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AN EMPIRICAL INVESTIGATION INTO
THE CAUSES OF THE DOLLAR'S DECLINE
(1985 - 1993)

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AN EMPIRICAL INVESTIGATION INTO

THE CAUSES OF THE DOLLAR'S DECLINE

(1985 - 1993)

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In this paper, the writer develops and estimates a synthesis of the monetary and the portfolio-balance approaches of exchange rate determination in an attempt to explain the dollar's recent depreciation. Since 1985, the U.S. dollar has declined against the German deutsche mark and the Japanese yen. Different explanations have arisen as to the cause of the dollar's depreciation. Some economists blame U.S. monetary policy makers for flooding the world with dollars. Others ascribe fault to fiscal policy makers for not being able to bring the budget and current account deficits under control. And still others attribute most of the U.S.'s economic problems to its continuing deterioration of industrial competitiveness. The empirical results of this study suggest that the current account played the most prominent role in the dollar's recent decline. To strengthen the dollar, U.S. current account deficits must be reduced. Therefore, economic policy must increase domestic savings and lower the budget deficit.
CHAPTER I
INTRODUCTION

In 1973, the primary currency countries of the industrialized world began operating under a system of floating exchange rates. Prior to that time, most of the market economies of the world operated under a system of fixed exchange rates which was established by the Bretton Woods agreement after World War II. Under the Bretton Woods agreement, these economies, which were member nations of the then formed International Monetary Fund, were to establish a value for their currencies in terms of U.S. dollars. In turn, the dollar was to be convertible into gold at a fixed rate of $35 per ounce. The Bretton Woods agreement was terminated in 1971 when President Nixon suspended the convertibility of dollars into gold and unilaterally changed the exchange rate of the dollar against the other international currencies. The major currencies - the U.S. dollar, the German deutsche mark (DM), and the Japanese yen - have floated against each other since 1973.

1Actually, the current system can be described as a managed float, as opposed to a freely floating, currency system. Exchange rates have not been permitted to float cleanly, as evidenced by recent large interventions of central banks, previous efforts to "talk" the dollar up or down, and by formal agreements among the major industrialized nations (i.e., the Plaza Agreement, the Louvre Accord, etc.).
According to Feldstein (1988), since the collapse of the Bretton Woods system the dollar has experienced three major swings. The first was marked by a sustained rise of foreign currencies against the dollar between the beginning of 1977 and the end of 1979. This swing was followed by a five-year surge in the dollar and then, in early 1985, foreign currencies once more began to rise. These major swings can be traced primarily to the pursuit and subsequent correction of inappropriate monetary and budget policies: the first to the inflation of the 1970s followed by the anti-inflationary, monetary policy at the beginning of the 1980s; and the second and third (respectively) to the surge in actual and projected budget deficits in the early 1980s followed by a gradual decline in the actual and projected budget deficits after 1985 (figures 1 through 3 show how the dollar has performed against the DM, yen, and SDR, respectively, since 1973).

Recently, much attention has been focused on the precipitous depreciation of the dollar against the DM and the yen. Divergence between macroeconomic policies of the major industrial countries over the last decade has generated massive swings in exchange rates, each characterized by extreme volatility. Measured against the mark and the yen, the dollar has lost half its value since

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2 These swings have been accompanied by large movements in real exchange rates, reflecting the fact that nominal exchange rate variations have not closely followed changes in relative prices of traded goods.

3 Special Drawing Rights are unconditional reserve assets that are created by the IMF to supplement existing reserve assets. Their value is determined daily by the IMF on the basis of a basket of currencies with each currency assigned a weight in the determination of that value.
FIGURE 1. DM per Dollar
Source: IMF's International Financial Statistics

FIGURE 2. Yen per Dollar
Source: IMF's International Financial Statistics

FIGURE 3. SDR per Dollar
Source: IMF's International Financial Statistics
1985 and has dropped 11 percent and 8 percent, respectively, since the start of 1995. Some experts blame the Federal Reserve's more accommodative monetary policy over the last few years for flooding the world with dollars it does not especially want. Others claim that the market's steady loss of confidence in Washington's ability to bring the budget and current account deficits under control is responsible for the dollar's extraordinary depreciation against the other major currencies. And still others claim that the root cause of most of America's economic problems, from the current run on the dollar to the budget and current account deficits, is the continuing deterioration of the industrial competitiveness of the United States, most notably compared with Japan.

In this paper, the writer develops and estimates a model of exchange rate determination that integrates the roles of the money supply, real industrial production, the federal debt and the current account in an attempt to explain the sustained depreciation of the dollar against the yen and the DM and its slow motion decline as the linchpin of the world's monetary structure. The model draws on and synthesizes two of the more prominent asset-market views of the exchange rate: the monetary and portfolio-balance models of exchange rate determination. The model was estimated using Ordinary Least Squares (OLS) over the period 1985:1 to 1993:4 for the dollar/DM and the dollar/yen exchange rates. Because evidence of first-order serial correlation was present, both models
were reestimated using an Exact Maximum Likelihood (EML) method. The results suggest that the accumulation of the U.S. current account deficit is the most significant determinant of the dollar's recent depreciation.

The second section of this study contains a review of the literature on the asset-market view of the exchange rate. In the third section, the writer develops the monetary and portfolio-balance approaches to the determination of the exchange rate and, subsequently, constructs the synthesis model. In section four, estimates of the model are generated for Germany and Japan, and the results are then analyzed. Finally, section five consists of concluding remarks.
CHAPTER II
REVIEW OF THE LITERATURE

Early theories of the exchange rate singled out purchasing power parity or the current account as the chief determinant of the exchange rate. But these theories had a difficult time explaining the volatility that has been characterized by the recent float. Mussa (1976) asserts that this volatility can be explained by viewing the exchange rate as an asset price. Influential papers by Mundell (1963) and Fleming (1962) introduced capital mobility as a significant feature of exchange rate determination and demonstrated an initial expression of the asset-market view. Recently, asset-market models have developed into the principal models of exchange rate determination. The asset-market approach surmises that the exchange rate is ascertained in the same manner as other asset prices—that is, relative prices adjust to determine the allocation of the total stock in question. The common attribute of asset-market models is that the exchange rate is perceived as equilibrating the net stock demands for financial assets denominated in distinct currencies. The theoretical assumption that all asset-market models share is the lack of significant transactions costs, capital controls, or other
barriers to the flow of capital between countries, that is, they assume perfect capital mobility. Thus, the exchange rate must adjust instantaneously to equilibrate the international demand for stocks of national assets.

The most consequential dichotomy (in differentiating) between asset-market models is according to whether or not domestic and foreign bonds are assumed to be perfect substitutes in asset-holder's portfolios. In one class of asset-market models known as the monetary approach, domestic and foreign bonds are perfect substitutes and the money markets assume the burden of determining the exchange rate. Initial empirical studies by Frenkel (1976) and by Bilson (1978) have established results in support of the monetary model. Frenkel, in his work, examines the relationship between money and the exchange rate during the period of the German hyperinflation of the 1920s. Bilson (1978) applied sophisticated econometric techniques to test the major implications of the monetary approach using data which pertain to the first few years of floating rates. In his analysis, rational expectations played a decisive role in describing the seemingly erratic nature of exchange rates.

The above works assume that prices adjust instantly\(^4\) and, therefore, that purchasing power parity (PPP)\(^5\) holds continuously. However, there is some

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\(^4\) These models have been deemed "flexible price" monetary models.

\(^5\) In its basic form, the PPP theory says that the domestic price of a good is equal to the product of the exchange rate and the foreign price of that good. A more detailed discussion of this theory follows.
debate about the legitimacy of PPP as a short-run relationship. Out of this controversy have arisen the so-called "sticky price" monetary models. Dornbusch (1976), in a classic paper on exchange rate theory, analyzes three different speeds of adjustment for the goods and money markets. His model is adept at providing an interpretation for the dynamic adjustment mechanism that transpires as exchange rates move toward a new equilibrium. The model demonstrates that subsequent to an unanticipated monetary disturbance, exchange rate expectations will depart from PPP for as long as necessary for goods prices to completely calibrate to the new monetary state. One implication of this is that the exchange rate can overshoot its equilibrium path. In another influential study, Frankel (1979) maintains a short-run sticky price assumption similar to Dornbusch's. However, in his work the adjustment of the exchange rate to its equilibrium level depends on the real interest differential (RID).\(^6\)

In the other class of asset-market models, domestic and foreign bonds are considered imperfect substitutes. The portfolio-balance approach to exchange rates was developed as the international extension of Tobin's (1969) portfolio-

\(^6\)Frankel defines the real interest rate \((r)\) as the nominal interest rate \((i)\) minus the expected inflation rate \((e\Delta p)\)

\[
r = i - e\Delta p
\]

The real interest differential is defined as

\[
r - r^* = (i - e\Delta p) - (i^* - e\Delta p^*)
\]

where * denotes a foreign country.
balance macroeconomic model. In this model, asset-holders wish to allocate their portfolios (wealth) in shares that are well-defined functions of expected rates of return. Branson, Halttunen and Masson (1977) estimate the model for the German mark/U.S. dollar exchange rate. The actual form of the equation uses the money supply as well as foreign assets but leaves out domestic assets because of their ambiguous effect on the exchange rate. Papell (1988) constructs an econometric portfolio-balance model with rational expectations. The model incorporates a stochastic structure within a framework that consists of both portfolio balance and slow price adjustment, and traces out how the structure influences the dynamics of exchange rate expectations. Another approach, taken in Frankel (1982), involves placing more structure on the model derived from utility maximization. Other empirical studies of the portfolio-balance model, such as Obstfeld (1983), and Rogoff (1984), have estimated bilateral structural models by investigating basic relationships postulated in the theoretical portfolio-balance model while not imposing the type restrictions mentioned in the above studies.

In an effort to better estimate the reduced-form monetary approach and portfolio-balance equations and, specifically, to overcome the model misspecifications implied by evidence of first-order serial correlation, a number

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7This effect depends on the degree of substitutability between traded and nontraded bonds.
of researchers have sought to merge properties of both models into a reduced-form exchange rate equation. Hooper and Morton (1982) divide the equilibrium nominal exchange rate into a relative price and a real component. They assume that the expected change in the real exchange rate is zero and the real rate moves over time in reaction to unexpected developments or "news," about the current account. Thus, the equilibrium exchange rate is a function of some initial exchange rate and the cumulative sum of past unexpected current account shocks. After incorporating a risk premium, the relationship is then synthesized with the monetary model. Driskill et al. (1992) maintain a rational expectations approach while modifying the monetary model to include imperfect capital substitutability and current account effects. The model is part of a line of work that highlights the interplay between risk-aversion, rational speculators and current account flow-market phenomena. The attribute that differentiates it from most other monetary models is its assumption concerning stock/flow interactions under conditions of less-than-perfect international capital substitutability. In Frankel's (1984) implementation of the portfolio/monetary model, the current account news term is not considered. His version assumes that interest rate parity does not hold and the portfolio-balance model is, therefore, modelled using the exchange risk premium as a function of the relative stocks of domestic and foreign debt outstanding. Frankel's synthesis combines his own RID monetary model with this
risk premium model. For the most part, the synthesis model constructed for this paper follows Frankel (1984). However, unlike Frankel's study, prices are assumed to adjust quickly and, therefore, the flexible price monetary model will be combined with the portfolio-balance model.
A. THE ROLE OF EXPECTATIONS

By treating exchange rates as financial asset prices, the asset-market view draws attention to the substantial influence of expectations. Several writers\(^8\) have argued that the exchange rate market, as any asset market, is efficient. A market is considered to be efficient when prices reflect all available information, including expectations about economic policies. The efficient market view assumes that private agents process all information in a rational manner. Therefore, the market equilibrium exchange rate reflects the underlying economic fundamentals. Consequently, exchange rates are affected in an important way by new information that is continuously being processed by economic agents. Continuous revisions in expectations make for continually changing exchange rates. In fact, if exchange rate variations were exclusively determined by new and unanticipated information, the exchange rate would follow a random walk

\(^8\)Mussa (1976), Dornbusch (1980), and Frenkel and Mussa (1985) are among those who agree that the foreign exchange market is efficient.
(i.e., today's exchange rate would be the best predictor of expected future exchange rates).

B. THE MONETARY APPROACH

According to the monetary approach to the determination of the exchange rate, the exchange rate is determined by conditions for equilibrium in the markets for flows of funds. The monetary aspects of the model arise through the assumption that the exchange rate, as the relative price of two monies, is primarily determined by the relative supplies and demands for these monies, and that the relevant real demand and supply functions are affected by the level of income and the interest rate. This section begins with a discussion of these determinants and some crucial assumptions concerning the monetary model.

Purchasing Power Parity. Frenkel (1976) shows that the purchasing power parity (PPP) relationship can be viewed as the doctrinal precursor of the present monetary approach to exchange rate determination. As the starting point within the monetary approach, the following are assumed for goods markets: not only are there no barriers (such as transportation costs or trade controls) segmenting international goods markets, but also domestic and foreign goods are perfect

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9 According to Mussa (1976), PPP need not be imposed to derive the monetary approach.
substitutes in consumer demand functions as well.

The basic idea behind the PPP theorem is the law of one price. It states that if domestic and foreign markets are unified, then prices of specific commodities should be the same in the two countries when expressed in a common currency.\(^\text{10}\) Arbitrage ensures that the law holds.\(^\text{11}\) The law of one price can be represented algebraically as\(^\text{12}\)

\[
p = s + p^* \tag{1}
\]

where \(p\) and \(p^*\) represent the domestic and foreign price (respectively) of a particular commodity and \(s\) is the exchange rate (measured in terms of domestic currency per unit of foreign currency). The PPP theorem extends the law of one price from individual commodities to the basket of goods and services that determine the price level in an economy. The relationship in equation (1) is rearranged as

\(^{10}\)Actually, differences will occur if transport costs, tarriffs, and various transactions costs are taken into account.

\(^{11}\)It should be mentioned that the evidence on PPP is mixed. For example, Roll (1979), Adler and Lehman (1983), and Meese and Rogoff (1988) have shown that, in the short-run, departures from PPP were considerable. Other studies by Hakkio (1984), Frankel (1986), and Abauf and Jorion (1990) have adduced evidence that there is a proclivity, although slow, for the exchange rate to approach to its PPP estimate.

\(^{12}\)Variables which are signified as lowercase letters are expressed as natural logarithms, except \(i\).
\[ s = p - p^* \]
\[ (2) \]

which is the starting point for the approach.

Money Demand and Money Supply. The real money demand function forms one of the links between the exchange rate, the monetary sector, and the real sector. It helps to demonstrate how changes in prices, productivity and interest rates are manifested in exchange rate fluctuations. Any adjustment in the exchange rate affects the variables which enter into the money demand function

\[ m_d - p = k + \eta y - \mu i \]
\[ (3) \]

where \( m_d - p \) is the demand for real balances (\( p \) is the price level), \( y \) is real income, \( i \) is the interest rate, \( \eta \) is the income elasticity of the demand for money, \( \mu \) is the interest rate elasticity of the demand for money and \( k \) is a constant.

The monetary approach is predicated on the assumption that the demand for real balances (money) is relatively stable over time. Stability in this context does not mean that occasional or even frequent shifts in estimated demand functions necessarily invalidate the monetary approach. Rather, stability means that a shock to one of the arguments in the function will set in motion a transmission process that will cause one or more of the other arguments to respond in a predictable manner. An increase in the stock of money may generate a predictable rise in the price level which would, subsequently, lead to
an equiproporionate depreciation in the exchange rate. For a given stock of money, an increase in the level of real output raises the demand for real balances, thereby leading to a fall in domestic prices and, consequently, an offsetting appreciation. Furthermore, higher interest rates reduce the demand for real balances and, therefore, bring about an exchange depreciation.

Real Income. The most important real variable affecting money demand and, therefore, the exchange rate is the level of real income. A higher level of real income will tend to appreciate the exchange rate through an associated increase in the demand for money. Countries that enjoy rapid increases in real income will also experience rapid growth in their demand for money. According to Froyen (1990), real income is separated into two components: permanent real income and transitory real income, such that

\[ y_t = y_t^p + y_t^T \] (4)

Permanent income, \( y_t^p \), denotes the average (trend) income which is anticipated over an extended time horizon and is denoted by

\[ y_t^p = y_{t-1}^p + \gamma \] (5)

This equation indicates that permanent income grows at a constant rate, \( \gamma \).

Transitory income (which is the fluctuation of real income around its
normal trend) also affects the exchange rate since it influences the demand for money. It is denoted by:

\[ y_t^T = \rho y_{t-1}^T + u_t \]  \hspace{1cm} (6)

where \( \rho \) is the first-order autoregressive coefficient and the error term, \( u_t \), is white noise. The equation states that transitory income is assumed to follow a first-order autoregressive scheme. The implication is, of course, that present period transitory income influences not only current real income but also real income in the immediate future.

The disturbance, \( u_t \), captures transitory income shocks (i.e., unanticipated money supply growth, or some exogenous shock in relative real income) on the exchange rate. These shocks influence both the level and the anticipated growth of real income. A positive shock will increase the level of real income but will decrease the anticipated rate of growth since transitory income must finally fall back to zero. The total effect will be to appreciate the exchange rate, although the appreciation will depend positively on the autoregressive parameter.

Interest Rate Parity. In the monetary class of asset-market models, domestic and foreign bonds are considered perfect substitutes. Perfect substitutability between domestic and foreign bonds suggests that asset holders are indifferent as to the composition of their bond portfolios as long as the expected rates of return on
the two countries' bonds are the same when expressed in any common terms. It implies that portfolio shares (bonds) are infinitely sensitive to expected rates of return. Thus, the uncovered interest parity (UIP) theorem

\[ i - i^* = e \Delta s_{t+1} \]  

must hold. The UIP theorem says that the interest rate on a domestic bond minus the interest rate on a foreign bond equals the expected rate of appreciation of foreign currency. Given that the UIP condition does hold, and domestic and foreign bonds are perfect substitutes in investor demand functions, then bond supplies become irrelevant because, in essence, there is only one bond in the world. Consequently, the responsibility for determining the exchange rate is shifted onto the money markets.

The Monetary Model. The critical equilibrium condition for the monetary approach is the requirement that the demand for the stock of each national money must equal the stock of that money available to be held, or

\[ m_s = m_d \]  

The stable money demand function constrains the equilibrium size of the money supply inside an economy. Any excess supply of money, say from a central bank

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13 Assuming that there are no barriers (such as transaction costs or capital controls) segmenting international capital markets.
open market operation, will translate into an increased demand for foreign currency and, thus, depreciate the domestic exchange rate. Therefore, equilibrium can be achieved only by an adjustment in the exchange rate.

The following definitions apply to variables used to construct the monetary model:

\[ p = \text{the price level} \]
\[ m = \text{the nominal money supply} \]
\[ y = \text{the level of real income} \]
\[ i = \text{the nominal interest rate} \]
\[ s = \text{the exchange rate} \]

The essentials of the model are expressed in the ensuing equations:\(^\text{14}\)

Money Demand (domestic): \[ m_d - p = k + \eta y - \mu i \] (9)

Money Demand (foreign): \[ m_d^* - p^* = k^* + \eta y^* - \mu i^* \] (10)

Money Supply (domestic): \[ m_s = m_d = m \] (11)

Money Supply (foreign): \[ m_s^* = m_d^* = m^* \] (12)

Purchasing Power Parity: \[ s = p - p^* \] (13)

Interest Rate Parity: \[ i - i^* = e \Delta s_{t,t} \] (14)

The differential between the domestic and foreign real money demand functions

\[ (m - m^*) - (p - p^*) = (k - k^*) + \eta (y - y^*) - \mu (i - i^*) \] (15)

\(^\text{14}\)Asterisks denote the foreign country argument.
is rewritten as

\[(p - p^*) = -(k - k^*) + (m - m^*) - \eta(y - y^*) + \mu(i - i^*) \quad (16)\]

By substituting (16) into (13) and replacing the interest differential with the expected exchange rate, the following reduced-form equation is derived:

\[s = -(k - k^*) + (m - m^*) - \eta(y - y^*) + \mu(\varepsilon \Delta s_{t+1}) \quad (17)\]

The model establishes that relative changes in the money supply, the expected exchange rate, and real income affect the exchange rate. The underlying logic of the relationship is that an increase in the domestic money supply will cause a currency depreciation because, with fixed levels of income and interest rates, the increase can only be absorbed through the price level and, thus, a depreciation of the exchange rate to maintain PPP. Similarly, an increase in income will be associated with a higher demand for money, which requires a reduction in the price level and currency appreciation. Expectations of a depreciation lead to a higher interest rate and, thus, a reduced demand for money balances. The consequent excess (money balances) will be absorbed only by a price increase and a currency depreciation.

C. THE PORTFOLIO-BALANCE APPROACH

The shift to flexible exchange rates has conclusively altered the structure of real returns confronting international investors, central banks, firms, and
households. Dornbusch (1980) argues that the system of flexible exchange rates, macroeconomic policies and disturbances have established an impetus for portfolio diversification, and resultant portfolio shifts (or capital flows) account for some unexplained variation in the exchange rate. The portfolio-balance approach has functioned as the cornerstone for far-reaching analysis seeking to decipher exchange rate movements with variations in relative asset supplies. With uncertain real returns, portfolio diversification makes assets imperfect substitutes and gives rise to determinate demands for the respective securities and to real yield differentials or a risk premium. There are a number of factors which suggest that non-monetary assets issued in different countries are unlikely to be viewed as perfect substitutes. Examples include differential tax risk, liquidity considerations, political risk, default risk, and exchange rate risk.

The Risk Premium. The factor most relevant for this study is that which is due to uncertainty concerning the expected exchange rate. To diversify this exchange rate risk, investors, given a risk premium, divide their portfolios between domestic and foreign securities according to the expected relative return. Just as international transactors are likely to hold a portfolio of currencies to minimize exchange risk, risk averse international investors will wish to hold a portfolio of non-monetary assets, the proportions of particular assets held depending on
risk/return factors. The existence of risk implies that uncovered interest rate parity does not hold and the interest rate differential is equal to the expected change in the exchange rate plus a time varying risk premium, or

\[ i - i^* = \epsilon \Delta s_{t+1} + \lambda_t \]  

(18)

where \( \lambda_t \) is the risk premium. The incorporation of such a risk premium is the distinguishing attribute of the portfolio-balance model. It suggests that if international investors decide that a currency has become riskier, they are likely to reallocate their bond portfolios in favor of the less risky assets.

The Portfolio-Balance Model. The level of the exchange rate in the portfolio-balance model is determined by supply and demand in the markets for financial assets. Domestic and foreign assets are assumed to differ in only one respect: their currency denomination. Investors, in order to diversify the risk that emanates from exchange rate variability, offset their asset portfolios between domestic and foreign bonds in proportions that depend on the expected relative rate of return, or risk premium. According to Frankel (1984), the portfolio-balance model divides net private sector financial wealth into two components: domestically-issued bonds, which can be thought of as government debt; and foreign-issued bonds, which can be thought in terms of the level of net claims on foreigners. Because a current account surplus must equal a capital account
deficit, the current account determines the rate of accumulation of foreign-denominated bonds over time. The portfolio-balance model may be expressed algebraically as

\[ b - s - f = -\alpha + \beta(i - i* - e\Delta s_{t+1}) \]  

(19)

where \(b\) is the stock of domestic-denominated bonds held by investors, \(f\) is the stock of foreign-denominated bonds (or, the accumulated current account), \(s\) is the exchange rate, \(\alpha\) is a constant and \(\beta\) is a parameter. This relationship suggests that an increase in the interest differential or a fall in the expected rate of depreciation causes investors to shift their portfolios out of foreign bonds and into domestic bonds.

Concerning asset holders, it is common to make any one of the following four assumptions in the analysis of the model. First, domestic and foreign investors must possess the same portfolio preferences; when residents of all countries have uniform asset preferences, government bond supplies are all that matter. Therefore, \(b\) and \(f\) symbolize the supply of domestic and foreign government bonds denominated in the issuing country's currency. On rearranging (19), the ensuing equation is derived

\[ s = -\alpha + \beta(i - i* - e\Delta s_{t+1}) + b - f \]  

(20)

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15Frankel (1984) tests all four assumptions for the portfolio-balance models. The results were poor in that the coefficients on all four stock variables were signed incorrectly and in some cases, significantly.
Second, the supply of domestic securities (in domestic currency terms) is demanded only by domestic residents. This assumption is primarily applicable to small countries.\(^\text{16}\) However, it is employed in many portfolio models and implies that the flow of capital can be interpreted as an increase or decrease of foreign securities on the domestic market, thus

\[
s = -\alpha + \beta(i - i^* - e\Delta s_{t+1}) + b_h - f_h
\]

where \(b_h\) is defined as the sum of all domestic bonds held by home residents, and \(f_h\) is the sum of all foreign bonds held by domestic residents (equal to the accumulation of past current account surpluses).\(^\text{17}\)

A third alternative is that the foreign country is small and the domestic country is of nontrivial size, so that domestic residents do not hold any foreign securities,\(^\text{18}\) therefore,

\[
s = -\alpha + \beta(i - i^* - \Delta s_{t+1}) + b_f - f
\]

where \(b_f\) is defined as domestic bonds held by foreign residents (equal to the accumulation of past foreign account surpluses under the small country assumption).

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\(^{16}\) Kouri (1976), Dornbusch and Fisher (1980), and Rodriguez (1980) are among those who assume that domestic assets are not held by foreigners.

\(^{17}\) The role of current account changes is important in the portfolio-balance model setting because the counterpart of a current account surplus is a transfer of wealth from foreign residents to domestic residents.

\(^{18}\) Shafer (1979) utilizes the small foreign country assumption.
A fourth portfolio-balance model for large countries recognizes that residents of the two countries hold assets issued by both of them. The accumulated current account will still have the expected effect on the exchange rate, provided domestic residents desire to retain a greater percentage of their wealth as domestic assets and foreign residents wish to hold a greater percentage of their wealth as foreign assets. The reason is that the current account will redistribute world wealth in such a way as to stimulate net world demand for the surplus country's assets, thus boosting the price of its currency. Frankel (1984) estimated the combined asset demand function with an equation similar to that which follows:

\[
s = -\alpha + \beta(i - i^* - eA_{t,t}) + (b - b^*) - (f - f^*)
\]

(23)

where \( b \) is defined as domestic-denominated bonds held by domestic residents, \( f \) is defined as foreign-denominated bonds held by domestic residents, and asterisks indicate the foreign country argument. Assumption four is the most comprehensive and will be used to measure the effects of the domestic and foreign government debts and accumulated current accounts on the exchange rate.

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19 These models are known as "preferred local habitat" models.

20 The variable, \( f \), which represents foreign-denominated bonds held by domestic residents is equal to the accumulation of past current account balances. Therefore, these terms are used interchangeably.
D. THE SYNTHESIS

In the monetary model, the uncovered interest parity assumption ensured that the risk premium was zero. The synthesis of the monetary and portfolio-balance equations is established merely by easing that condition. Thus, uncovered interest parity (14) is replaced with the imperfect substitutability condition (18) in the monetary model so that the exchange rate deviates from its equilibrium value because imperfect bond substitutability creates a risk premium.

Solving (23) for the expected change in the exchange rate gives

\[ \epsilon \Delta s_{t+1} = \frac{\alpha}{\beta} - \frac{1}{\beta} s + (i - i^*) + \frac{\phi_1}{\beta} (b - b^*) - \frac{\phi_2}{\beta} (f - f^*) \]  

(24)

Substituting (24) into (17) and solving for \( s \) results in the following reduced-form equation:

\[ s = - \frac{\alpha + \beta}{\beta + \mu} (k - k^*) + \frac{\beta}{\beta + \mu} (m - m^*) - \frac{\beta \eta}{\beta + \mu} (y - y^*) \]

\[ + \frac{\beta \mu}{\beta + \mu} (i - i^*) + \frac{\mu \phi_1}{\beta + \mu} (b - b^*) - \frac{\mu \phi_2}{\beta + \mu} (f - f^*) \]  

(25)
A. THE DATA

The data are quarterly observations for the United States, Germany and Japan, and were obtained from the I.M.F.'s *International Financial Statistics*. The sample consists of 36 observations extending from 1985:1 to 1993:4. The exchange rates are period averages and are quoted in units of U.S. dollars per unit of foreign currency (for example, dollars per DM). The monetary variable used to construct the fundamental value in the dollar is seasonally-adjusted M1 and seasonally-adjusted money for both the DM and the yen. The U.S. currency is measured in billions of U.S. dollars, and the German and Japanese currencies in billions of DM and billions of yen, respectively. Since U.S. industrial competitiveness is in question as a source of the dollar's decline, then the seasonally-adjusted Index of Industrial Production is used as a measure of the level of real income. The base year for each economy's industrial production index is 1985 where the index is set at 100. U.S., German and Japanese government debts and current accounts are measured in billions of dollars, DM
and yen, respectively.

B. REGRESSION ESTIMATES AND ANALYSIS

The object of this section is to obtain an empirical explanation of the dollar's depreciation since the beginning of 1985. Therefore, variables with significant coefficients\textsuperscript{21} will be deemed to have a considerable impact on the exchange rate. In order to describe the tests, equation (25) is respecified as the following regression relation:

\[
s_t = \beta_0 + \beta_1(m - m^*) + \beta_2(y - y^*) + \beta_3(i - i^*)
+ \beta_4(b - b^*) + \beta_5(f - f^*) + u_t
\]

(26)

where $u_t$ is a white noise error term.

Theory suggests the following concerning the coefficients in equation (26).\textsuperscript{22}

\begin{itemize}
  \item $\beta_1 > 0$. An increase in the domestic/foreign money supply ratio results in a depreciation of the domestic currency.
  \item $\beta_2 < 0$. An increase in the domestic/foreign real income ratio results in an appreciation of the domestic currency.
  \item $\beta_3 > 0$. An increase in the domestic/foreign interest rate ratio results in
\end{itemize}

\textsuperscript{21}5 percent is the relevant level of significance for this study.

\textsuperscript{22}The ceteris paribus condition holds for the other variables.
a weakening of the domestic currency.

$\beta_s > 0$. A rising domestic/foreign bond supply (debt) ratio tends to depreciate the domestic currency.

$\beta_s < 0$. A rising domestic/foreign accumulated current account ratio results in an appreciation of the domestic currency.

Results for Germany. The results of estimating equation (26) using OLS with Germany as the foreign country are presented in Table 1. The estimated model explains some 92 percent of the variation in the dollar/DM exchange rate as given by $R^2$. The coefficients on all of the variables have the correct signs. However, only the debt and accumulated current account ratios are significant at the 5 percent level. Additionally, the real income variable is significant at the 10 percent level. Somewhat problematic, though, is evidence of first-order serial correlation, suggesting a misspecification problem. The Durbin-Watson $d$ test was used to test for autocorrelation and the null hypothesis of no positive autocorrelation was rejected. This outcome suggests that, although the OLS estimators are still linear and unbiased, they are not efficient (that is, they do not have minimum variance) and, therefore, not best linear unbiased estimators. Moreover, the estimated variances of the OLS estimators are biased and may seriously underestimate actual variances and standard errors. An underestimate
### Table 1

<table>
<thead>
<tr>
<th>Country</th>
<th>Technique</th>
<th>(c)</th>
<th>((m - m^*))</th>
<th>((y - y^*))</th>
<th>((i - i^*))</th>
<th>((b - b^*))</th>
<th>((f - f^*))</th>
<th>(R^2)</th>
<th>D.W.</th>
<th>(P)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>OLS</td>
<td>-4.438</td>
<td>0.242</td>
<td>-0.502*</td>
<td>0.018</td>
<td>1.881*</td>
<td>-0.073*</td>
<td>0.920</td>
<td>0.851</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EML</td>
<td>-3.437</td>
<td>0.129</td>
<td>-0.274</td>
<td>0.009</td>
<td>1.020</td>
<td>-0.102*</td>
<td></td>
<td></td>
<td>0.650*</td>
</tr>
<tr>
<td>Japan</td>
<td>OLS</td>
<td>-11.014</td>
<td>1.466*</td>
<td>-0.558</td>
<td>0.026*</td>
<td>-0.037</td>
<td>-0.166*</td>
<td>0.947</td>
<td>1.480</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EML</td>
<td>-9.354</td>
<td>0.653*</td>
<td>0.039</td>
<td>0.017</td>
<td>-0.007</td>
<td>-0.175*</td>
<td></td>
<td></td>
<td>0.534*</td>
</tr>
</tbody>
</table>

a. Significant at the 5% level.
b. Significant at the 10% level.

T - statistics are in parentheses.

Of standard errors results in inflated \(t\) values which may give the appearance that particular coefficients are significantly different from zero when, in fact, they are not. Consequently, the \(t\) test and computed \(R^2\) (as a measure of true \(R^2\)) may be unreliable.

In order to remedy the problem, the residuals were assumed to follow a first-order autoregressive scheme and the model was respecified as the ensuing regression equation:

\[
s_t = \beta_0 + \beta_1(m - m^*) + \beta_2(y - y^*) + \beta_3(i - i^*) + \beta_4(b - b^*) + \beta_5(f - f^*) + \rho u_{t-1} \tag{27}
\]

where \(\rho\) is the coefficient of autocorrelation and \(u_{t-1}\) is the residual in the previous time period. The above equation was estimated using Exact Maximum Likelihood (EML) estimates. Table 1 indicates that the \(t\) values for the money supply, real income, interest rate, and government bond ratios
declined with the new estimate. Thus, although the coefficients on the variables are all of the correct sign, only the accumulated current account ratio and the correlation coefficient, \( \rho \), are statistically significant. The implication is that, of the theoretical fundamental determinants of the exchange rate, the accumulated current account was the most significant source of variation in the dollar/DM exchange rate for the period in question. Moreover, the significant correlation coefficient suggests that unexplained shocks have persistent effects on the exchange rate.

Results for Japan. Table 1 shows the results of estimating equation (26) with Japan as the foreign country. As with the results for Germany, the coefficients in the first row of the Japan results were estimated using OLS. \( R^2 \) indicates that the model explains approximately 95 percent of the variation in the dollar/yen exchange rate. Similar to the results for Germany, the accumulated current account ratio has the correct sign and is significant. However, unlike the dollar/DM results, the dollar/yen results demonstrate that both the money supply and interest rate ratios also are significant and have the correct sign. Furthermore, the debt and real income variables are insignificant, and the debt variable carries the wrong sign. A misspecification problem was inferred since the Durbin-Watson \( d \) test did not allow for rejection of \( H_0: \) no first-order serial
correlation. In fact, the test indicated that evidence of autocorrelation was inconclusive. As a remedial action, the model was respecified as equation (27), and EML estimates were run in order to come to a conclusion regarding serial correlation.

The EML estimates for Japan are presented in the last row of Table 1. The significant coefficient of correlation, $\rho$, provided the necessary evidence to conclude the existence of autocorrelation. Again, as in the dollar/DM results, the $t$ values are deflated. The real income, interest and government bond ratios are all statistically insignificant. And although the signs of the coefficients attached to the interest rate and bond ratios remained the same, the sign for the real income coefficient changed from negative to positive (the incorrect sign). The accumulated current account ratio continues to contain the correct sign and its statistical significance at the 5 percent level. As in the Germany results, the accumulated current account played the dominant role in explaining the direction of the dollar/yen exchange rate for the test period.
In this paper, the researcher combined the two most-renowned asset-market theories of exchange rate determination, the monetary approach and the portfolio-balance approach, to form a model which attempted to explain the causes of the dollar's depreciation against the DM and the yen from 1985 to 1993. The results of the Exact Maximum Likelihood regression analysis in section IV suggest that, of the fundamental determinants of the exchange rate, the ratio of domestic to foreign accumulated current accounts was the primary factor which explained the dollar's precipitous fall.

Since 1982, the United States has experienced large and chronic current account deficits. The current account balance of a nation is equal to the difference between national saving and investment.\footnote{A simple accounting identity relates private savings, domestic investment, the budget deficit, and the current account deficit: \[ CA = I + DEF - S \]} In a country with a current account deficit, investment exceeds saving by an amount which is equal to the funds raised from other countries. The underlying cause of U.S. current account

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\footnote{A simple accounting identity relates private savings, domestic investment, the budget deficit, and the current account deficit: \[ CA = I + DEF - S \]}

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deficits is apparently a chronic shortfall of savings relative to domestic investment: net national saving fell from 8.3 percent of net national product during 1960-81 to 3.5 percent during 1982-94, while net domestic investment fell from 7.9 percent to 5.0 percent. These current account deficits have to be financed one way or another. As they become increasingly incessant and cumulative, the currency has to depreciate in order to entice international investors to continue financing them. Thus, the substantial increase in America's obligations to the rest of the world because of its current account deficits means that the dollar has to be lower than it would have been in the last decade. Consequently, the U.S. currency fell towards a value at which the resulting current account deficit could be financed.

A continuing depreciation of the U.S. dollar should be of concern to Americans because the value of the dollar is the ultimate measure of the economic worth of the United States. Everything that Americans own or produce is valued in dollars: homes, savings and investments, real estate, natural resources, skills, labor, etc. In a sense, the dollar is the price in a share of America. When it depreciates, the lower dollar not only cheapens U.S. exports, but also reduces the value of everything that Americans own or produce.

Consequently, unless Americans rediscover the habit of saving, large current account deficits will persist. To be effective in trimming current account
deficits, economic policy must either reduce investment, expand private savings, or reduce the budget deficit. Clearly, reducing investment in order to reduce the deficit is not in the economy's long-run interest. Therefore, the best prescription to lower the current account deficit and, hence, strengthen the dollar, is for economic policy to increase domestic savings and trim down the budget deficit.
REFERENCES


