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THE MONETARY APPROACH TO EXCHANGE RATES:
WHAT NOW REMAINS?

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INTERNATIONAL FINANCE SECTION

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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):

$$m - \bar{p} = \beta_1 y - \beta_2 i \quad (1)$$

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

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

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

$$\bar{e} = \bar{p} - \bar{p}^* , \quad (5)$$

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

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

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

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

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).