could have an additional effect on the behavior of the private saving-investment balance. Specifically, rising inflationary expectations may increase uncertainty about the investment environment, and thus raise the risk premium demanded on U.S. dollar assets. A rise in the risk premium, in turn, would discourage capital inflows, and cause the currency

to depreciate, even if domestic real interest rates do not fall. The currency depreciation would stimulate saving, but not investment spending in this case. Thus, a rise in the risk premium unambiguously would raise the offsetting response of the private saving-investment balance to budget deficits.

This analysis suggests that if inflationary expectations had not been rising in the 1970s, the impact of the liberalization of capital controls and the shift to floating exchange rates on the behavior of the private saving-investment balance would have been felt earlier. Instead, the impact of the liberalization of capital controls and the shift to floating exchange rates was felt only after 1979, when monetary policy changed and budget deficits no longer had the same influence on inflationary expectations. This break in the link between budget deficits and inflationary expectations led to capital inflows and an appreciating currency in the 1980s, as would have been expected, given enhanced international capital mobility.

IV. Conclusions

The unprecedented rise in the U.S. external deficit in the 1980s mainly is the result of the interplay of two factors. First, government deficits remained large in the expansion of the 1980s, rather than tending towards zero as they had during previous expansions. Second, the private saving-investment balance failed to offset the rising budget deficits as it had in the past.

The liberalization of capital movements in industrial countries and the shift to floating exchange rates in the first half of the 1970s had no perceptible effect on the offsetting response of the private saving-investment balance to fiscal policy until a major shift in monetary policy and a further liberalization of international capital movements occurred in 1979.

This paper offers a hypothesis that is theoretically consistent with the timing of the changes in the response of the private saving-investment balance to fiscal policy. By feeding back into inflationary expectations and increasing uncertainty about the investment environment, the tendency toward monetary accommodation of fiscal policy until 1979 (found by Dewald) reduced the willingness of foreigners to finance U.S.deficits and caused a continuing currency depreciation which stimulated a strong offsetting response of the private-saving investment balance to the budget balance. This curtailed the tendency for the external deficit to increase in response to rising budget deficits in the 1970s, notwithstanding the liberalization of capital restrictions and the shift to floating exchange rates in the early 1970s. Once monetary accommodation of fiscal policy ceased in the 1980s, the external balance deteriorated significantly. As the reduced-form specification used in this paper does not permit a direct test of this hypothesis, further research is needed.

If this interpretation is valid, the results presented here have important policy implications. Budget deficits pose a dilemma—a decline in the external balance can be averted by accommodating budget deficits with monetary policy and currency depreciation, but at the cost of high inflation and greater crowding out of domestic investment. Conversely, policymakers can avoid high inflation and reduce crowding out by refusing to accommodate budget deficits, but with a rising external deficit. Thus, if efforts to reduce the U.S. external deficit are to succeed without a resurgence of inflation, they must be accompanied by a reduction in budget deficits.

APPENDIX

The purpose of this Appendix is to demonstrate how the response of the private saving-investment balance to policy may be affected by inflationary expectations, as this mechanism is not usually discussed in the literature. It also shows that the direct response of the private saving-investment balance to monetary policy is more likely to be positive if capital mobility is high.

Rewrite equation (2) in the text as follows:

$$\underset{+}{S(Y)} - \underset{-\ +}{I(r,\ Y)} + T - G = \underset{+\ -\ +}{B(E,\ Y,\ Y^*)} \qquad \text{(A-1)}$$

The signs refer to the partial derivatives and:

Y = income
r = real domestic interest rate
E = domestic currency price of a unit of foreign currency (e.g. dollars per yen)
* = superscript for foreign variables
f = superscript for holdings by foreign residents

Equation (A-1) represents equilibrium in the goods market. The money market equilibrium equates real money supply to demand by domestic residents (assume foreign residents hold no domestic money):

$$M = \underset{+\ -}{L(Y,\ i)} \qquad \text{(A-2)}$$

where M is the real money supply, L is the demand for money. The nominal interest rate, i, is defined as the sum of the real interest rate and inflationary expectations:

$$i = r + \Pi \qquad \text{(A-3)}$$

The domestic bond market is in equilibrium when the real supply of domestic bonds equals the demand by domestic and foreign residents:

$$k^s = \underset{+\ +}{k(Y,\ i,\ i^*} + \underset{-}{\Pi} + \underset{+}{\phi)} + \underset{+\quad +\quad -}{k^f(Y^*, i - \Pi - \phi,\ i^*)} \qquad \text{(A-4)}$$

where k^s is the supply of domestic bonds, k(.) and k^f(.), respectively, are the domestic and foreign demand for domestic bonds, and ϕ is the risk premium. It is assumed that inflationary expectations, Π, also correspond with the expected rate of depreciation. For similar specifications up to this point see Dornbusch (1980) or Marston (1985).

Assume that the risk premium on dollar assets responds to rising inflationary expectations, that is:

$$\phi = \underset{+}{\phi(\Pi)} \qquad \text{(A-5)}$$

Assume further that monetary authorities respond to changes in fiscal policy by changing the *rate of growth* in the money supply.* If agents are aware of this, they will form inflationary expectations as follows:

$$\Pi = \underset{(-)}{\Pi(T - G)} \qquad \text{(A-6)}$$

The extent to which inflationary expectations respond to fiscal deficits will depend on the degree of monetary accommodation to fiscal policy.

The above is a Mundell-Fleming model that allows for imperfect asset substitutability and includes specific assumptions about monetary policy and expectations formation. The following simplifying assumptions have been made in obtaining a solution:

a. The country is small, which means that the ramifications of domestic policies on foreign income and world interest rates are ignored. The impact of these foreign effects on the U.S. economy apparently is small (see Sachs and Roubini and Taylor).

b. Short-term price rigidity is assumed. Except for specifying inflationary expectations, the dynamics of price adjustment are not spelled out.

c. The effect of exchange rate changes on the domestic price level is ignored. This implies that two effects of an exchange rate appreciation are ignored in the present analysis. These are: the improvement in the terms of trade and real income, which tends to *raise* saving; and the increase in real wealth brought about by an exchange rate appreciation, which tends to *reduce* saving. Wealth effects are important in principle, specifically in portfolio demand, but they are ignored to simplify notation. This does not affect our main conclusions.

d. The implications of a country's net creditor or debtor position similarly are ignored. As discussed in Frenkel and Razin (1987), if a country is a net debtor, the slopes of the LM and IS curves may change (the LM curve may slope downward, the IS curve becomes steeper), reversing a number of standard conclusions. For example, a tax increase may be expansionary, rather than contractionary.

Discussion of this type of model usually focuses on the implications of capital mobility and the exchange rate

regime for the ability of fiscal and monetary policy to affect income. Here we will focus instead on how inflationary expectations affect the responsiveness of the private saving-investment balance to fiscal and monetary policies.

The Solution

Substituting (6) into (3) and totally differentiating (2) to (4), we obtain:

$$\begin{bmatrix} s+m-i_y & -B_E & -I_r \\ -L_y & 0 & -L_i \\ -k_y & 0 & -(k_i+k^f_{i\text{-}\Pi\text{-}\phi}) \end{bmatrix} \begin{bmatrix} d_y \\ d_E \\ d_r \end{bmatrix} = \begin{bmatrix} -d(T-G) & 0 \\ L_i\Pi_{(T-G)}d(T-G) & -dM \\ \left(k_{i^*+\Pi+\phi} - k^f_{i\text{-}\Pi\text{-}\phi}\right)\phi_\Pi\Pi_{T\text{-}G}d(T-G) & 0 \end{bmatrix}$$

where s = marginal propensity to save
m = marginal propensity to import

and subscripts refer to partial derivatives.

The solution to the system is

$$\begin{bmatrix} d_y \\ d_E \\ d_r \end{bmatrix} = \frac{1}{\Delta}A' \begin{bmatrix} -d(T-G) & 0 \\ L_i\Pi_{(T-G)}d(T-G) & -dM \\ \left(k_{i^*+\Pi+\phi} - k^f_{i\text{-}\Pi\text{-}\phi}\right)\phi_\Pi\Pi_{T\text{-}G}d(T-G) & 0 \end{bmatrix}$$

where: $\Delta = \left((k_i + k^f_{i\text{-}\Pi\text{-}\phi})L_y - k_yL_i\right)B_E > 0,$

under plausible conditions, and

$$A' = \begin{bmatrix} 0 & -B_E(k_i + k^f_{i\text{-}\Pi\text{-}\phi}) & B_EL_i \\ -[L_y(k_i + k^f_{i\text{-}\Pi\text{-}\phi}) - L_ik_y] & -(s+m-i_y)(k_i + k^f_{i\text{-}\Pi\text{-}\phi}) - I_rk_y & (s+m-i_y)L_i + I_rL_y \\ 0 & B_Ek_y & -B_EL_y \end{bmatrix}$$

Fiscal Policy:

$$\frac{d_y}{d(T-G)} = \frac{-(1+\phi_\Pi)B_EL_i\Pi_{T-G}\left(k_i + k^f_{i-\Pi-\phi}\right)}{\Delta} < 0$$

$$\frac{dE}{d(T-G)} = \frac{L_y\left(k_i + kf_{i-\Pi-\phi}\right) - L_i k_y}{\Delta}$$

$$\frac{\left\{\left[\left(s+m-i_y\right)\left(k_i + kf_{i-\Pi-\phi}\right) + I_i k_y\right]L_i - \left(\left(s+m-i_y\right)L_i + I_i L_y\right)\phi_\Pi\left(k_i + kf_{i-\Pi-\phi}\right)\right\}\ \Pi_{T-G}}{\Delta}$$

$$\frac{dr}{d(T-G)} = \frac{B_E\Pi_{(T-G)}\left(k_y L_i + L_y\phi_\Pi(k_i + kf_{i-\Pi-\phi})\right)}{\Delta} \lessgtr 0$$

Where, to simplify notation, the following relation is used:

$$k_{i^*+\Pi+\phi} - kf_{i-\Pi-\phi} = -\left(k_i + kf_{i-\Pi-\phi}\right)$$

Inflationary expectations (reflected in the term $\Pi_{(T\text{-}G)}$) expand income by making it more likely that the currency will depreciate in response to fiscal deficits (that is, $dE/d(T-G)<0$). Two effects are at work here. First, the rising inflationary expectations in response to fiscal deficits lower real money demand. The resulting excess demand for money lowers real rates in the short run, tending to depreciate the currency, and stimulate net exports and income. Second, in addition to the effect of lower interest rates, the currency depreciates further because inflationary expectations raise the risk premium demanded by foreigners, thereby stimulating net exports and income even more.

The effect of inflationary expectations on money demand tends to lower real interest rates, while the effect of inflationary expectations on the risk premium tends to raise real interest rates. If the impact of inflationary expectations on the risk premium is sufficiently strong, the currency may depreciate even when domestic real interest rates are not falling, or perhaps even when they are rising. In a large economy such as the United States, it is likely that the effects of variations in the risk premium will be reflected largely in the exchange rate rather than in the interest rate.

The effect of an increase in the government surplus on the private saving-investment balance is therefore:

$$\frac{d(S-I)}{d(T-G)^2} = s\ \frac{dy}{d(T-G)} - I_r\ \frac{dr}{d(T-G)} \qquad (A\text{-}7)$$

$$-\left\{\frac{\left(s(k_i + kf_{i\text{-}\Pi\text{-}\phi}) + I_i k_y\right)L_i}{\Delta} + \frac{\phi_\Pi(k_i + kf_{i\text{-}\Pi\text{-}\phi})(sL_i + I_i L_y)}{\Delta}\right\}\ B_E\Pi_{T-G}$$

In the absence of international capital mobility, $d(S-I)/d(T-G) = -1$, because domestic saving must fully finance government deficits. However, in the presence of capital mobility and floating exchange rates, as assumed here, $d(S-I)/d(T-G) = 0$ if $\Pi_{(T-G)} = 0$. This is because neither income nor interest rates will increase in response to fiscal deficits, in the case where fiscal deficits do not affect inflationary expectations. Thus, in the absence of changes in inflationary expectations, capital mobility and floating rates imply that the offsetting response of the private saving-investment balance to budget deficits will decline. The intuition is discussed in the text.

Equation (A-7) shows that if $\Pi_{(T-G)}$ is negative, the response of the private saving-investment balance to fiscal deficits will not necessarily fall to zero even with capital mobility and floating exchange rates. The sign of the first

right hand side term, which reflects the impact of inflationary expectations on money demand, is ambiguous; the private saving-investment balance may rise or fall. In contrast, the second right-hand side term (multiplied by Φ_{Π}) is unambiguously negative. Thus, $d(S-I)/(T-G)$ will remain negative if the second right-hand side term is sufficiently large.

The text argues implicitly that the response of inflationary expectations, and particularly its impact on the risk premium in the 1970s, may have risen by enough to prevent $d(S-I)/d(T-G)$ from falling in absolute value in the 1970s. In the 1980s, $d(S-1)/d(T-G)$ fell because $\Pi_{(T-G)}$ fell to zero.

In the next section, it is shown that the conditions that determine the sign of the impact of monetary policy on the private saving-investment balance determine the sign of the first right hand side term of equation (A–7).

Monetary Policy

$$\frac{dy}{dM} = \frac{B_E(k_i + k^f_{i-\Pi-\Phi})}{\Delta} > 0$$

$$\frac{dE}{dM} = \frac{(s + m - i_y)(k_i + k^f_{i-\Pi-\Phi}) - I_r k_y}{\Delta} > 0$$

$$\frac{dr}{dM} = -\frac{B_E k_y}{\Delta} < 0$$

The effect of an increase in the money supply on the private saving-investment balance is

$$\frac{d(S-I)}{dM} = s\frac{dy}{dM} - I_r\frac{dr}{dM} = \frac{B_E\left[s\left(k_i + k^f_{i-\Pi-\Phi}\right) + I_r k_y\right]}{\Delta} \qquad (A\text{-}8)$$

In the text the impact of an expansionary monetary policy on the private saving-investment balance, and therefore the external balance, is ambiguous. For example, if the interest sensitivity of investment demand (I_r) is large, an expansionary monetary policy will lower the private saving-investment balance.

An increase in capital mobility [$(k_i + k^f_{i-\Pi-\Phi})$ increases in absolute value] means the term $(B_e I_r k_y/\Delta)$ becomes smaller, which implies that a monetary expansion is more likely to improve the external balance.** The reason is that a greater degree of capital mobility will tend to weaken the ability of monetary policy to influence domestic interest rates, and therefore, investment demand and the external balance. The finding that there was an increase in the impact of monetary policy on the private saving-investment balance after 1974 is consistent with the expected effect of liberalization of capital controls.

It has been assumed that an increase in the stock of money does not directly affect inflationary expectations; instead, expectations respond to the *growth* in the money supply associated with fiscal deficits. Inspection of equations (A–7) and (A–8) also confirms that if $d(S-I)/d(T-G)$ in equation (A–8) is negative, as found in the regressions in the text, the impact of inflationary expectations on money demand cannot explain why $d(S-I)/(T-G)$ did not fall in the 1970s.

Notes to Appendix

* *See Dewald (1982), who finds evidence of this type of accommodation between 1948 and 1980.*

** *The effect of a tax cut may differ from that of an increase in government spending in two ways: first, a tax cut will raise disposable income directly as well as indirectly. Second, a tax cut may increase money demand for any level of pretax income. This tends to reduce the expansionary impact of a tax cut on income. These effects are ignored in order to simplify the present discussion.*

ENDNOTES

1. The external balance measure used here is U.S. net foreign investment abroad, the measure which is conceptually most consistent with the use of equation 2. This measure is approximately equal to net exports of goods and services as measured in the national income and product accounts.

2. The middle-expansion trend of GNP is calculated by classifying each quarter into one of four cyclical phases: recession, recovery, middle expansion, and late expansion. The geometric mean of GNP during each middle expansion phase provides one observation of the trend GNP. The middle expansion begins when the level of real GNP passes its pre-recession peak and lasts 12 quarters unless a downturn occurs before 12 quarters have passed. In the latter case, the middle expansion ends at the cyclical peak just before the downturn. The advantage of this approach is that it reflects the path of actual GNP purged of cyclical movements and requires no assumption about potential GNP. See De Leeuw and Holloway (1983).

3. The statistical discrepancy between internal and external balances has been added to gross private saving. It is therefore reflected in the private saving-investment balance.

4. The cyclical patterns disguise certain trends in these variables and may provide a misleading picture of the relationships among the variables. For example, the unadjusted U.S. government budget deficit, illustrated in Chart 1, averaged 0.7 percent between 1976:1 and 1979:4 and turned into a surplus for a brief period. On a cyclically adjusted basis, however, the government budget was consistently in deficit, averaging nearly 2 percent of the middle expansion trend of GNP. The empirical analysis reported later controls for cyclical effects.

5. The observed budget balance, and by the accounting identity of (2), the external balance, are also the consequence of these same exogenous disturbances to fiscal and monetary policy.

6. A coefficient for a_1 of -1 could mean that an expansionary fiscal policy will produce a trade *surplus* because such an expansionary policy will tend to create an offsetting improvement in the fiscal balance.

7. The model assumes perfect capital mobility and perfect asset substitutability. Careful attention is paid to dynamics, and rational expectations in asset and labor markets is assumed. Sticky wages are modelled by staggered wagesetting. An earlier example of a structural analysis of the U.S. external balance as determined by internal balances is provided by Von Furtensberg (1980), who examines the domestic price and quantity determinants of three components of the net national saving rate (government saving, personal saving, and corporate saving) and two components of net domestic investment (fixed domestic investment and the rate of inventory change). A similar approach, which focuses on international as well as domestic determinants, is followed by Turner (1986) for the seven major OECD countries.

8. Taylor (1987) p. 15. Taylor performs a counterfactual experiment in which U.S. government spending grows less rapidly than it actually did starting in the first quarter of 1982, so that by 1986:1 real government purchases are lower than they actually were by an amount equal to 3 percent of real GNP. This roughly would balance the fiscal deficit, and result in a reduction in the outstanding stock of government bonds.

9. The model is related to intertemporal dynamic models of fiscal policy and solves for a full intertemporal equilibrium in which agents have rational expectations of future variables. Attention is given to intertemporal optimization and intertemporal budget constraints. In this respect, it differs from the simple Mundell-Fleming framework utilized in this paper. Obstfeld (1987) provides an analytic (as opposed to simulation) solution to this type of optimization problem.

10. For a study that includes developing countries see Dooley, Frankel, and Mathieson (1987). For a similar approach that treats investment as the exogenous, rather than the endogenous variable, see Sachs (1981).

11. This is consistent with the standard trade literature, recently summarized by Hooper and Mann (1987), who suggest that by bringing about a currency depreciation, a monetary expansion would tend to improve the external balance, presumably by increasing the private saving-investment balance as well as the budget balance. Friedman uses the detrended logarithm of the ratio of M1 to GNP as the monetary policy variable.

12. They argue that four years of erratic upward movements in real per capita M1, which reversed a secular decline, contributed significantly to a decline in saving.

13. To see this, recall equation (2), $S - I + T - G = B$. An expansionary monetary policy will always tend to increase $T - G$, because as income rises, tax revenue increases. If an expansionary monetary policy lowers B, it must be because $S - I$ has fallen. Note that given the neutrality of money in Taylor's model, in the long-run money has no effect on the external balance in his simulations ($a_2 = 0$). Sachs and Roubini also find that monetary policy is of little importance in influencing the external balance.

14. Darby, Gillingham, and Greenless argue that the reduction in the U.S. national saving rate in the 1980s, and the associated deterioration in the U.S. external balance, were caused in large measure by a decline in the personal saving rate. Darby reports preliminary studies that find a significant increase in investment demand in the U.S. over the period 1981–85. In Darby's view, such an increase in demand permitted investment to flourish in the 1980s, even though negative real U.S. interest rates in the 1970s turned positive in the 1980s. Darby argues that this upward shift in investment demand was due to reductions

in anticipated business taxes and greater confidence that the regulatory environment would not arbitrarily turn against business. Note, however, that the empirical approach of the present paper is closer to that of Friedman than that of Darby *et. al.* The theoretical interpretation of the results also differs from those in the studies conducted by Darby.

15. The U.S. shifted to floating exchange rates in March 1973. Except for a brief effort to strengthen a rapidly falling dollar in November 1978, the behavior of exchange rates apparently had little influence on U.S. monetary policy from March 1973 until the Louvre agreement of February 1987.

16. Capital controls, which were widely used in OECD countries after World War II, were liberalized in the first half of the 1970s following the adoption of generalized floating exchange rates and in response to the rapid growth of the Euromarkets in the 1960s, which tended to limit the effectiveness of such controls. Capital mobility probably had increased after the convertibility of European currencies was restored in 1958, but restrictions on capital flows largely remained effective throughout the 1960s. See OECD (1982).
In the case of the U.S., restrictions that were designed to prevent capital outflows largely were eliminated in January 1974. These were the Interest Equalization Tax (IET), the Voluntary Foreign Credit Restraint Program, and controls on direct foreign investment. More stringent controls on capital flows had been imposed from time to time in the 1960s. For example, at the beginning of 1968, President Johnson announced controls on outflows of capital by American businesses, banks, and other financial institutions. This included a requirement that no U.S. capital finance direct investment in other industrial countries. This action was taken in response to the deterioration in the U.S. external position.

17. Dewald finds evidence that money growth was positively related to fiscal deficits between 1948 and 1980. He estimates that over the period a unit rise in the ratio of the fiscal deficit to high employment output was associated with a rise in the growth of M2 of 0.4 percent.

18. See De Leeuw and Holloway (1983).

19. Because the variables are expressed in ratios, a significant constant term (b_0) indicates that the *level* (not the ratio) of the private saving-investment balance is related to the middle expansion trend of GNP. Furthermore, a significant coefficient on INVMET indicates that if the relationship between the private saving-investment balance and the budget deficit were expressed in levels rather than ratios, the constant term would be significant. To see this, assume 8 lags on M2. Suppose the true relationship in levels (not ratios to the middle expansion trend of GNP) is

$$S - I = c_0 + c_1 \cdot (T-G)_t + \sum_{i=0}^{8} c_{2+i} \cdot M2_{t-i} \qquad (5)$$

$$+ c_{11} \cdot GNPGAP_t + c_{12} \cdot GNPMET_t$$

$$+ c_{13} \cdot DUM \cdot (T-G)_t + \sum_{i=0}^{8} c_{14+i}$$

$$\cdot DUM \cdot M2_{t-i} + c_{23} \cdot DUM \cdot GAP_t$$

where GNPMET is the middle expansion trend of GNP. Then the relationship expressed as ratios will be the equation shown in the text. Note that $c_0 = b_{12}$ and $c_{12} = b_0$ in equation (4) in the text.

20. The first stage regression to construct an instrumental variable for the budget balance included the budget balance lagged 1 to 3 quarters and contemporaneous department of defense spending. It produced an adjusted R^2 coefficient of .81 and a D.W. statistic of 1.93. The first stage regression for M2 included a constant, the short-term nominal interest rate in the U.S. lagged 1 to 8 quarters and M2 lagged 1 quarter. The adjusted R-squared was .967, the Durbin-Watson statistic 1.4. Equation (4) in the text resembles one of the reduced form regressions performed by Friedman (1986). However, Friedman did not use an instrumental variables procedure.

21. The correction was implemented by running a regression with quasi-differenced data. The data were quasi-differenced with the rho coefficient estimated from the instrumental variables regression.

22. The sample begins in the first quarter of 1959. However, degrees of freedom were used up by various lag lengths tried in the second stage regressions. Lagged variables were also used in creating instrumental variables.

23. The PC criterion is a better indicator than the adjusted R-squared because it considers the losses associated with choosing an incorrect model. It thus imposes a higher penalty for adding variables than does Theil's adjusted R-squared. See Judge *et. al.* (1985), pp 865–866, 868.

24. However, attempts to introduce a stock market variable as an explanatory variable were not fruitful. The absence of a slowdown in the economy after the stock market decline of October 1987 also suggests that wealth effects are not very strong.

25. The marginal significance level is 10 percent, which is a weak basis for not rejecting the hypothesis that there was a shift.

26. The external balance is estimated by adding the actual government deficit and the predicted private saving-investment balance. Note that the actual government deficit may be seen as the sum of the exogenous contemporaneous government deficit used on the right hand side of the regressions and of the endogenous response of the budget balance to fiscal and monetary policy.

27. In terms of equation (3), $a_1 = -1$ or close to it, as there is no foreign financing of fiscal deficits.

28. It also should have increased the positive response of

the private saving-investment balance to monetary policy, which did occur, as there is a statistically significant and positive slope dummy variable for M2 for 1974–79.

29. This interpretation needs to be qualified because the regression allows for lags in the impact of the M2/GNP ratio. Furthermore, although the demand for M2 has been more stable than the demand for M1 in the 1980s, it is still not perfectly stable. The rise in the M2/GNP ratio may in some cases reflect a rise in money demand, particularly in the most recent expansion.

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