ESSAYS IN INTERNATIONAL FINANCE

No. 171, October 1988

THE MONETARY APPROACH TO EXCHANGE RATES: WHAT NOW REMAINS?

JAMES M. BOUGHTON

INTERNATIONAL FINANCE SECTION

DEPARTMENT OF ECONOMICS
PRINCETON UNIVERSITY
PRINCETON, NEW JERSEY

ESSAYS IN INTERNATIONAL FINANCE

ESSAYS IN INTERNATIONAL FINANCE are published by the International Finance Section of the Department of Economics of Princeton University. The Section sponsors this series of publications, but the opinions expressed are those of the authors. The Section welcomes the submission of manuscripts for publication in this and its other series. See the Notice to Contributors at the back of this Essay.

The author of this Essay, James M. Boughton, is an Advisor in the Research Department of the International Monetary Fund. He was formerly Professor of Economics at Indiana University and an economist at the Organization for Economic Cooperation and Development (OECD). Mr. Boughton is the author of two books on monetary policy, and he has published a number of articles on domestic and international macroeconomic policy issues.

DWIGHT M. JAFFEE, *Acting Director*
International Finance Section

ESSAYS IN INTERNATIONAL FINANCE

No. 171, October 1988

THE MONETARY APPROACH TO EXCHANGE RATES: WHAT NOW REMAINS?

JAMES M. BOUGHTON

INTERNATIONAL FINANCE SECTION

DEPARTMENT OF ECONOMICS
PRINCETON UNIVERSITY
PRINCETON, NEW JERSEY

Library of Congress Cataloging-in-Publication Data

Boughton, James M.
The monetary approach to exchange rates : what now remains? / James M. Boughton.

p. cm. — (Essays in international finance, ISSN 0071-142X ; no. 171 (Oct. 1988))
Bibliography: p.
ISBN 0-88165-078-1
1. Foreign exchange. 2. Monetary policy. I. Title. II. Series: Essays in international finance ; no. 171.
HG136.P7 no. 171 [HG3821] 332'.042 s—dc19 [332.4'56]
88-27496
CIP

Printed in the United States of America by Princeton University Press at Princeton, New Jersey.

International Standard Serial Number: 0071-142X
International Standard Book Number: 0-88165-078-1
Library of Congress Catalog Card Number: 88-27496

CONTENTS

THE MONETARY APPROACH TO EXCHANGE RATES: WHAT NOW REMAINS?

1 Introduction

During the past decade, the monetary approach has become the standard point of departure for the literature on exchange-rate determination. Nonetheless, it must be acknowledged that the monetary approach has clearly failed to provide an adequate explanation of the movements in major-currency values during the floating-rate period that began in 1973. The intent of this essay is to examine the components of the monetary approach and to isolate the causes of this failure.

Unlike most other surveys of the monetary approach, my discussion is not concerned primarily with describing the monetary models that have been developed in the literature. Rather, it attempts to analyze the fundamental building blocks of the approach. It asks the question, What hypotheses must be valid if exchange-market behavior is to be consistent with the view that exchange rates are determined principally by shifts in the demand for and the supply of money? After specifying a set of hypotheses, it surveys the available empirical evidence relating to each one.

Section 2 examines the theoretical issues that are relevant for evaluating the monetary approach. It begins by contrasting the monetary approach with alternative theories and then describes in more detail the specific monetary hypotheses. Section 3 discusses the empirical evidence pertaining to each hypothesis. The conclusions are presented in section 4.

2 Theoretical Issues

Description of the Monetary Approach

Before reviewing the performance of models based on the monetary approach to exchange rates, it is helpful to define the approach by contrasting it with alternatives that have or have had a prominent place in the literature on exchange-rate determination.

On one general level, the monetary approach may be contrasted with a

I am grateful to Charles Adams, Michael Dooley, Jeffrey Frankel, Kenneth Froot, Peter Isard, Malcolm Knight, Leslie Oxley, Michael Tindall, and the referees for helpful suggestions on earlier drafts, even though each of them may wish I had paid more attention.

"flow" approach. In the flow approach, shocks such as shifts in monetary or fiscal policies alter trade flows through shifts in the terms of trade or in the relationship between domestic absorption and output. The demand for foreign exchange is derived from the demand for imports, and the supply is derived from exports. For example, an expansionary demand-management policy (say, a rise in government spending or a rise in the money supply) will raise the demand for imports and for foreign exchange; as a consequence, the exchange rate will tend to depreciate. In general, in this type of model a strengthening of the current-account balance and appreciation of the exchange rate will go hand in hand, and conversely. For further descriptions, see Isard (1978), Mussa (1979), and Kenen (1984).

In contrast to exchange-rate models based on flows of goods and services, the monetary approach is one member of a class of "stock" or "asset" approaches, in which changes in relative prices of goods are assumed to play a fairly minor supporting role. The common feature of asset-market models is that the exchange rate is viewed as equilibrating the net stock demands for financial assets denominated in different currencies. These two general modeling strategies are not mutually exclusive; in principle, one could treat the exchange rate as equilibrating the total demand for and supply of foreign exchange, with complete integration of the current and capital accounts of the balance of payments and with asset stocks fully consistent with the corresponding flows. A synthesis of this type was developed (in a fixed-exchange-rate framework for explaining the balance of payments) by Frenkel *et al.* (1980). As a practical matter, however, most research has tended to emphasize one dimension or the other; the predominant view throughout the floating-rate period since 1973 has been that financial-asset markets play the central role in determining exchange rates.

Because asset-market models have received by far the greatest attention in the literature during the past fifteen years, the more interesting contrast is between the monetary approach and other asset-market models. In fact, virtually every model developed since 1973 to explain movements in the values of floating currencies incorporates—implicitly or explicitly—an adjustment process that gives a prominent role to the equilibration of national money markets. Whatever may be wrong with the existing set of exchange-rate models, no one is suggesting that better results would be obtained by ignoring the financial aspects of the problem. Although real shifts have clearly been very important during this period, what is principally in dispute is the precise specification of asset models. Therefore, the remainder of this essay focuses principally on the features that distinguish a monetary exchange-rate model from other asset models.

For convenience, nonmonetary-asset models may collectively be referred to as portfolio-balance models. However, this term actually encompasses two rather different subclasses of models: models such as those of Hooper and Morton (1982) or Frankel (1983) that contain the monetary approach as a special case, and models such as those of Branson, Halttunen, and Masson (1977), Boughton (1984), and Dooley and Isard (1983) that do not. The latter derive more directly from the portfolio approach developed by Tobin (1969) in the context of domestic financial analysis. These two types of portfolio-balance models are discussed and compared in Boughton (1987).

The monetary approach and the specification of the more general portfolio-balance model may be illustrated by reference to the following two-country model, which is similar to the specification developed by Frankel (1983):

$$m - \bar{p} = \beta_1 y - \beta_2 i \tag{1}$$

$$m^* - \bar{p}^* = \beta_1 y^* - \beta_2 i^* \tag{2}$$

$$i - i^* = E(\Delta e) + \beta_3 k \tag{3}$$

$$E(\Delta e) = E(\Delta p - \Delta p^*) - \beta_4(e - \bar{e}) \tag{4}$$

$$\bar{e} = \bar{p} - \bar{p}^* , \tag{5}$$

where m, p, and y refer to the logarithms of the money stock, the price level, and real output, respectively; i is the interest rate; k is the cumulative balance on the external private capital account; and e is the logarithm of the nominal exchange rate, expressed as local-currency units per unit of foreign currency (that is, an increase in e is a depreciation). Asterisks indicate the foreign country, bars over variables indicate long-run equilibrium values, and E indicates an expected value.

Equations (1) and (2) are simple money-demand functions—identical for each country—in which adjustment lags are eliminated by setting prices at long-run values; in this form, these equations may be interpreted as determining equilibrium price levels for each country. Equation (3) states that interest rates may differ in the two countries to the extent that the exchange rate is expected to change or in response to the accumulation of international credit ($k < 0$) or indebtedness ($k > 0$). This latter term will vanish if securities issued by the two countries are perfect substitutes, as explained below.

Equation (4) hypothesizes that the expected rate of change in the exchange rate is equal to the expected inflation differential, adjusted for any difference between the current exchange rate and its equilibrium value. Finally, equation (5) asserts that the equilibrium exchange rate is the value that will equate prices in the two countries.

The empirical properties of the monetary approach to exchange-rate determination can be described by restrictions placed on the parameters of this general model. A general statement of the monetary approach comprises the following five hypotheses:

1. Purchasing power parity (PPP) holds over some relevant time horizon.
2. Uncovered-interest parity (UIP) holds at all times.
3. The demand for real money balances is a stable function of a small set of real variables.
4. The supply of money is determined by a stable process.
5. Expectations are in some sense rational.

These hypotheses have not all been present in each and every model that has been called part of the monetary approach; nonetheless, they do describe an economic system in which money plays the dominant role.

Purchasing-Power Parity

Before discussing the relationship between PPP and the monetary approach, it may be helpful to clarify three possible empirical meanings of PPP.

First, as a relatively weak proposition, one can hypothesize that—*ceteris paribus*—the nominal exchange rate between two currencies will move in line with the expected inflation differential between the two countries. In terms of equation (4), this proposition is simply that the coefficient on the inflation differential is equal to 1. Some form of this first hypothesis is implicit in most asset-based exchange-rate models whether or not they would otherwise be classified as consistent with the monetary approach, and it is essentially noncontroversial.

As a second, and stronger, proposition, one can hypothesize that the real exchange rate will tend toward a time-invariant equilibrium level determined in some manner by the law of one price.[1] Then, if expectations are rational, the expected rate of depreciation will be equal to the expected inflation differential plus a linear function of the gap (if any) between the current level of the nominal exchange rate and its equilibrium value. This proposition is the basis for the form of equation (4), which is the familiar Dornbusch-Frankel expectations function (see Dornbusch, 1976, and Frankel, 1979).

Third, and stronger still, one can hypothesize that the real exchange rate will always be at its equilibrium value, i.e., that the gap is always zero, or $e = \bar{e}$ in equation (4). The addition of this last requirement is what, in Frankel's (1983) taxonomy, constitutes a "monetarist" exchange-rate model rather than a "monetary" model. But it is the second hypothesis that has most often been incorporated in tests of the monetary approach.

There is a close and obvious relationship between PPP and the flexibility

[1] These two propositions are similar to the familiar "relative" and "absolute" versions of PPP, but each is somewhat weaker than those theoretical labels imply. Specifically, the propositions cited here are intended to be partial—i.e., *ceteris paribus*—conditions. As such, the first does not rule out substantial movements in real exchange rates, as would a strict interpretation of relative PPP. The second does not require that actual market prices be equal in the two currency areas, as would absolute PPP.

of goods prices. If prices are not flexible, then changes in nominal exchange rates will not be fully reflected in offsetting movements in aggregate price levels, and real exchange rates will be likely to move in the same direction as nominal rates. Thus, the conditions for PPP are essentially the same as the conditions for the natural rate of unemployment to hold, with an important addition: prices must be flexible not only within a country (or currency area) but internationally as well. The gradual realization during the past several years that PPP is an unrealistic hypothesis in the short or medium run has been a natural corollary to the dissatisfaction that has emerged with the natural unemployment rate as anything other than a long-run hypothesis. In the case of PPP, however, there may be considerably more reason to doubt its importance even in the long run.

Uncovered-Interest Parity

The hypothesis of UIP states that expected returns on interest-bearing securities will be equal, regardless of the currency of denomination, except possibly for an additive constant determined by differences in the characteristics of the securities. In terms of the simple model given above, UIP implies that $\beta_3 = 0$, so that

$$i - i^* - E(\Delta e) = 0 \,. \qquad (3')$$

It may be noted that this hypothesis is the source of the proposition that the exchange rate is the relative price of national moneys except in the trivial sense in which the proposition holds by definition in terms of money as the unit of account. A more general statement of the proposition that would not require UIP would be the following: the exchange rate is the relative price of outside assets that are denominated in different currencies and that are imperfect substitutes.[2] Money, properly delimited, clearly satisfies at least the latter requirement, since national money stocks do not serve as wide a variety of functions outside the home country as they do within it. If some portion of the money stock consists of inside assets, then the general proposition will still hold, so long as those inside assets are perfect substitutes for the outside-asset portion. Money, however, might not be the only collection of assets that meets this requirement.

UIP, which is also known as the "Fisher open hypothesis," after Fisher (1930), holds if and only if securities that are similar except for currency of denomination are perfect substitutes, in which case their expected rates of return should be equal (up to an additive constant). If government securities

[2] "Outside assets" in this context are those that are net wealth for the combined domestic private sectors of the two economies. Private securities clearly do not meet this criterion. Government securities would meet it to the extent that the private sector does not regard their value as being offset by future tax liabilities (Ricardian equivalence).

with different currency denomination are imperfect substitutes and are regarded as net wealth by the private sector, then an exogenous increase in the stock of, say, dollar-denominated U.S. securities will reduce their price, raising U.S. interest rates without having a fully commensurate effect on the interest rates of other countries or on the expected rate of currency depreciation. Thus UIP will not hold. This effect is usually described as a "risk premium" on the higher-yielding assets.

Stability of the Demand for Money

The stability of the money-demand function is an obvious requirement for a monetary model of exchange rates, as is the requirement that the demand for real balances be homogeneous of degree zero in the price level. Without the latter condition, a change in the level of the money stock will not necessarily be neutral in its long-run economic effects.

Stability in this context does not mean that occasional or even frequent shifts in estimated demand functions necessarily invalidate the monetary approach. To the extent that such shifts can be identified and quantified, they can be incorporated into an *ex post* explanation of exchange-rate movements. 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; for a given stock of money, an increase in the level of real output may generate a predictable rise in interest rates. The exact nature of these transmission processes is a more general macroeconomic question, but the hypothesis that they can be adequately described by a relatively simple money-demand function is a key element of the monetary approach.

In the sticky-price versions of monetary models, only the long-run demand for money appears directly in the solution for the exchange rate. Short-run changes are determined by real-interest-rate differentials. However, the latter are themselves determined by the excess demands for money balances. As Frankel (1983, p. 91) put it, "Intuitively, when a tight domestic monetary policy causes the nominal interest differential to rise above its equilibrium level, an incipient capital inflow causes the value of the currency to rise above *its* equilibrium level."

Stability of the Supply of Money

The role of the money-supply process in the monetary approach is perhaps less well formulated in the theoretical literature than is the role of the demand function. In a model of floating exchange rates without official intervention, the stock of money is frequently assumed to be an exogenous policy-controlled variable (as in the model sketched out above). It is equally valid, however, to posit the existence of a reaction function in which the monetary authorities respond systematically or with discretion to changes in one or more indicator variables. Examples of monetary models incorporating reaction functions include Frenkel and Aizenman (1981) and Papell (1984).[3] In Frenkel and Aizenman, the authorities are assumed to attempt to minimize losses arising from incomplete information; stochastic real and monetary shocks induce adjustments in monetary growth. This structure is used to derive optimum intervention in exchange markets under a variety of shocks. In Papell's reaction function, monetary growth is postulated to be allowed to rise whenever the exchange rate appreciates or when domestic prices fall relative to foreign prices. In a model of managed floating, a reaction function is always at least an implicit part of the model because the authorities can manage the exchange rate only by reacting to observed changes in it. If the money supply is endogenous, it can also be specified in part as a function of commercial-bank portfolio selection and liability management. The important point for the monetary approach is that an unstable supply process will negate the ability of the money market to equilibrate the economy, in much the same way as will an unstable demand.

Rational Expectations

The final building block of the monetary approach is rational expectations, without which one cannot assure the efficiency of foreign-exchange markets. In this context, rational expectations may be defined as the full use of all *available* information; it does not necessarily imply perfect foresight over a finite period of time.[4] The failure of this weak-form rationality would imply that market participants could exploit the unused information in order to make economic profits. If financial-asset markets are inefficient processors of information, there is no reason to expect these markets—rather than the flow markets for goods and services—to play the dominant role in the adjustment of exchange rates to an exogenous shock.

These considerations suggest that an appropriate expectations function for a monetary model (in which PPP holds) must begin with the expectation that the exchange rate will, *ceteris paribus*, respond one-for-one to changes in the rationally expected inflation differential. The exact specification of the latter term, as well as of other possible determinants of the expected change in the exchange rate, is open to interpretation.

[3] For examples of portfolio-balance models with reaction functions, see Knight and Mathieson (1983) and Boughton (1984).

[4] This distinction is discussed in Friedman (1979). The weak form of rational expectations may be referred to as Friedman-rational, as opposed to Muth-rational. If the latter holds in a monetary model, then only unanticipated changes in the rate of growth of money will have real effects. For a discussion of the relationship between rational expectations and efficiency, see Mussa (1979).

3 Empirical Issues

Reduced-Form Tests of the Monetary Approach

Tests of the monetary approach may be classified broadly as of two types: tests of the validity of an exchange-rate model and tests of the validity of specific hypotheses. The first type of test usually focuses on the reduced form of a model such as the one set out above. Solving equations (1) to (5) for the exchange rate gives

$$e = (m - m^*) - \beta_1(y - y^*) + \beta_2 E(\Delta p - \Delta p^*) - (1/\beta_4 - \beta_2)(r - r^*) + (\beta_3/\beta_4)k \, , \tag{6}$$

where r is the real interest rate $[i - E(\Delta p)]$. The monetary approach can be tested by examining the validity and stability of the coefficients in equation (6) and by testing whether $\beta_3 = 0$ (i.e., whether UIP holds).[5]

Estimation of a reduced-form equation such as (6) constitutes a joint test of a set of hypotheses, not all of which are central to the validity of the monetary approach as a general proposition. For example, although most such tests have used some form of instrumental-variables technique to account for the endogeneity of interest rates, output and money-stock differentials have usually been treated as exogenous. Assumptions must also be made regarding the formation of inflationary expectations; one common approach (see Frankel, 1983) has been to set expected inflation equal to the trend rate of monetary growth. The empirical validity of these various assumptions has not been tested systematically in the context of this type of exchange-rate equation. See, for example, Judd and Scadding (1981), on the difficulty of evaluating exogeneity in money-demand functions; Johannes (1981), on the endogeneity of output and interest rates with respect to the balance of payments; and the structural tests discussed below.

As noted in the Introduction, such tests have clearly indicated the failure of the monetary approach to explain movements in the exchange rates of major currencies during the post-1973 floating-rate period. Not only have virtually all such tests of specific models revealed substantial problems with parameter estimates, but studies of the post-sample predictive ability of these models have been uniformly negative.

An early attempt to estimate the monetary model was made by Bilson (1978), with the exchange rate between the deutsche mark and the pound sterling as the dependent variable. Bilson's unrestricted estimates revealed coefficients that were mostly insignificantly different from zero; however, by imposing a set of prior restrictions on the model, he was able to obtain esti-

[5] In practice, because of the arbitrary indexing implicit in equation (5), estimation of the reduced-form equation (6) requires relaxing the assumption that the coefficient on $(m - m^*)$ is equal to 1.

mates that were consistent with the monetary approach. Dornbusch (1980) estimated the monetary model for the deutsche mark–U.S. dollar exchange rate and found that, even with the coefficient on relative money stocks constrained to unity, the estimates did not support the model. He concluded that current-account developments and portfolio shifts arising from limited substitutability among securities were important additional determinants of exchange rates.

Hacche and Townend (1981) estimated a monetary model for the effective pound-sterling exchange rate. The only coefficient that was significantly different from zero was the one on official intervention, which does not enter the model unless the assumption of UIP is relaxed. Frankel (1983) presented estimates for the mark-dollar rate and found coefficients that were mostly either not significant or of the incorrect sign; he characterized the results as a "disaster." Similarly, using tests for five exchange rates against the U.S. dollar (deutsche mark, French franc, pound sterling, Japanese yen, and Canadian dollar), Frankel (1984, p. 242) concluded that "the presence of wrong signs . . . and the predominance of low significance levels render the results discouraging for the monetary equation."

Backus (1984) estimated a number of models for the exchange rate between the U.S. and Canadian dollars. He found evidence that the monetary models were excessively restricted; Durbin-Watson coefficients were extremely low, and tests against a more general compound model rejected the restrictions. He concluded that the exchange rate approximated a random walk.

As for post-sample predictive tests, the in-sample problems just cited make it all but inevitable that the monetary model will fail to generate useful forecasts. In a series of oft-cited papers, Meese and Rogoff (1983a, 1983b, forthcoming) demonstrated this fact quite clearly. Meese and Rogoff presented estimates for the effective rate for the U.S. dollar and for bilateral rates against the U.S. dollar for the deutsche mark, the Japanese yen, and the pound sterling. In almost no case was the monetary model able to predict out-of-sample exchange-rate movements better than a simple random walk. Similar results were reported in Boughton (1987) and Schinasi and Swami (1987). Schinasi and Swami found that monetary models could predict better than a random walk when the coefficients in the model were allowed to change over time and the lagged dependent variable was included as a regressor. However, their paper did not report the values of the estimated coefficients, so that it is difficult to judge the extent to which their results support the monetary model.

There is evidence that some portfolio-balance models outperform monetary models. In particular, evidence is presented in Boughton (1987) that the portfolio-balance models of Artus (1976, 1981, 1984) and Boughton (1984) perform better than the monetary models. There I argue that if models are to perform better than a random walk in out-of-sample tests they must (a) relax the assumption of perfect asset substitutability and (b) incorporate in foreign-exchange markets either an eclectic (rather than perfect-foresight) expectations process or a stock-adjustment process (or both). Artus's models include very general expectations functions, while my model uses a stock-adjustment framework.

Rogoff (1984) also notes a number of studies that have provided evidence in favor of models that incorporate a portfolio-balance effect in the form of a risk premium. However, Rogoff questions the appropriateness of the measures of the portfolio effect in those studies, which typically involve some variant of the cumulated external balance. In Rogoff's view, the linkages between the cumulated external balance and the currency composition of the outstanding stock of securities are too weak to support the conclusions drawn in a favor of a portfolio effect on exchange rates.

Unfortunately, these and other studies have given relatively little firm indication of the direction in which research should turn in order to develop better models. Frankel (1983) concludes that his estimates for the monetary approach are enough better than the "disaster" that he found for the "synthetic" monetary-portfolio-balance model "tentatively to justify a return of attention to the monetary approach." In contrast, Isard (1983) suggests revamping the portfolio-balance models by incorporating more microeconomic structural hypotheses. Ancot *et al.* (1985) estimate a model that incorporates a rich dynamic structure, allows for imperfect asset substitutability, and reintroduces elements of the flow approach by endogenizing the determination of output and domestic prices. In view of these conflicting conclusions, it is necessary to examine more closely the performance of specific hypotheses.

Tests of Purchasing-Power Parity

The testing of the PPP hypothesis has been widely discussed in the literature. Many of the issues that arise are largely technical, involving choices related to (a) the time period over which data are to be examined (whether PPP is hypothesized to hold in the short run or only over long periods, and what base period is appropriate); (b) the currencies to be covered (relatively few currencies float freely; some models apply only to small countries, and those few small countries with a long enough experience with floating rates may not have the other data required for testing the model); and (c) the definition of the price index (e.g., consumer or wholesale prices, traded-goods prices, value-added deflators, or cost indexes in manufacturing industries). For reviews of these issues, see Officer (1976), McKinnon (1979, Chap. 6), and Levich (1984).

In the final analysis, although each of these technical issues is important in its own right, none of them has proved to matter greatly in the determination of the empirical importance of PPP. No matter how the question is defined, the massive movements that have taken place in real exchange rates during the past ten years lead inexorably to the conclusion that PPP (as defined in section 2 by the second version, and *a fortiori* by the third version) plays a very limited role in exchange-rate determination.

Levich (1984) surveyed a variety of empirical tests of PPP, including regressions in level and first-difference form, simple base-period comparisons, and microeconomic comparisons of individual prices across countries. Except possibly in periods of hyperinflation, all of these tests revealed substantial departures from PPP. More recently, Edison (1985) showed that departures from PPP were even larger in the 1920s than in the 1970s and early 1980s, and that the monetary model was rejected for the dollar-sterling exchange rate over the 1919-25 period. This finding was based on tests of an autoregressive model containing PPP restrictions against a more general unrestricted model; it contrasts with other papers (including those of Frenkel, 1976, 1978, and of Sommariva and Tullio, forthcoming) that have found PPP to be consistent with data from the 1920s. Along these same lines, Edison and Klovland (1987) test a restricted PPP model against a more general model, using data for the United Kingdom and Norway over the period 1876-1980. Their tests indicate that PPP does not hold even in the very long run, in part because of factors altering the relative price of nontraded goods.

The implication of these various tests appears to be that, at best, a PPP-based model can explain exchange-rate movements only during periods of hyperinflation, and that even in that case a less restricted model may perform better. It is thus difficult to escape the conclusion that shifts in relative goods prices are an important determinant of exchange-rate movements.

To allow for such departures from PPP, what may be needed is an integration of asset-market models with models of the effects on exchange rates of flow demands for and supplies of traded goods, as sketched above in section 2. Unfortunately, this avenue has been relatively unexplored in the empirical literature, although a few structural models have incorporated shifts in relative goods prices by endogenizing the current account. Examples include the theoretical model of Dooley and Isard (1983), where the expected exchange rate balances expected current-account flows; and the empirical model of Ancot *et al.* (1985). In a more recent theoretical paper, Dooley and Isard (1987) argued that relative prices of tradable and nontradable goods and services will be affected by considerations of country risk. They used this framework to help explain the appreciation of the U.S. dollar in the early 1980s. However, the empirical implications of these various models have been studied less extensively than have other aspects of exchange-rate determination.

Tests of Uncovered-Interest Parity

Tests of the UIP hypothesis have yielded mixed results. Recall that this hypothesis states that, in the absence of capital controls, interest rates in the home country should be equal to comparable interest rates in a second country plus the expected depreciation rate against the currency of that country during the remaining life of the assets in question [equation (3′)]. Direct tests of this hypothesis have been impossible to conduct until recently because of the absence of observable data on exchange-rate expectations. Tests of UIP have therefore involved one of two types of joint hypothesis.

The first type of joint hypothesis is a standard procedure for testing UIP:

a. Assume that asset markets are efficient, so that *covered*-interest parity holds. That is, the home-country interest rate equals the foreign interest rate plus the forward discount on the exchange rate. There may also be a premium associated with differences in default risk, tax treatment, or other properties of the securities, but empirical tests of covered-interest parity generally attempt to select securities with very similar properties. The hypothesis of covered-interest parity may be tested directly, since all the data required for calculating deviations from covered parity are readily available. For a survey of such tests, see Levich (1984, pp. 1026-1028). Levich concluded that the evidence shows that Eurocurrency markets are efficient, but that "the results for covered arbitrage between domestic or onshore markets are ambiguous." More recently, Frankel and MacArthur (forthcoming) presented evidence that onshore covered parity holds reasonably well for the large industrial countries but not for smaller countries.

b. Hypothesize that securities denominated in different currencies are not perfect substitutes, so that a risk premium will be associated with holding foreign-currency assets, and that this premium may be explained by one or more variables. UIP is then the hypothesis that this risk premium is zero, or at least constant.

c. Embody this hypothesis in a portfolio-balance model and estimate the reduced form. If the variables introduced into the model in order to explain the risk premium have a statistically nonsignificant effect, then reject the hypothesis that a risk premium exists in favor of the null hypothesis that UIP holds.

These are joint tests of UIP, model specification, and measurement of relevant variables. In most tests of this first type, the risk premium has been specified as a function of some measure of the relative stocks of outside securities denominated in each currency. Frequently, the cumulated external balance on the current or the private capital account serves as a proxy for the relative stock of securities, as in equation (3). This relative stock enters the model in the absence of UIP because the uncovered-interest differential is an argument in the demand function for securities in each country; this relationship is then inverted in the reduced form. But other variables have sometimes been included as well. See, for example, Dooley and Isard (1983), where the determinants of shifts in wealth—budget deficits, current-account deficits, and intervention flows—are treated separately. Regardless of the formulation, all such tests indicate that changes in the risk premium account at best for a small portion of actual changes in exchange rates.

The other type of joint-hypothesis test focuses more directly on the strong rational-expectations assumption, under which the actual exchange rate is used as a proxy for the rate that was expected in the previous period to prevail in the current period. Given this assumption, one might ask simply whether *ex post* returns are equalized across countries except for a white-noise error term. In general, they are not, so this test leads to the rejection of UIP (see Cumby and Obstfeld, 1981). This type of test, however, is unable to distinguish whether the estimated departure from UIP is attributable to the existence of a risk premium or to systematic differences between expected exchange-rate changes and actual outcomes. Frenkel (1981) tested the role of unexpected events by assuming that relevant news is immediately reflected in interest rates. The residuals from an interest-rate equation based on past data thus represent such news. Frenkel concluded that most of the variation in exchange rates over time is attributable to news in this sense. For a general discussion of this approach, see Mussa (1979).

A third type of test that has been conducted recently is based not on joint hypotheses but on survey data of exchange-rate expectations. Surveys of exchange-rate expectations have been conducted annually since 1976 by American Express (in the *Amex Bank Review*) and more frequently by the *Economist Financial Report* and Money Market Services (MMS) since 1981. The MMS survey has been conducted weekly since October 1984. These data have been assembled by Frankel and Froot (1985) and used by Frankel and Froot (1987a, 1987b), and Froot and Frankel (1988) to test for the validity of UIP. Frankel and Froot used the mean responses from these various surveys as proxies for expectations in order to test whether equation (3′) holds. The presence of a large gap between interest-rate differentials and the expected rate of change in the exchange rate indicated by these tests is taken to represent the risk premium. For the U.S. dollar, this risk premium was negative and large throughout the 1981-84 period (using the Amex survey data), suggesting that investors were willing to accept lower expected returns on dollars than on other major currencies. However, the survey data also indicate the presence of large systematic prediction errors. As a consequence, investors—expecting low returns on dollar assets but buying them anyway—in the event received much higher returns. It is possible, of course, that the survey data are not an accurate measure of market participants' true expectations or that people do not act on the expectations they express.

Nonetheless, unless the survey data are highly inaccurate, the tests conducted by Frankel and Froot lead to the rejection of UIP.

The Role of the Demand for Money

The hypothesis of a stable demand for money has fared somewhat better in the literature than have the two hypotheses just examined, although even here there have been some important reservations. The instabilities in the demands for M-1 in the United States and Canada and for sterling M-3 in the United Kingdom that emerged in the 1970s may have given rise to a more general impression of instability, but there is very little evidence for that view. Boughton (1981) argued that for other definitions of money in those countries and for both narrow and broad definitions of money in other major industrial countries, money-demand functions were broadly stable. Similarly, Atkinson *et al.* (1984, p. 17) concluded that "while there is evidence for money-demand instability in the case of some aggregates, a reasonably stable equation can be identified for all of the major seven OECD countries."

Perhaps a more serious problem with the way the demand for money enters most tests of exchange-rate determination is that there is a gap between the way demand functions are specified in such tests and the way they are written in studies focusing on money demand itself. A typical demand function in an exchange-rate model specifies the demand for real money balances (or for money balances as a portion of wealth) as a function only of the current levels of real income and an interest rate. In contrast, functions estimated directly virtually always incorporate a lengthy lag process, and they frequently add variables such as the expected inflation rate or additional rates of return (longer-term interest rates or expected equity yields). Even these more complex functions have frequently been found to be unstable, and there is substantial evidence of misspecification of the simple functional forms implicit in most exchange-rate equations. For international evidence, see Anderson (1985), Atkinson *et al.* (1984), Boughton (1981), and den Butter and Fase (1981). Furthermore, parameters such as income elasticities that are generally assumed to be equal across countries in exchange-rate studies often have rather different values in comparative studies. Thus the possibility exists that the money-demand functions that are implicitly estimated in reduced-form exchange-rate equations are unstable even if the actual demand functions are not.[6]

[6] In sticky-price monetary models, as noted above, only the long-run demand for money appears in the solution for the exchange rate. But the real-interest-rate differential is usually treated as endogenous, with instrumental variables used for estimation. The question then is whether the money-demand equations implicit in the formulation of these instrumental variables are stable. Sometimes not enough information has been provided about the specification of the instrumental variables to answer that question.

A related issue concerns the proper definition of money: the definitions that produce stable estimates of the demand for money may not be consistent with the definitions that are appropriate for the monetary approach. In a number of countries, the demand for narrowly defined money stocks is less stable than is the demand for broader aggregates. Both Boughton (1981) and Atkinson *et al.* (1984) found that the broader aggregates were relatively more stable in the United States, Germany, and France. I also found the broad aggregates to be relatively stable in Canada and Japan. Only in the United Kingdom did both studies find M-1 to be more stable than the broader aggregate (sterling M-3).

Broadly defined stocks are inappropriate measures of money in a monetary exchange-rate model for two reasons. First, broadly defined aggregates generally include deposits that bear a market interest rate. As such, they are properly regarded as securities (see Girton and Roper, 1981); if UIP holds, these assets should also be perfect substitutes. Second, as a consequence of the payment of market interest rates, broad aggregates are less likely to have a significant negative interest elasticity. In the extreme case, for money balances that pay a full market interest rate, there is no reason to expect a rise in the interest rate to induce a shift out of those balances. Without that relationship, the monetary equation for the exchange rate [equation (6)], must be truncated in an odd way. Note that the coefficient on the expected inflation differential arises solely from the existence of an interest elasticity in the demand for money (β_2). Therefore, a finding that money demand does not respond to the interest rate in either country would imply as well that the nominal exchange rate is unaffected by a change in one country's expected inflation rate.[7]

The Role of the Supply of Money

The stability of the money-supply process is a difficult issue to assess in general terms. Many exchange-rate models assume that the stock of money is an exogenous policy-controlled variable that follows a steady growth path. The number of countries for which this assumption is applicable would appear to be quite small. Most of the large industrial countries follow eclectic strategies in determining the appropriate stance of monetary policy. As a result, the stock of money is an endogenous variable in the sense that its movements are—at least in principle—explained by the variables in which the monetary authorities have a more fundamental interest. The close control of the stock of central-bank money in Germany and of M-2 plus CDs in Japan in recent years are exceptions, but they do not confute this general pattern.

[7] This problem is alleviated if money is a substitute for real goods. In that case, the demand for money will be a function of the expected inflation rate, and the latter will thereby be reintroduced into the reduced-form exchange-rate equation.

An alternative procedure is to specify a reaction function for the monetary authorities, which may include the exchange rate as one target variable. There is a substantial literature in which reaction functions have been estimated successfully for a number of countries, and both Papell (1984) and Sommariva and Tullio (forthcoming) have estimated monetary models that incorporate reaction functions. Other studies, however, have questioned the temporal stability of such equations, particularly Black (1983) and several of the papers in Hodgman, ed. (1983), which include discussion of the stability problems with reaction functions, especially in view of the political effects on policy formulation. Black and Salemi (forthcoming) argue that shifts in reaction functions have been an important source of coefficient instability in exchange-rate models.

Tests of Rational Expectations

The final empirical issue concerns the rationality of exchange-rate expectations. As noted above, the evidence is quite clear that only a very small proportion of actual exchange-rate changes is anticipated; that is, only a small proportion can be predicted by standard models. Furthermore, it is well known that forward discount rates are essentially uncorrelated with actual changes in spot rates; see Hansen and Hodrick (1980, 1983) and Levich (1984). Hence, tests that employ either the actual realized change or the forward rate as a measure of the rationally expected change in the spot exchange rate are not likely to be very powerful tests against a null hypothesis of rationality. To illustrate, consider the test regression

$$E(e_{t+1}) - e_{t+1} = a + bZ_t + \epsilon_t ,$$

where Z_t is a vector of contemporaneously known data that affect e. The null hypothesis is that $a = b = 0$. If the proxy for the expected rate is very weakly correlated with the actual rate, then the left-hand variable may approximate white noise and the null hypothesis could be accepted whether or not expectations are rational.

Expectations functions based on the notion that market participants have a view as to the PPP level of the exchange rate (and, implicitly, that they are willing to act on that view) are also difficult to reconcile with the empirical realities of the floating-rate period. The most notable example of this type of function is the Dornbusch-Frankel expectations mechanism [equation (4)], which has been incorporated in a number of recent monetary models. Dornbusch (1976) and Frankel (1979) argue that in the presence of price rigidity the real exchange rate will rationally be expected to return to its PPP level at a steady rate. However, the massive swings in real exchange rates that have been observed during the past several years have made it increasingly difficult to accept this idea.

What would account for the rise in the value of the U.S. dollar during 1983 and 1984 (a period when real-interest-rate differentials did not shift in favor of the dollar)? There may have been an expectation that the long-run sustainable level of the dollar had risen, perhaps because of confidence or "safe haven" factors. But unless one is willing to argue that such a shift accounted for a very large long-run effect, it would appear that market participants were unwilling to act on their expectations that the dollar was overvalued or that the implicit rate of adjustment was extremely slow. The papers by Frankel and Froot cited above offer an alternative explanation. They argue that investors, while expecting a depreciation of the dollar, placed a premium on holding dollars (i.e., were willing to accept a lower expected return on holding them) but systematically erred in their expectations and so received a higher return *ex post*. In any case, the Dornbusch-Frankel expectations mechanism would be of limited value in explaining actual developments.

A number of other rational-expectations mechanisms have been employed in monetary models. The simplest form is that of Frenkel (1976), in which the expected depreciation rate is hypothesized to be equal to the expected inflation differential.[8] This function is undoubtedly oversimplified as a representation of actual expectations, but it has substantial theoretical appeal as a characterization of the central tendency of those expectations.[9] Frankel and Froot (1987a) present tests of this type of function, using the survey data discussed earlier. For these tests, they regress the expected depreciation rate, measured by the survey responses, on the expected inflation rate, measured both by surveys and by forecasts made at the same time. While in most cases they are unable to reject the hypothesis that the coefficient on the expected inflation differential is equal to one, they estimate constant terms that are significantly different both from zero and from the process generating actual changes in exchange rates. Thus they are able to reject the hypothesis of rational expectations.

Froot and Frankel (1988) use another type of test of rational expectations to ascertain whether the process determining changes in exchange rates is the same as the process generating expectations. For this type of test, each variable is regressed on a set of variables that are hypothesized to be relevant

[8] The same function is employed in Boughton (1984), but the latter is a nonmonetary model in which the rationale is somewhat different. Whereas Frenkel assumes that the real exchange rate is always in equilibrium and is expected to remain so, my model assumes that market participants lack information about whether or not the exchange rate is in equilibrium and therefore act as if it were.

[9] Artus (1984) develops an expectations function of this more general type in the context of a portfolio-balance model. In his function, the expected depreciation rate is a function of the expected inflation differential *plus* differences between other relevant variables and their equilibrium values. Boughton (1987) provides evidence that the less restricted function may improve the performance of portfolio-balance models.

for exchange-rate determination, and the equality of the coefficient sets is tested statistically. These tests, like the earlier ones in which expectations were linked to PPP, lead to the rejection of rationality in the survey data.

Hartley (1983) estimates a simple monetarist model similar to Frenkel's, with the expected depreciation rate measured by the forward discount on foreign exchange. The model assumes that the forward discount is equal to the nominal-interest-rate differential and the expected depreciation rate. With perfect asset substitutability plus PPP, the nominal-interest-rate differential will also equal the expected inflation differential. Hartley's tests fail to reject the hypothesis of rationality, but the sample variances of the parameter estimates are large enough that the model itself appears to be inconsistent with the data. Because it is not possible to separate the hypothesis of model structure from that of the rationality of the expectations function, this test sheds little light on the issue.

4 Conclusions

This essay has examined several hypotheses that are essential elements in the monetary approach to exchange-rate determination. We have seen that each of them has some claim to validity but that the relevance of each for the empirical explanation of exchange-rate movements is open to question. Purchasing-power parity (in level form) is at best a long-run hypothesis that has little or no bearing on short- or medium-term developments. Uncovered-interest parity appears to be a viable approximation under some indirect tests but not at all when subjected to other tests, including direct tests using survey data on expectations. The money-demand functions and supply mechanisms that are usually specified in exchange-rate models are too simplified to be likely to be stable in practice. And the expectations mechanisms do not appear to be well founded.[10]

As this brief summary indicates, some of the empirical problems associated with the monetary approach may be solvable by recourse to more careful specification of the empirical relationships and do not call into question the underlying monetary theory. The specification of demand functions and supply processes for money and of expectations functions are in this category. Others, however, are more fundamental: neither PPP nor UIP may be a very good approximation to reality, raising the possibility that the monetary approach may be too restricted a view to be applicable in practice.

The weaknesses in these two hypotheses—PPP and UIP—have very dif-

[10] Smith and Wickens (1986) present a number of tests that lead to the similar conclusion that the failure of the monetary model is attributable to specification errors in virtually all the underlying structural relationships.

ferent implications for the direction in which research on exchange-rate determination should go. The problem with PPP implies that shifts in relative goods prices may be important and must be explained if we are to have a more complete theory of exchange-rate movements. Unfortunately, little progress has so far been achieved in this direction. On the other hand, the failure of UIP implies that shifts in relative asset supplies via current-account imbalances may be important and that exchange-rate models should include an explanation of shifts affecting securities markets. There is some evidence that less restricted portfolio-balance models perform somewhat better than monetary models, at least in estimates of equations for major currencies. The general asset-market approach certainly has become the standard for any analysis of exchange-market behavior and is likely to continue to be the standard. Nevertheless, a great deal of research remains to be done before we will have anything more than a fragmentary understanding of this important issue.

References

Ancot, J.-P., J.H.P. Paelink, and J.-M. Viaene, "A Dynamic Exchange-Rate Model," in Theo Peeters, Peter Praet, and Paul Reding, eds., *International Trade and Exchange Rates in the Late Eighties*, Amsterdam, North-Holland, 1985.

Anderson, Palle S., *The Stability of Money Demand Functions: An Alternative Approach*, BIS Economic Paper No. 14, April 1985.

Artus, Jacques R., "Exchange Rate Stability and Managed Floating: The Experience of the Federal Republic of Germany," *IMF Staff Papers*, 23 (July 1976), pp. 312-332.

———, "Monetary Stabilization and Government Credibility," *IMF Staff Papers*, 28 (September 1981), pp. 495-533.

———, "Effects of United States Monetary Restraint on the DM/$ Exchange Rate and the German Economy," Chap. 14 in John F.O. Bilson and Richard Marston, eds., *Exchange Rate Theory and Practice*, Chicago, University of Chicago Press, 1984.

Atkinson, Paul, Adrian Blundell-Wignall, Manuela Rondoni, and Helmut Ziegelschmidt, "The Efficacy of Monetary Targeting: The Stability of Demand for Money in Major OECD Countries," *OECD Economic Studies* (Autumn 1984), pp. 145-165.

Backus, David, "Empirical Models of the Exchange Rate: Separating the Wheat from the Chaff," *Canadian Journal of Economics*, 17 (November 1984), pp. 824-846.

Bilson, John F.O., "The Monetary Approach to the Exchange Rate: Some Empirical Evidence," *IMF Staff Papers*, 25 (March 1978), pp. 48-75.

Black, Stanley R., "The Use of Monetary Policy for International and External Balance in Ten Industrial Countries," in Frenkel, ed. (1983).

Black, Stanley W., and Michael K. Salemi, "FIML Estimation of the Dollar—Deutsche Mark Risk Premium in a Portfolio Model," *Journal of International Economics* (forthcoming).

Boughton, James M., "Recent Instability of the Demand for Money: An International Perspective," *Southern Economic Journal*, 47 (January 1981), pp. 579-597.

———, "Exchange Rate Movements and Adjustment in Financial Markets," *IMF Staff Papers*, 31 (September 1984), pp. 445-468.

———, "Tests of the Performance of Reduced-Form Exchange Rate Models," *Journal of International Economics*, 23 (August 1987), pp. 41-56.

Branson, William H., Hannu Halttunen, and Paul Masson, "Exchange Rates in the Short Run: The Dollar-Deutschemark Rate," *European Economic Review*, 10 (December 1977), pp. 303-324.

Cumby, Robert E., and Maurice Obstfeld, "A Note on Exchange Rate Expectations and Nominal Interest Differentials: A Test of the Fisher Hypothesis," *Journal of Finance*, 36 (June 1981).

den Butter, F.A.G., and M.M.G. Fase, "The Demand for Money in EEC Countries," *Journal of Monetary Economics*, 8 (September 1981), pp. 201-230.

Dooley, Michael P., and Peter Isard, "The Portfolio-Balance Model of Exchange Rates and Some Structural Estimates of the Risk Premium," *IMF Staff Papers*, 30 (December 1983), pp. 683-702.

———, "Country Preferences, Currency Values and Policy Issues," *Journal of Policy Modeling*, 9 (Spring 1987), pp. 67-81.

Dornbusch, Rudiger, "Expectations and Exchange Rate Dynamics," *Journal of Political Economy*, 84 (December 1976), pp. 1161-1176.

———, "Exchange Rate Economics: Where Do We Stand?" *Brookings Papers on Economic Activity* (1980, No. 1), pp. 143-185.

Edison, Hali J., "Purchasing Power Parity: A Quantitative Reassessment of the 1920s Experience," *Journal of International Money and Finance*, 4 (September 1985), pp. 361-372.

Edison, Hali J., and Jan Tore Klovland, "A Quantitative Reassessment of the Purchasing Power Parity Hypothesis: Evidence from Norway and the United Kingdom," *Journal of Applied Econometrics*, 2 (October 1987), pp. 309-333.

Fisher, Irving, *The Theory of Interest*, New York, Macmillan, 1930.

Frankel, Jeffrey, "On the Mark: A Theory of Floating Exchange Rates Based on Real Interest Differentials," *American Economic Review*, 69 (September 1979), pp. 610-622.

———, "Monetary and Portfolio-Balance Models of Exchange Rate Determination," Chap. 3 in Jagdeep S. Bhandari and Bluford H. Putnam, eds., *Economic Interdependence and Flexible Exchange Rates*, Cambridge, Mass., MIT Press, 1983.

———, "Tests of Monetary and Portfolio Balance Models of Exchange Rate Determination," in John F.O. Bilson and Richard C. Marston, eds., *Exchange Rate Theory and Practice*, Chicago, University of Chicago Press, 1984.

Frankel, Jeffrey, and Kenneth A. Froot, "Using Survey Data to Test Some Standard Propositions Regarding Exchange Rate Expectations," NBER Working Paper No. 1672, July 1985.

———, "Using Survey Data to Test Standard Propositions Regarding Exchange Rate Expectations," *American Economic Review*, 77 (March 1987a), pp. 133-153.

———, "Short-Term and Long-Term Expectations of the Yen/Dollar Exchange Rate: Evidence from Survey Data," *Journal of the Japanese and International Economies*, 1 (1987b), pp. 249-274.

Frankel, Jeffrey A., and Alan T. MacArthur, "Political vs. Currency Premia in International Real Interest Differentials: A Study of Forward Rates for 24 Countries," *European Economic Review* (forthcoming).

Frenkel, Jacob A., "A Monetary Approach to the Exchange Rate: Doctrinal Aspects and Empirical Evidence," *Scandinavian Journal of Economics*, 78 (May 1976), pp. 200-224.

———, "Purchasing Power Parity: Doctrinal Perspective and Evidence from the 1920s," *Journal of International Economics*, 8 (May 1978), pp. 169-191.

———, "Flexible Exchange Rates, Prices, and the Role of 'News': Lessons from the 1970s," *Journal of Political Economy*, 89 (August 1981), pp. 665-705.

Frenkel, Jacob A., ed., *Exchange Rates and International Macroeconomics*, Chicago, University of Chicago Press, 1983.

Frenkel, Jacob A., and Joshua Aizenman, "Aspects of the Optimal Management of Exchange Rates," Chap. 9 in E. Claassen and P. Salin, eds., *Recent Issues in the Theory of Flexible Exchange Rates*, Amsterdam, North-Holland, 1981.

Frenkel, Jacob A., Thorvaldur Gylfason, and John F. Helliwell, "A Synthesis of Monetary and Keynesian Approaches to Short-Run Balance-of-Payments Theory," *Economic Journal*, 90 (September 1980), pp. 582-592.

Friedman, Benjamin, "Optimal Expectations and the Extreme Information Assumptions of 'Rational Expectations' Macromodels," *Journal of Monetary Economics*, 5 (January 1979), pp. 23-41.

Froot, Kenneth A., and Jeffrey A. Frankel, "Forward Discount Bias: Is It an Exchange Risk Premium?" Berkeley, University of California, Department of Economics, Working Paper No. 8874, June 6, 1988.

Girton, Lance, and Don Roper, "Theory and Implications of Currency Substitution," *Journal of Money, Credit and Banking*, Columbus, Ohio State University Press, February 1981, pp. 12-30.

Hacche, Graham, and John Townend, "Exchange Rates and Monetary Policy: Modeling Sterling's Effective Exchange Rate, 1972-80," in W. A. Ellis and P.J.N. Sinclair, *The Money Supply and the Exchange Rate*, Oxford, Clarendon Press, 1981, pp. 201-247.

Hansen, Lars Peter, and Robert J. Hodrick, "Forward Exchange Rates as Optimal Predictors of Future Spot Rates: An Econometric Analysis," *Journal of Political Economy*, 88 (October 1980), pp. 829-853.

———, "Risk Averse Speculation in the Forward Foreign Exchange Market: An Econometric Analysis of Linear Models," in Frenkel, ed. (1983).

Hartley, Peter R., "Rational Expectations and the Foreign Exchange Market," in Frenkel, ed. (1983).

Hodgman, Donald R., ed., *The Political Economy of Monetary Policy: National and International Aspects*, Federal Reserve Bank of Boston Conference Series No. 26, 1983.

Hooper, Peter, and John Morton, "Fluctuations in the Dollar: A Model of Nominal and Real Exchange Rate Determination," *Journal of International Money and Finance*, 1 (April 1982), pp. 39-56.

Isard, Peter, *Exchange Rate Determination: A Survey of Popular Views and Recent Models*, Princeton Studies in International Finance No. 42, Princeton, N.J., Princeton University, International Finance Section, May 1978.

———, "What's Wrong with Empirical Exchange Rate Models?" International Finance Discussion Paper No. 226, Washington, Board of Governors of the Federal Reserve System, August 1983.

Johannes, James M., "Testing the Exogeneity Specification Underlying the Monetary Approach to the Balance of Payments," *Review of Economics and Statistics*, 63 (February 1981), pp. 29-34.

Jones, Ronald W., and Peter B. Kenen, eds., *Handbook of International Economics*, Vol. 2, Amsterdam, North-Holland, 1984.

Kenen, Peter B., "Macroeconomic Theory and Policy: How the Closed Economy Was Opened," Chap. 13 in Jones and Kenen, eds., 1984.

Knight, Malcolm D., and Donald J. Mathieson, "Economic Change and Policy Response in Canada under Fixed and Flexible Exchange Rates," in Jagdeep S. Bhandari and Bluford H. Putnam, eds., *Economic Interdependence and Flexible Exchange Rates*, Cambridge, Mass., MIT Press, 1983, pp. 500-529.

Levich, Richard M., "Empirical Studies of Exchange Rates: Price Behavior, Rate Determination and Market Efficiency," Chap. 19 in Jones and Kenen, eds. (1984).

McKinnon, Ronald I., *Money in International Exchange Oxford*, Oxford University Press, 1979.

Meese, Richard A., and Kenneth Rogoff, "Empirical Exchange Rate Models of the Seventies: Do They Fit Out of Sample?" *Journal of International Economics*, 14 (February 1983a), pp. 3-24.

———, "The Out-of-Sample Failure of Empirical Exchange Rate Models, Sampling Error or Misspecification" (1983b), in Frenkel, ed. (1983).

———, "Was It Real? The Exchange Rate-Interest Differential Relationship over the Modern Floating Rate Period," *Journal of Finance* (forthcoming).

Mussa, Michael, "Empirical Regularities in the Behavior of the Foreign Exchange Market," in Karl Brunner and Allan H. Meltzer, eds., *Policies for Employment, Prices, and Exchange Rates*, Carnegie-Rochester Conference Series on Public Policy, Vol. 11, Amsterdam, North-Holland, 1979, pp. 9-57.

Officer, Lawrence H., "The Purchasing-Power-Parity Theory of Exchange Rates: A Review Article," *IMF Staff Papers*, 23 (March 1976), pp. 1-60.

Papell, David H., "Activist Monetary Policy and Exchange-Rate Overshooting: The Deutsche Mark/Dollar Rate," *Journal of International Money and Finance*, 3 (December 1984), pp. 293-310.

Rogoff, Kenneth, "On the Effects of Sterilized Intervention: An Analysis of Weekly Data," *Journal of Monetary Economics*, 14 (September 1984), pp. 133-150.

Schinasi, Gary J., and P.A.V.B. Swamy, "The Out-of-Sample Forecasting Performance of Exchange Rate Models When Coefficients Are Allowed to Change," International Finance Discussion Papers No. 301, Washington, Board of Governors of the Federal Reserve System, January 1987.

Smith, P. N., and M. R. Wickens, "An Empirical Investigation into the Causes of Failure of the Monetary Model of the Exchange Rate," *Journal of Applied Econometrics*, 1 (1986), pp. 143-162.

Sommariva, A., and G. Tullio, "Inflation and Currency Depreciation in Germany 1920-1923: A Dynamic Model of Prices and the Exchange Rate," *Economic Journal* (forthcoming).

Tobin, James, "A General Equilibrium Approach to Monetary Theory," *Journal of Money, Credit and Banking*, 1 (February 1969), pp. 15-29.

PUBLICATIONS OF THE INTERNATIONAL FINANCE SECTION

Notice to Contributors

The International Finance Section publishes at irregular intervals papers in four series: ESSAYS IN INTERNATIONAL FINANCE, PRINCETON STUDIES IN INTERNATIONAL FINANCE, SPECIAL PAPERS IN INTERNATIONAL ECONOMICS, and REPRINTS IN INTERNATIONAL FINANCE. ESSAYS and STUDIES are confined to subjects in international finance. SPECIAL PAPERS are surveys of the literature suitable for courses in colleges and universities.

An ESSAY should be a lucid exposition of a theme, accessible not only to the professional economist but to other interested readers. It should therefore avoid technical terms, should eschew mathematics and statistical tables (except when essential for an understanding of the text), and should rarely have footnotes.

A STUDY or SPECIAL PAPER may be more technical. It may include statistics and algebra and may have many footnotes. STUDIES and SPECIAL PAPERS may also be longer than ESSAYS; indeed, these two series are meant to accommodate manuscripts too long for journal articles and too short for books.

To facilitate prompt evaluation, please submit three copies of your manuscript. Retain one for your files. The manuscript should be typed on one side of 8½ by 11 strong white paper. All material should be double-spaced—text, excerpts, footnotes, tables, references, and figure legends. For more complete guidance, prospective contributors should send for the Section's style guide before preparing their manuscripts.

How to Obtain Publications

A mailing list is maintained for free distribution of all new publications to college, university, and public libraries and nongovernmental, nonprofit research institutions.

Individuals and organizations not qualifying for free distribution can receive all publications—ESSAYS, STUDIES, SPECIAL PAPERS, and REPRINTS—by paying a fee of $30 (inside and outside U.S.) to cover the period January 1 through December 31, 1988.

ESSAYS and REPRINTS can also be ordered from the Section at $4.50 per copy, and STUDIES and SPECIAL PAPERS at $6.50. Payment MUST be included with the order and MUST be made in U.S. dollars. PLEASE INCLUDE $1.25 FOR POSTAGE AND HANDLING. (These charges are waived on orders from persons or organizations in countries whose foreign-exchange regulations prohibit such remittances.) For airmail delivery outside U.S., Canada, and Mexico, there is an additional charge of $1.50.

All manuscripts, correspondence, and orders should be addressed to:

International Finance Section
Department of Economics, Dickinson Hall
Princeton University
Princeton, New Jersey 08544

Subscribers should notify the Section promptly of a change of address, giving the old address as well as the new one.

List of Recent Publications

To obtain a complete list of publications, write the International Finance Section.

ESSAYS IN INTERNATIONAL FINANCE

147. Edmar Lisboa Bacha and Carlos F. Díaz Alejandro, *International Financial Intermediation: A Long and Tropical View*. (May 1982)
148. Alan A. Rabin and Leland B. Yeager, *Monetary Approaches to the Balance of Payments and Exchange Rates*. (Nov. 1982)
149. C. Fred Bergsten, Rudiger Dornbusch, Jacob A. Frenkel, Steven W. Kohlhagen, Luigi Spaventa, and Thomas D. Willett, *From Rambouillet to Versailles: A Symposium*. (Dec. 1982)
150. Robert E. Baldwin, *The Inefficacy of Trade Policy*. (Dec. 1982)
151. Jack Guttentag and Richard Herring, *The Lender-of-Last Resort Function in an International Context*. (May 1983)
152. G. K. Helleiner, *The IMF and Africa in the 1980s*. (July 1983)
153. Rachel McCulloch, *Unexpected Real Consequences of Floating Exchange Rates*. (Aug. 1983)
154. Robert M. Dunn, Jr., *The Many Disappointments of Floating Exchange Rates*. (Dec. 1983)
155. Stephen Marris, *Managing the World Economy: Will We Ever Learn?* (Oct. 1984)
156. Sebastian Edwards, *The Order of Liberalization of the External Sector in Developing Countries*. (Dec. 1984)
157. Wilfred J. Ethier and Richard C. Marston, eds., with Kindleberger, Guttentag and Herring, Wallich, Henderson, and Hinshaw, *International Financial Markets and Capital Movements: A Symposium in Honor of Arthur I. Bloomfield*. (Sept. 1985)
158. Charles E. Dumas, *The Effects of Government Deficits: A Comparative Analysis of Crowding Out*. (Oct. 1985)
159. Jeffrey A. Frankel, *Six Possible Meanings of "Overvaluation": The 1981-85 Dollar*. (Dec. 1985)
160. Stanley W. Black, *Learning from Adversity: Policy Responses to Two Oil Shocks*. (Dec. 1985)
161. Alexis Rieffel, *The Role of the Paris Club in Managing Debt Problems*. (Dec. 1985)
162. Stephen E. Haynes, Michael M. Hutchison, and Raymond F. Mikesell, *Japanese Financial Policies and the U.S. Trade Deficit*. (April 1986)
163. Arminio Fraga, *German Reparations and Brazilian Debt: A Comparative Study*. (July 1986)
164. Jack M. Guttentag and Richard J. Herring, *Disaster Myopia in International Banking*. (Sept. 1986)
165. Rudiger Dornbusch, *Inflation, Exchange Rates, and Stabilization*. (Oct. 1986)
166. John Spraos, *IMF Conditionality: Ineffectual, Inefficient, Mistargeted*. (Dec. 1986)
167. Rainer Stefano Masera, *An Increasing Role for the ECU: A Character in Search of a Script*. (June 1987)
168. Paul Mosley, *Conditionality as Bargaining Process: Structural-Adjustment Lending, 1980-86*. (Oct. 1987)
169. Paul A. Volcker, Ralph C. Bryant, Leonhard Gleske, Gottfried Haberler, Alexandre Lamfalussy, Shijuro Ogata, Jesús Silva-Herzog, Ross M. Starr, James

Tobin, and Robert Triffin, *International Monetary Cooperation: Essays in Honor of Henry C. Wallich.* (Dec. 1987)

170. Shafiqul Islam, *The Dollar and the Policy-Performance-Confidence Mix.* (July 1988)
171. James Boughton, *The Monetary Approach to Exchange Rates: What Now Remains?* (Oct. 1988)

PRINCETON STUDIES IN INTERNATIONAL FINANCE

49. Peter Bernholz, *Flexible Exchange Rates in Historical Perspective.* (July 1982)
50. Victor Argy, *Exchange-Rate Management in Theory and Practice.* (Oct. 1982)
51. Paul Wonnacott, *U.S. Intervention in the Exchange Market for DM, 1977-80.* (Dec. 1982)
52. Irving B. Kravis and Robert E. Lipsey, *Toward an Explanation of National Price Levels.* (Nov. 1983)
53. Avraham Ben-Bassat, *Reserve-Currency Diversification and the Substitution Account.* (Mar. 1984)
*54. Jeffrey Sachs, *Theoretical Issues in International Borrowing.* (July 1984)
55. Marsha R. Shelburn, *Rules for Regulating Intervention under a Managed Float.* (Dec. 1984)
56. Paul De Grauwe, Marc Janssens, and Hilde Leliaert, *Real-Exchange-Rate Variability from 1920 to 1926 and 1973 to 1982.* (Sept. 1985)
57. Stephen S. Golub, *The Current-Account Balance and the Dollar: 1977-78 and 1983-84.* (Oct. 1986)
58. John T. Cuddington, *Capital Flight: Estimates, Issues, and Explanations.* (Dec. 1986)
59. Vincent P. Crawford, *International Lending, Long-Term Credit Relationships, and Dynamic Contract Theory.* (Mar. 1987)
60. Thorvaldur Gylfason, *Credit Policy and Economic Activity in Developing Countries with IMF Stabilization Programs.* (Aug. 1987)
61. Stephen A. Schuker, *American "Reparations" to Germany, 1919-33: Implications for the Third-World Debt Crisis.* (July 1988)
62. Steven B. Kamin, *Devaluation, External Balance, and Macroeconomic Performance: A Look at the Numbers.* (Aug. 1988)

SPECIAL PAPERS IN INTERNATIONAL ECONOMICS

13. Louka T. Katseli-Papaefstratiou, *The Reemergence of the Purchasing Power Parity Doctrine in the 1970s.* (Dec. 1979)
*14. Morris Goldstein, *Have Flexible Exchange Rates Handicapped Macroeconomic Policy?* (June 1980)
15. Gene M. Grossman and J. David Richardson, *Strategic Trade Policy: A Survey of Issues and Early Analysis.* (April 1985)

* Out of print. Available on demand in xerographic paperback or library-bound copies from University Microfilms International, Box 1467, Ann Arbor, Michigan 48106, United States, and 30-32 Mortimer St., London, WIN 7RA, England. Paperback reprints are usually $20. Microfilm of all Essays by year is also available from University Microfilms. Photocopied sheets of out-of-print titles are available on demand from the Section at $6 per Essay and $8 per Study or Special Paper, plus $1.25 for postage and handling.

22. Jorge Braga de Macedo, *Exchange Rate Behavior with Currency Inconvertibility*. [Reprinted from *Journal of International Economics*, 12 (Feb. 1982).] (Sept. 1982)
23. Peter B. Kenen, *Use of the SDR to Supplement or Substitute for Other Means of Finance*. [Reprinted from George M. von Furstenberg, ed., *International Money and Credit: The Policy Roles*, Washington, IMF, 1983, Chap. 7.] (Dec. 1983)
24. Peter B. Kenen, *Forward Rates, Interest Rates, and Expectations under Alternative Exchange Rate Regimes*. [Reprinted from *Economic Record*, 61 (Sept. 1985).] (June 1986)
25. Jorge Braga de Macedo, *Trade and Financial Interdependence under Flexible Exchange Rates: The Pacific Area*. [Reprinted from Augustine H.H. Tan and Basant Kapur, eds., *Pacific Growth and Financial Interdependence*, Sydney, Australia, Allen and Unwin, 1986, Chap. 13.] (June 1986)

ISBN 0-88165-078-1