2
Causes of Appreciation and Volatility of the Dollar

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Introduction and summary

In 1981 real interest rates in the United States increased spectacularly, and the dollar appreciated in real terms by about 20 percent. Since the end of 1981, long-term real interest rates have remained in the range of five to ten percent, with nominal long rates above short rates. This suggests that the financial markets expect rates to rise. The dollar appreciated further, but more gradually, until early 1985, and has come down by six to seven percent since then. This paper argues that these movements in real interest rates and the real exchange rate are due to the budget program that was announced in March 1981, and has been subsequently executed. In particular, the shift in the high employment—or "structural," as the responsible parties have taken to calling it—deficit by some $200 billion requires an increase in real interest rates and a real appreciation to generate the sum of excess domestic saving and foreign borrowing to finance it. The argument is a straightforward extension of the idea of "crowding out" at full employment to an open economy.

The current situation is not sustainable, however. It is a "temporary equilibrium," to use the jargon of macroeconomic dynamics. Eventually international investors will begin to resist further absorption of dollars into their portfolios, so U.S. interest rates will have to rise further, as the markets seem to expect, and the dollar will have to depreciate. This will continue until the current account is back in approximate balance, and the entire load of deficit financing is shifted to excess U.S. saving. The following sections of this paper describe the mechanisms that will generate this outcome, if it occurs.

The first two sections of this paper present the "fundamentals" framework of the analysis. This is fundamental in the sense that it emphasizes the variables, such as the high-employment deficit, that the market should look to when it is forming expectations about movements in interest rates or the

exchange rate. The focus is on real interest rates and the real (effective) exchange rate; these are the variables whose movements have been surprising. The argument that the shift in the budget can explain the rise in real interest rates and the dollar is presented in these two sections.

The role of expectations and the timing of the jump in interest rates and the dollar is discussed in the section of this paper entitled "Expectations and timing." The Economic Recovery Tax Act of 1981 provided a credible announcement of a future shift in the budget. The financial markets reacted by raising interest rates and the dollar well in advance of the actual fiscal shift, contributing to the recession of 1981-82.

The volatility of the dollar is briefly discussed in the section entitled, "Volatility." Modem models of the foreign exchange market emphasize the idea that the exchange rate is proximately determined in financial markets, and should be expected to fluctuate like a stock price. Exchange-rate fluctuations may be of more concern to policymakers than stock-price fluctuations, because the exchange rate directly influences the price of tradeable goods.

Finally, in the last section, three alternative explanations of recent movements in the dollar are analyzed. The arguments that these could be due to tax changes that have increased investment incentives or to financial deregulation are plausible, but would require evidence of an investment boom to be quantitatively important. The argument that the strong dollar is due to a shift in international portfolio demands--the "safe haven" effect—runs up against the old problem of identification. If this were driving the dollar, U.S. interest rates should have been down, not up.

I have attempted to make the exposition here as non-technical as possible, to maximize accessibility. The paper draws heavily on Branson (1977, 1983, 1985) and Branson, Fraga, and Johnson (1985). The technical details are given in those references; here I attempt to lay out the logic and the implications for policy.

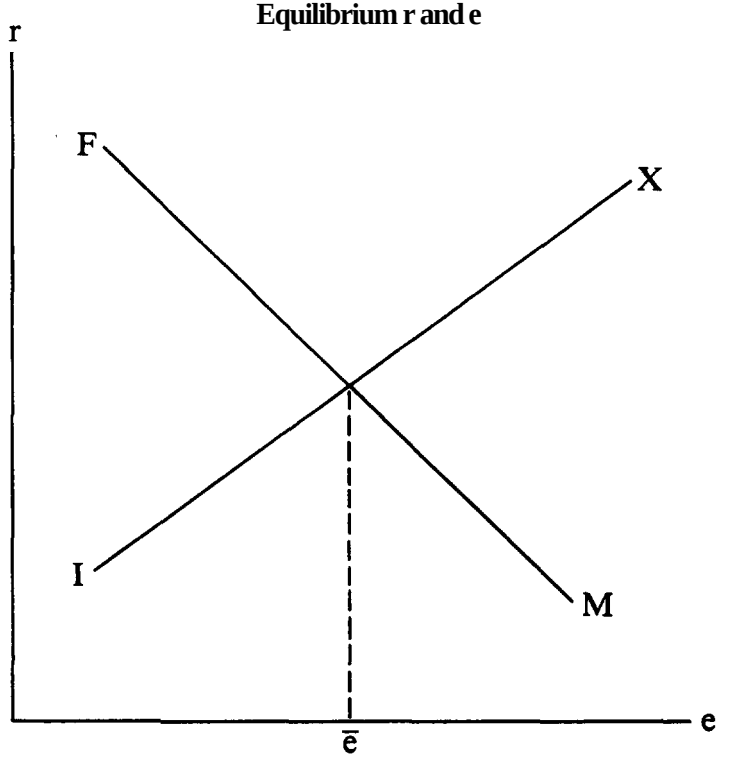
Short-run equilibrium in a fundamentals framework

A good start for our discussion of the causes of the strength and volatility of the dollar since 1980 is exposition of a "text-book-ish" framework that describes the determination of movements in real interest rates and the real exchange rate. The focus is on *real* rates because these have been the source of surprise and concern. If nominal interest rates had simply followed the path of expected or realized inflation and the exchange rate had followed the path of relative prices, the world would be perceived to be in order. It is the movement of interest rates and the exchange rate relative to the price path that is of interest here. So we begin by taking the actual and expected path of prices as given, perhaps determined by monetary policy, and focus on real

interest rates and the real exchange rate. In this section we develop a framework that integrates goods markets and asset markets to describe simultaneous determination of the interest rate and the exchange rate. It is "short run" in the sense that we take existing stock of assets as given. Movement in these stocks will provide the dynamics of the next section of this paper. It is a "fundamentals" framework because it focuses on the underlying macroeconomic determinants of movements in rates, about which the "market" will form expectations. The latter are discussed in "Expectations and timing." The framework is useful because it permits us to distinguish between external events such as shifts in the budget position (the "deficit"), shifts in international asset demands (the "safe haven effect"), and changes in tax law or financial regulation by analyzing their differing implications for movements in the interest rate and the exchange rate. We begin with the national income, or flow-of-funds, identity that constrains flows in the economy, then turn to asset-market equilibrium that constrains rates of return, and finally bring the two together in Figure 1.

FIGURE 1

Equilibrium r and e



Flow equilibrium: The national income identity

The national income identity that constrains flows in the economy is generally written as

$$Y = C + I + G + X = C + S + T,$$

with the usual meanings of the symbols, as summarized in Table 1. Note that X here stands for ***net*** exports of goods and services, the current account balance. All flows are in real terms. We can subtract consumer expenditure C from both sides of the right-hand equality and do some rearranging to obtain a useful version of the flow-of-funds identity:

$$(1)\ G - T = (S-I) - X$$

In terms of national income and product flows, Equation (1) says the total (federal, state, and local) government deficit must equal the sum of the excess of domestic private saving over investment less net exports.

Let us now think of Equation (1) as holding at a standardized "full-employment" level of output, in order to exclude cyclical effects from the discussion. This allows us to focus on shifts in the budget at a given level of income. If we take a shift in the full-employment deficit (G-T) as external, or exogenous to the economy, Equation (1) emphasizes that this shift requires some endogenous adjustment to excess private saving (S-I) and the current account X to balance the flows in income and product. In particular, if (G-T) is increased by $200 billion, roughly the actual increase in the "structural" deficit, a combination of an increase in S-I and a decrease in X that also totals $200 billion is required.

Standard macroeconomic theory tells us that for a given level of income, (S-I) depends positively on the real interest rate r, and X depends positively on the real exchange rate e (dollars per unit of foreign exchange, adjusted for relative price levels).[1] So the endogenous adjustments that would increase S-I and reduce X are an increase in r and a reduction in e. Some combination of these changes would restore balance in Equation (1), given an increase in G-T.

We can relate this national income view of the short-run adjustment mechanism to the more popular story involving foreign borrowing and capital flows by noting that net exports X is also net foreign investment (NFI)

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[1] Here, for simplicity, I ignore changes in the term structure of interest rates and focus on "the" real rate. See Branson, Fraga, and Johnson (1985) for the analysis of relative movements of short and long rates consistent with the story being told here.

TABLE 1

Definitions of Symbols

National Income Flows (all in real terms)

Y = GNP

C = Consumer expenditure

I = Gross private domestic investment

G = Government purchases of goods and services

X = ***Net*** exports of goods and services, or the current account balance

S = Gross private domestic saving

T = Tax revenue

NFI = Net foreign investment by the U.S.

NFB = Net foreign borrowing = - NFI

Prices and Stocks

r = Real domestic interest rates

i = Nominal domestic interest rate

i* = Nominal foreign interest rate

e = Real effective exchange rate (dollars per unit of foreign exchange); an increase in e is a depreciation of the dollar

$\hat{e}$ = Expected rate of change of e

$\hat{P}$ = Expected rate of inflation

ρ = Risk premium on dollar-denominated bonds

B = Outstanding stock of government debt

from the balance of payments identity:

X - private NFI = public NFI, or

(2) X = national NFI

Since national NFI is minus national net foreign borrowing (NFB), so that, X = NFI = -NFB, the flow-of-funds Equation (1) can also be written as

(3) (G-T) = (S-I) - NFI = (S-I) + NFB

This form of the identity emphasizes that an increase in the deficit must be financed either by an increase in excess domestic saving or an increase in net foreign borrowing (decrease in NFI). One way to interpret the adjustment mechanism is that the shift in the deficit raises U.S. interest rates, increasing S-I. The high rates attract foreign capital or lead to a reduction in U.S. lending abroad, appreciating the dollar, i.e., reducing e. This process continues, r increasing and e falling, until the increase in S-I and the decrease in X add up to the originating shift in the deficit.

The actual movements in the government deficit, net domestic saving (S-I), net foreign borrowing, and the associated movements in the real long-term interest rate r and the real exchange rate e (indexed to 1980 = 100) are shown in Table 2. The total deficit was roughly zero at the beginning of 1981. It expanded to a peak of $179 billion in the bottom of the recession in the fourth quarter of 1982, and then shrank in the recovery. But the shift in the ***federal*** budget position leaves the total government deficit at $140 billion in early 1985, after two years of recovery. The recent ***World Development Report*** (1985) estimates that the inflation-adjusted shift in the total deficit for 1979 to 1984 is $160 billion. Initially the deficit was financed mainly by net domestic saving, which also peaked at the bottom of the recession. But since 1982 the fraction financed by net foreign borrowing has risen; by early 1985 three-quarters of the government deficit was financed by foreign borrowing.

The movements in the real interest rate and the real exchange rate roughly reflect this pattern of financing. The real interest rate jumped from around two percent to over five percent in 1981, fell during the recession, and rose in the recovery, staying in the five to ten percent range since mid-1983. The real exchange rate shows an initial fall of 20 percent in 1981, and a more gradual decrease beginning in early 1983. The standard lags in adjustment of net exports to changes in the exchange rate can explain the slow reaction of net exports (net foreign borrowing) to the dollar appreciation.

The data in Table 2 are roughly consistent with the story of maintenance of the flow-of-funds equilibrium in Equation (1), with one big exception and

TABLE 2

National Income Flows, Interest Rates, and Exchange Rates

Year	Current Account Deficit (billions)	Excess Domestic Saving (billions)	Total Budget Deficit (billions)	Real LT Interest Rate (%)	Real Exchange Rate ($/composite)	Ratio Budget Def. to GNP (%)
1979:Q1	-3.4	-15.4	-22.2	'0.5	1.01	0.4
Q2	4.3	-17.4	-20.1	-0.2	0.99	0.2
Q3	-2.7	-14.6	-12.9	0.3	1.03	0.7
Q4	4.6	-15.6	-2.1	1.6	1.01	1.1
1980:Q1	2.9	-7.3	7.5	3.6	1.00	1.5
Q2	-7.9	43.0	38.1	2.1	0.99	2.5
Q3	-21.5	61.3	43.3	1.9	1.02	2.8
Q4	-3.5	37.1	33.9	3.0	0.99	2.5
1981:Q1	-13.6	9.5	9.7	2.5	0.95	1.6
Q2	-1.8	5.1	11.4	2.9	0.88	1.7
Q3	-2.9	19.5	23.3	5.1	0.83	2.0
Q4	-9.3	69.0	62.4	4.4	0.87	3.2
1982:Q1	-2.5	84.6	73.8	5.3	0.83	3.5
Q2	-11.1	91.8	77.6	6.4	0.80	3.6
Q3	18.9	112.4	130.4	5.8	0.76	5.3
Q4	20.9	147.8	179.2	5.2	0.76	6.8
1983:Q1	4.1	140.1	151.7	6.6	0.78	5.8
Q2	30.9	88.5	123.4	6.4	0.76	5.1
Q3	41.5	96.7	133.5	8.1	0.74	5.4
Q4	59.1	75.0	129.3	8.4	0.74	5.2
1984:Q1	77.7	27.5	107.4	8.3	0.73	4.5
Q2	85.0	33.2	109.2	9.6	0.72	4.4
Q3	119.4	26.6	133.0	9.0		4.8
Q4	81.5	71.6	140.1	7.8		5.1

Data from Citibase and IFS tapes. Real long-term interest rates are the net of the long-term (20 year) bond rate and inflation. The real exchange rate series (IFS) is based on relative normalized unit labor costs. A decrease in the real exchange rate represents an appreciation, The TOTBDEF series include the federal balance as well as the state and local balances. The CAB is MPA net foreign investment summed with net capital grants received by the U.S. XDOMSVNG is the difference between Gross Domestic Savings and Gross Domestic Investment in the U.S. FDEFGNP is the ratio of the U.S. federal deficit to GNP (muhiplied by 100).

one major loose end. The exception is that interest rates and exchange rates jumped in 1981, while the structural deficit only began actually to emerge in 1982. In the next section, we argue that this reflects the market's anticipation of the shift in the budget. The loose end is that we have not said anything about what determines the precise mix or combination of rise in r and e that achieves short-run equilibrium. For this we turn to the financial markets.

Financial market equilibrium and rate of return

We can obtain a relationship between r and e that is imposed by financial market equilibrium by considering the returns that a representative U.S. asset-holder obtains on domestic and foreign assets of the same maturity. The return on the domestic asset is i in nominal terms, and $r = i - \hat{P}$ in real terms, where $\hat{P}$ is the (exogenous, from our point of view) expected rate of inflation. The return on the foreign asset is $i^* + \hat{e}$ in nominal terms, where $\hat{e}$ is the expected rate of change in the exchange rate. In real terms the U.S. asset-holder's return would be $i^* + \hat{e} - \hat{P}$. In equilibrium, the difference between the two returns must be equal to the market-determined risk premium $\rho(B)$. Here we assume that dollar-denominated bonds are imperfect substitutes for foreign-exchange-denominated bonds, so that the risk premium on dollar bonds increases with their supply: $\rho'(B) > 0$. The equilibrium condition for rates of return in real terms is then

$$(4)\quad r - (i^* + \hat{e} - \hat{P}) = \rho(B)$$

Next we need to relate the expected rate of change of the exchange rate to the actual current rate. If we denote the perceived long-run equilibrium real rate that sets the full-employment current account balance at zero as $\bar{e}$, one reasonable assumption is that the current rate is expected to return gradually toward long-run equilibrium. Following Dornbusch (1976), we can write this as a proportional adjustment mechanism:

$$(5)\quad \hat{e} = \theta(\bar{e} - e)$$

If e is below the long-run equilibrium, it is expected to rise, and vice versa. If we put Equation (5) into the equilibrium condition Equation (4), and rearrange a bit, we obtain the financial-market relationship between e and r:

$$(6)\quad e = \bar{e} - \frac{1}{\theta}[r - (i^* - \hat{P}) - \rho(B)]$$

This condition says that for given values of the bond stock B, inflation $\hat{P}$, the foreign nominal interest rate i*, and the long-run equilibrium real

exchange rate e, and increase in r requires a decrease in e to maintain equilibrium in financial markets. Why? If the home interest rate rises, equilibrium can be maintained for a given foreign rate only if the exchange rate is expected to rise. From Equation (5), this means that the actual current rate must fall to establish $\hat{e} > 0$. In terms of market operations, the rise in domestic rates r causes sales of foreign assets and a fall in e until equilibrium is reestablished.

Below we argue that this is essentially what happened in 1981 with the announcement of a path of future deficits. This did not substantially change the long-run $\bar{e}$ that would balance the current account, but did move r and e.

Interest rates and the exchange rate

We can now join the flow equilibrium condition Equation (1) and the rate-of-return condition Equation (6) to form the short-run framework for simultaneous determination of r and e. Let us re-write Equation (I) to show the dependence of S and I on r, and of X on e:

$$(7)\quad G\text{-}T = S(r) - I(r) - X(e)$$

For a given level of the full-employment budget, the trade-off between r and e that maintains flow equilibrium is given by the positively-sloped IX curve in Figure 1.[2] For a given G-T, an increase in r, which reduces (S-I), requires an increase in e, which increases X, to maintain flow equilibrium. An increase in G-T will shift the IX curve up or to the left, requiring some combination of a rise in r and fall in e to maintain flow equilibrium.

The rate-of-return condition Equation (6) gives us the negatively-sloped FM curve in Figure 1, for given B, i^*, $\check{P}$, and $\bar{e}$. Its slope is $-\Theta$, the speed-of-adjustment parameter for expectations. An increase in the risk premium p, due to a rise in the supply of U.S. bonds B, will shift the FM curve up and to the right, requiring an increase in r for any given value of e.

In the short run, equilibrium r and e are reached at the intersection of IX and FM in Figure 1; there both equilibrium conditions are met. For the purposes of the analysis here, we assume that initially $e = \bar{e}$, with no *expected* movement in exchange rates. This is taken to represent the equilibrium around 1980, before the surge in interest rates and the exchange rate that we are trying to explain.

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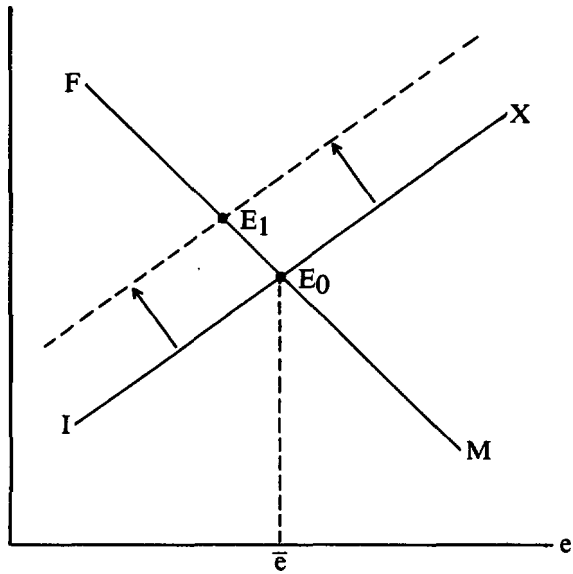
[2] The slope is given by $X'/(S'-I')$.

FIGURE 2
Shift in the Structural Deficit



Effects of a shift in the budget

A shift in the full-employment, or structural, budget towards deficit shifts the IX curve up, as shown in Figure 2. The real interest rate rises, and the real exchange rate falls, as described earlier. The composition of these movements is determined by the slope of the FM curve, representing financial market equilibrium. The movement of r and e from E_0 to E, raises excess domestic saving (S-I) and reduces net exports X by a sum equal to the shift in G-T. This also produces the short-run equilibrium financing of the shift in the deficit by domestic saving and foreign borrowing. The results of the shift in G-T are the movements in excess domestic saving and foreign borrowing, and in r arid e, that are shown in Table 2. Thus the framework of Figure 2 roughly captures the movements of r and e from 1981 to 1985.

Dynamic adjustment to long-run equilibrium

In Figure 2, point E_0 is taken to represent the initial equilibrium of 1980 or 1981, before the shift in the structural deficit, and point E, may represent the economy in 1984 or 1985, after the full shift in the budget was completed. The next question that arises is: is the equilibrium E, sustainable? The short answer is no. This takes us to the dynamics of debt accumulation.

At point E_1 in Figure 2, the economy is running a substantial current-account deficit, perhaps $150 billion in 1985. This is adding, on balance, that amount each year to the holdings of dollar-denominated assets in international portfolios. Either the U.S. is borrowing abroad to finance partially the budget deficit, or it is reducing its lending as U.S. asset-holders shift into government debt. In either case, the net foreign position in dollar-denominated assets is growing. This will lead eventually to international resistance to the absorption of further increases in dollar-denominated assets, and to a rise in U.S. interest rates and the exchange rate.

At any given set of interest rates and exchange rates such as point E, in Figure 2, international investors will have some desired demand distribution of their portfolios across currencies. This will depend, of course, on a whole array of expectations as well as current market prices. As the U.S. current account deficit adds dollars to these portfolios from the supply side, this disturbs the initial portfolio balance, shifting the distribution towards dollar assets. In order to induce investors to hold the additional dollar assets, either U.S. interest rates have to rise or the exchange rate must be expected to rise, offering investors a higher rate of return on dollars. This is the dynamic adjustment of the exchange rate discussed in terms of sustainability by Krugman (1985). As the dollar depreciates, the current account deficit will shrink, if the long-run equilibrium is stable. As the deficit shrinks, the rate at which international portfolio distributions are changing is reduced, and so is the rate at which the dollar depreciates. Eventually, the economy returns to a long-run equilibrium where the current account is again balanced, and excess domestic saving finances the budget deficit. The dynamics of this adjustment mechanism in a fundamentals model were described in detail in Branson (1977); the version with a rational expectations overlay is given in Branson (1983). Krugman (1985) explores the question of whether the U.S. economy is currently on such a stable path back to long-run equilibrium.

This adjustment mechanism has a straightforward interpretation in the fundamentals framework of the first section of this discussion. Consider the position of the economy at point E_1, reproduced in Figure 3. Remember that $\bar{e}_0$ was the initial value of the real exchange rate that produced current-account balance. At point E_1, the current account is in deficit, and dollar-denominated debt in international portfolios is increasing. This tends to raise the equilibrium U.S. interest rate r or the exchange rate e. In Figure 3, this is captured by a continuing upward drift in the FM curve. In Equation (6) for rate-of-return equilibrium, the bond stock B is growing. This raises the risk premium ρ, shifting FM up.[3] As FM shifts up, driven by the current-account deficit, the interest rate and exchange rate rise along IX. This move-

[3] The vertical measure of the shift is just $\rho'(B)$