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The Monetary Approach to the Balance of Payments: A Survey

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1 INTRODUCTION

The theory of the balance-of-payments adjustment mechanism is conventionally viewed as a succession of "approaches."[1] The four traditional approaches are the elasticities approach, the Keynesian multiplier or income approach, the absorption approach, and the policy approach that stresses internal and external balance. While these theories differ from one another in emphasis as well as point of departure, they are reconcilable in terms of their analytical apparatus and policy implications. Indeed, in this study the income, absorption, and policy approaches together are designated the "income/absorption" theory.

During the past decade, a fifth approach has emerged—one that highlights the role of money in the adjustment process. Originated in the 1950s by Polak (1957) and his associates at the International Monetary Fund and developed in the 1960s and early 1970s by Mundell (1968, 1971) and Johnson (1972), this "monetary" theory gained many converts in the 1970s, and writing on the subject expanded tremendously. The present state of the art—or, rather, of the controversy—is outlined, for a fixed or adjustably pegged exchange-rate regime, in Branson (1975a, 1975b), Frenkel and Johnson (1976a), Grubel (1976), Haberler (1976), Johnson (1975, 1976a, 1976b, 1977a, 1977b, 1977c), Rhomberg and Heller (1977), and Whitman (1975); and, for a floating-exchange-rate regime, in Myhrman (1976) and Isard (1978). Other major presentations of the monetary theory are, for fixed or adjustably pegged exchange rates, Dornbusch (1973, 1974, 1975), Mussa (1976a), Rodriguez (1976), and Swoboda (1973); and, for floating exchange rates, Dornbusch (1976), Frenkel (1976b), Humphrey (1977), and Mussa (1976b).[2] In the theoretical part of this survey (Chaps. 3 to 5), we attempt to integrate the essential elements of these and other authors' analyses. The References at the end of this study form a comprehensive bibliography of both the theoretical and empirical literature on the monetary approach.

The contribution of the monetary approach goes far beyond the mere addition of money to the "real" elements in the adjustment process: monetary aspects are regarded as the core and essence of the mechanism, to the nearly complete exclusion of other elements. As a result, the new

The authors are grateful to James M. Johannes, Robert H. Rasche, and anonymous referees for excellent comments.

[1] The various approaches are summarized by Johnson (1976b, 1977b).

[2] Useful collections of readings on the monetary approach to the balance of payments are Frenkel and Johnson (1976b) for fixed or adjustably pegged exchange rates, and Frenkel and Johnson (1978) for floating exchange rates.

effect concept, probably because the latter concept is relatively new, is not published in official statistics, and is not available except for the United States. Most models developed to test the monetary approach pertain to countries other than the United States. In practice, then, the only recorded balance-of-payments measure that resembles a "balance of money payments" is the official-settlements balance. Therefore, the studies to be reviewed in the empirical chapters of this survey use the official-settlements concept or some variant. So, in the final analysis, the monetary approach involves two concepts of the balance of payments: (a) the theoretically pure monetary-base-effect balance, and (b) the official-settlements concept, available in official statistics for almost all countries and used in empirical analysis.

In terms of general balance-of-payments terminology, the autonomous/accommodating dichotomy is nonmonetarist in nature. While the word "accommodating" implies passivity, the monetary approach regards international money flows as active, not passive. Indeed, there is almost a reversal of the autonomous/accommodating or active/passive types of transaction in the balance-of-payments table. For monetarists, the monetary-base-effect balance—or its empirical approximation, the official-settlements balance—is active or autonomous, because it is a result of the demand for and supply of money, about which behavior is centered. The precise composition of the balance of payments—in the form of trade flows, service transactions, or capital flows—is unexplained by the monetary approach.[5]

Thus the monetary approach does not attempt to explain the behavior of individual components of the balance of payments, such as trade and service flows, long-term capital, or private short-term capital. They are all lumped together into one "accommodating" category. Nor is the approach concerned with any of the "partial balances," such as the current-account balance. Consequently, it has been described (Whitman, 1975, p. 514) as analyzing the problem "from the bottom up," in contrast to other approaches, which pay attention to the composition of the balance or imbalance. This unique feature follows directly from the main focus of the approach.

[5] A few monetarist economists have developed models that explain individual components of the balance of payments. See Frenkel (1971, 1976a), Frenkel and Rodriguez (1975), and Lapan and Enders (1978). It is fair to say, however, that these studies are outside the mainstream of the monetary approach.

3 THE UNDERLYING CAUSE OF EXTERNAL IMBALANCES UNDER FIXED EXCHANGE RATES

As defined in Chapter 2, the balance of payments is considered by the monetarists to be essentially a monetary phenomenon. They regard the relationship between the demand for and supply of money—viewed as a stock and not a flow over a given time period—as the critical determinant of the balance of payments. The approach rests on the basic premise that, for any country over the long run,[1] there exists a stable demand function for money as a stock. In its simplest formulation, the demand for real money balances is a stable, linearly homogeneous function of real income.

This function may be obtained from a more general formulation by the following steps: The amount of nominal money balances demanded (M^d) is a function (L) of the price level (P), real income (y), and the interest rate (i). Thus a general formulation of the demand-for-money function is: $M^d = L(P, y, i)$.[2] Other things being equal, an increase in the price level or in real income increases the demand for nominal money balances, because there is a larger value of transactions, or nominal income, to be financed. An increase in the rate of interest decreases the demand for money balances, because it raises the opportunity cost of holding money. These relationships are postulated generally by monetarists and nonmonetarists alike.

Assuming no money illusion, the price variable can be moved outside the function, giving it the form: $M^d = PL^*(y, i)$. Then there is a unitary price elasticity of the demand for money. Dividing both sides of this equation by P, the demand for *real* money balances becomes a function of real income and the interest rate. If one assumes further that the income velocity of money is a function only of the rate of interest and is invariant to changes in income, the demand for nominal money balances becomes: $M^d = k(i)Py$, where $k(i)$ represents the inverse of velocity as a function of the interest rate and Py is nominal income. Finally, if income velocity ($1/k$) is assumed to be insensitive to the interest rate, the Cambridge cash-balances theory results: $M^d = kPy$, where k is the desired ratio of nominal money balances to nominal income. With a constant income velocity, there is a unitary income elasticity of the demand for money. Dividing both sides of the equation by P, the demand for the stock of *real* money

[1] A period longer than a year but shorter than a decade seems to be a reasonable definition of the "long run" in this context. Interestingly enough, monetarists are not generally on written record on this point.

[2] Lists of symbols used in the monetary approach appear in Tables 1 and 2 of Chapter 7.

balances is obtained as a stable, linearly homogeneous function of real income.[3]

In turn, the supply of nominal money (M^s) is the product of the money multiplier (m) and the monetary base (B), the latter sometimes called high-powered money: $M^s = m \cdot B$. The money multiplier, which represents the extent of multiple credit creation on the part of the commercial banking system, is sometimes assumed to be constant. Alternatively, it is assumed that the money multiplier does not systematically change in response to changes in the monetary base, because the two variables are subject to different influences. The monetary base itself has two components: a domestic component (D), consisting of domestic credit created by the monetary authorities, and an international component (R), the domestic-currency value of the international reserves of the government and central bank. The international component can be increased or decreased by any inflow or outflow (respectively) of reserves from or to foreign countries when the balance of payments is in a surplus or a deficit. It can also change with exchange-rate variations. In the theory, international reserves (R) are defined in accordance with the component elements of the monetary-base-effect balance. In notational form, $B \equiv D + R$. This is called the "monetary-base identity."

In line with the monetary-base-effect concept of the balance of payments, the money concept that applies to the monetary base is $M1$, currency and demand deposits held by the public. However, a few empirical studies that test the monetary approach use broader definitions of the money supply.

As a most general formulation, the monetary approach identifies balance-of-payments disequilibria with adjustment in the money market. Payments imbalances are rooted in the relationship between the demand for and supply of money. Monetarists postulate that there is always a tendency toward stock equilibrium in the money market, that is, toward equality between the stock demand for money (M^d) and the stock supply of money (M^s), where the latter is generated by the equation $M^s = m(D + R)$. Therefore, money-market equilibrium is described by the equation

$$M^d = m(D + R) \ . \tag{3.1}$$

[3] It should be noted that, in line with the monetary approach, this function represents strictly the *domestic* demand for money. Especially for non–reserve-currency countries, there is demand not only for the domestic money but also for foreign exchange (dollars). Yet the monetary approach shows the foreign component only on the supply side (see below), and in that sense exhibits a lack of parallelism between the demand and supply sides of the money market. Exchange-rate-determination models in which residents of a country demand both domestic money and foreign exchange are developed by Girton and Roper (1976), Calvo and Rodriguez (1977), Miles (1978), and Lapan and Enders (1978). These are called models of "currency substitution" if the ratio between the holdings of domestic and foreign currencies is endogenously determined.

Assuming, for simplicity, a constant money multiplier (m), changes in the demand for money (M^d) and in the domestic component of the monetary base (D) are the active ingredients that can pull the money market out of equilibrium. It is changes in the international component of the monetary base (R) that restore or maintain money-market equilibrium under fixed exchange rates. Such changes (ΔR) constitute balance-of-payments deficits or surpluses.

Monetarist literature includes three specific formulations of the process of adjustment in the money market. Two of the models relate to fixed exchange rates and the third to floating rates. The first fixed-rate model views balance-of-payments disequilibrium, considered here to be a *change in stock* rather than a flow variable, as a discrepancy between stock demand for and stock supply of money. Converting the equilibrium condition (3.1) to a once-and-for-all change in stock (rather than a continuous flow), one obtains

$$m\Delta R = \Delta M^d - m\Delta D \ . \tag{3.2}$$

Changes in the domestic-source money supply (D) or in money demand (M^d) can occur *quickly*, by means of either open-market operations or changes in the arguments of the demand-for-money function. These changes give rise to an excess stock demand for money [positive divergence between ΔM^d and $m\Delta D$, the right-hand side of equation (3.2)] or an excess stock supply of money (negative divergence between the two variables). It is crucial to bear in mind at all times that ΔM^d and ΔD are not continuous-injection (flow) variables but, rather, represent once-and-for-all changes in the corresponding stock variables.

The equilibrating factor that restores stock equilibrium of money demand and supply is ΔR, the once-and-for-all change in the international component of the monetary base. But this adjustment takes time. Monetarists do not specify the length of time required for the full ΔR to occur and therefore for money-market equilibrium—equation (3.1)—to be restored.

It is important to emphasize again that the variables ΔM^d , ΔD , and especially ΔR are not to be interpreted as continuous flows in this model. Rather, they are once-and-for-all changes in stocks. Since the ΔR adjustment can take many years, only a fraction of it would occur in any given year as temporary balance-of-payments flows. It is this model that monetarists generally employ in their theoretical and policy analysis.

A second, less frequently used formulation involves *continuous* money-market equilibrium maintained by a continuous payments imbalance. This can be shown by the equation

$$m\dot{R} = \dot{M}^d - m\dot{D} \ , \tag{3.3}$$

where dotted variables are expressed in rate-of-change form. Equation (3.3) models a situation in which there are slow, continuous changes in the demand for money (M^d) or domestic credit (D), giving rise to a continuous balance-of-payments deficit or surplus. The latter *flow* imbalance in turn maintains continuous money-market equilibrium in both the stock, equation (3.1), and flow, equation (3.2), senses.

The third model, which pertains strictly to floating exchange rates, is described in Chapter 5. It involves continuous stock equilibrium in the money market combined with continuous balance-of-payments equilibrium.

Consider the first of the three models just outlined, portrayed by equation (3.2). Demand for money can be satisfied either from domestic or international sources. Thus, if the demand for money rises (say, because of an increase in the rate of growth of real income) while the domestic component of the monetary base remains unchanged, the excess demand would be satisfied by an increase in the international component, that is, by drawing foreign funds into the country. That constitutes a balance-of-payments surplus.

In general, any change in the domestic component of the monetary base is ultimately offset by an equal and opposite change in the international-reserve component through the balance of payments. An important assumption underlying this fundamental monetarist proposition is that money demand is a *stable* function of very few variables, and that these variables are independent of the factors that influence money supply. In other words, nothing in the change in the domestic component of the monetary base would affect the demand for money.

A surplus or deficit in the balance of payments reflects *stock disequilibrium between demand for and supply of money*. A surplus occurs when the demand for monetary balances exceeds the money stock. If the excess demand for money is not satisfied from domestic sources (i.e., by an increase in D or, rarely, by an increase in m), funds will be attracted from abroad to satisfy it. Such an inflow can be generated by a surplus on commodity trade or on the service account, direct investments by foreign companies, or an attraction of private long-term or short-term portfolio funds. The precise composition is immaterial; the important thing is that the excess demand for money stock generates a balance-of-payments surplus. However, assuming no intervention by the monetary authorities to "sterilize" the resulting inflow of funds (by reducing D in step with the increase in R), such a surplus is necessarily temporary and self-correcting. It will continue only until the money stock rises to the level necessary to satisfy the demand for money balances, that is, until the excess demand for money is eliminated.

The feature responsible for the self-correction is that the demand function for money relates to money as a stock and not as a flow. When the desired stock is reached, the inflow of foreign funds—the counterpart and cause of the external surplus—ceases, and so does the balance-of-payments surplus. Under two circumstances, a surplus can be more than temporary. In the first model, equation (3.2), this would occur when official sterilization of the incoming funds prevents the monetary base, and hence the money stock, from rising to the desired level. Alternatively, in the second model, equation (3.3), it could be caused by a continuous increase in the demand for money ($\dot{M}^d$) over and above the rise in the domestic component of the money supply ($m\dot{D}$). Such an increase can be brought about by a continuous rate of increase in money income in excess of the rate of growth in the domestic component of the money supply. This is often advanced as an explanation of the continuous surpluses of Germany and Japan in the 1960s and 1970s: the growth rate of real income exceeded the growth rate in real money balances.

Returning to the first model, a balance-of-payments deficit reflects excess supply of money as a stock. When the stock of money exceeds the demand for money balances, people try to get rid of the excess supply. They do that by increasing purchases of foreign goods and services, by investing abroad, or by transferring short-term funds abroad to acquire foreign assets. Thus the deficit is viewed as a spillover of the excess supply of money; its composition is immaterial.

The deficit is temporary and self-correcting, provided that the monetary authorities do not replace the outflowing funds by creating new domestic credit (by increasing D in accordance with a sterilization policy). The deficit will last only until the excess supply is dissipated abroad and will stop when stock equilibrium in the money market is restored—when the total money stock declines to the level of desired money balances. Continuous deficit is possible only if a policy of complete sterilization is followed by the monetary authorities or (under the second model), if the condition causing the excess supply of money persists. Such a condition could be a growth rate in the domestic-source money supply in excess of the growth rate in money income.

The self-correcting apparatus outlined above takes time. Except for hints that the period required might be between a year and a decade, the monetary approach is silent on the dynamic process that the economy must undergo to reach the new equilibrium, and on the elapsed time necessary to reach it. It is concerned strictly with the final, long-run equilibrium position.

Clearly, money plays a central role in the approach. It is viewed as an active agent and not merely as fulfilling a passive role in transactions. In other words, the crucial decision of individuals and institutions concerns the adequacy of their money balances. Their demand for such balances relative to supply determines the level of their expenditures on goods and services. Indeed, aggregate spending is a function of real balances and not of income.[4] Monetarists reject the converse view that expenditure and investment decisions are the central ones and money is a passive agent used to finance these transactions. The self-correcting feature of the analysis derives from the focus on money as a stock rather than a flow.

It is often suggested that the "new" monetary approach is the intellectual grandchild of the "price–specie-flow mechanism" developed by David Hume in the eighteenth century.[5] Monetary flows are central to both theories, and both regard external imbalances as self-correcting. However, in the price–specie-flow mechanism, monetary flows rectify external disequilibria through their effect on relative commodity prices. In contrast, the monetary approach views a stable demand for money as the core of the mechanism, and relative commodity prices play no role in the adjustment process. Price elasticities are therefore considered irrelevant. In fact, some monetarists hypothesize that perfect international arbitrage ensures that one price will prevail internationally on all commodity and capital markets, so that no changes in relative commodity prices are even possible—let along necessary—for international adjustment.

Domestically, the monetary approach implies that under fixed exchange rates a country has no control over its money supply. The money supply is endogenous rather than an exogenous or policy variable. The pursuit of any domestic objective, such as price stability, by altering the domestic component of the monetary base will be frustrated by offsetting changes in the international component through reserve flows. If a country is unable to pursue sterilization policies, all the government can do is control the *composition* of the money supply, not its level. In precise terms, the government cannot determine the level of the monetary base, and thence the money supply, but only the division of the base into its domestic (D) and foreign (R) components. A change in D will produce an equivalent and opposite change in R unless there is a change in either the money multiplier or the demand for money. And the direction of causation is from D to R and not the other way around. It should be emphasized that the demand for and supply of money are considered to be independent of one another, and the money multiplier is considered to be independent of money-market conditions. Therefore, a change in D does not in itself bring about a change in money demand or the money multiplier.

[4] More accurately, monetarists specify *nominal* spending as a function of *nominal* money balances. A linearly homogeneous money-demand function, together with the assumption of no money illusion, allows one to respecify the function in terms of real variables.
[5] See, for example, Frenkel and Johnson (1976a, pp. 37-40) and Johnson (1977c, pp. 4-6).

To a monetarist, there is no difference between a central bank's intervention in the foreign-exchange market (the direct purchase of foreign exchange with domestic currency) and its open-market operations (the purchase of domestic bonds with domestic currency). Any excess supply of domestic currency created by open-market purchases of bonds will be exchanged by private agents for foreign currency. Therefore, whether the central bank buys bonds or foreign exchange, the outcome is identical. An analogous argument applies to contractionary open-market operations. Crucial to monetary analysis is the relation between the demand for and supply of money. It does not matter whether money is created by central-bank purchase of domestic or of foreign assets.

Absent from the mainstream of the monetarist literature is recognition of the relationship between monetary and fiscal policy. In particular, the amount of domestic credit created (ΔD) is exactly equal to the government's budget deficit less borrowing from the private sector, either domestic or foreign. Nearly all adherents to the monetary approach view monetary policy as active (albeit ineffective!) and fiscal policy as passive. Therefore, they ignore the fiscal aspect of creating domestic credit. The issue is whether the monetary or fiscal authorities determine ΔD. Is domestic credit creation purely a monetary-policy variable or is it determined by fiscal policy?

It has been argued—in contrast to the usual monetary approach—that, for the United Kingdom, fiscal policy is the active partner, while monetary policy passively adjusts to "cover" that part of the government deficit not financed by sales of government securities to the private sector.[6] More generally, the monetary approach has been criticized for ignoring not only the government-budget constraint on credit creation but also long-run relationships between fiscal policy and the balance of payments.[7]

The United States is perhaps unique in having a central bank that exercises control over the money supply independently of the fiscal authorities. Yet, paradoxically, the monetary approach is least applicable to the United States.

Special Position of the United States

The United States is considered by many monetarists to be in a unique position, capable of escaping many of the constraints implied by the above analysis. Because the United States is the reserve-currency country, a

[6] See Akhtar, Putnam, and Wilford (1977).
[7] See Currie (1976, 1977) and, in defense of the monetarist treatment of fiscal policy, Nobay and Johnson (1977). For a discussion of fiscal policy within the monetary approach, see Meltzer (1976).

balance-of-payments deficit (say, as a consequence of expansionary monetary policy, which increases the domestic component of the monetary base) need not imply a reduction in the monetary base and therefore the money supply. Rather, other countries may increase their reserves by piling up dollar deposits in the United States. Expansion of D in the United States may be accompanied by an increase in foreign R rather than a decline in U.S. R.

Furthermore, the United States is a large economy with a relatively small foreign sector. Any gain or loss in reserves is necessarily small relative to the total U.S. money market. Consequently, it is easier to pursue sterilization policies without significantly affecting interest rates. In contrast, small open economies that attempt to sterilize will change domestic interest rates relative to world interest rates, thereby inducing an inflow or outflow of foreign funds.

This special position of the United States has two effects. First, it restores monetary policy as a policy variable operating on the domestic economy, even under fixed exchange rates. Second, it destroys the symmetry whereby a given amount of domestic money creation has the same impact on the world money supply regardless of the origin of the disturbance. Asymmetries are introduced because ordinary money in a reserve-currency country becomes high-powered, or base, money in other countries as it enters these countries' international-reserve holdings via U.S. balance-of-payments deficits.[8]

These asymmetries may be more complicated than is apparent. For example, a sophisticated theoretical study (Swoboda, 1978) shows that a pure dollar standard in which the outer countries hold all their reserves in the U.S. *central* bank possesses the symmetry property of the gold standard. On the other hand, if all reserves are held with U.S. *commercial* banks, there is a maximum differential between U.S. and rest-of-the-world monetary policies in affecting the world money supply. Interestingly enough, the existence of a Eurodollar market tends to increase the asymmetrical effect of U.S. versus rest-of-the-world monetary policies.

[8] Putnam and Wilford (1978) use this asymmetry to explain the apparently inconsistent findings of two independent studies concerning the relationship between the money stock and the price level (and nominal income)—Sims (1972) for the United States and Williams, Goodhart, and Gowland (1976) for the United Kingdom—during the Bretton Woods period. Because the United States, the reserve-currency country, has control over its money supply even under a fixed-exchange-rate regime, Sims found the expected causal relationship of domestic monetarism from money stock to money income. The United Kingdom does not control its money stock, and its price level is also exogenously determined on the world market. The money stock and nominal income change simultaneously, so Williams *et al.* found no causality.

The General Monetary Approach and "Global Monetarism"

To recapitulate, the monetary approach to the balance of payments is concerned strictly with long-run equilibrium and rests on two central assumptions: (a) the demand for money is a stable function of very few variables; and (b) countries do not pursue sterilization policies, either because they cannot sterilize over a long period or because they do not wish to do so. Although the assumptions are not central to the approach, many monetarists also hypothesize that (c) wage-price flexibility fixes output at the full-employment level (defined to incorporate a "natural" rate of unemployment), at least in the long run, so that the Keynesian income-adjustment mechanism is irrelevant; and (d) perfect substitution (i.e., infinite cross-elasticities of substitution in demand) across countries in both the product and the capital markets ensures one price for each commodity and one rate of interest. In other words, *the world consists of a single integrated market* for all traded goods and for capital; the "law of one price" obtains around the globe. Consequently, changes in relative prices on world markets—for example, between a country's exports and those of competing sources—are not possible, and the "elasticities" approach to the balance of payments is rejected. Adherents to assumptions (c) and (d), in addition to (a) and (b), are often called "global monetarists."[9] Thus, global monetarism is a subset of the general monetary approach.

Global monetarists would object to the view that the United States is in a special position regarding the effectiveness of monetary policy because of their belief in the universal applicability of hypothesis (d): even in the United States, prices and interest rates cannot deviate from those prevailing on world markets.

If global monetarism is a subset of the general monetary approach, there is also a subset of global monetarism—the so-called Mundell-Laffer ratchet hypothesis set forth in the writings of Laffer (1973, 1974) and Wanniski (1974, 1975). In addition to the four assumptions, (a) through (d), of global monetarism, these authors postulate a "ratchet effect," namely, an asymmetrical price response to exchange-rate adjustment. They conclude that not only do exchange fluctuations fail to equilibrate the balance of payments, but they also contribute to worldwide inflation. Indeed, they may be the prime cause of that inflation.

Their argument runs as follows: The law of one price implies that currency devaluation cannot change a country's prices relative to world

[9] The term was apparently coined by Whitman (1975, p. 494). "Global monetarism" denies the value of any macroeconomic stabilization policies, because real income is considered to be exogenously determined. By treating the world as one market, the approach denies the relevance of national boundaries.

prices: either the country's prices rise, foreign prices decline, or a combination of both processes occurs until international price equalization is restored. The hypothesized "ratchet" involves export prices (in domestic currency) rising in the devaluing country but import prices failing to decline in the revaluing country. Consequently, international price equalization is accomplished strictly through price increases in countries with depreciating currencies; there are no induced domestic price decreases in countries with appreciating currencies. The result is that every time there is an exchange-rate change, world prices increase. One might ask what gives rise to exchange-rate fluctuations to begin with. According to the monetary approach, it is divergent rates of inflation, which in turn are caused by divergent growth rates in domestic money stocks. This takes us back to mainline monetarism, where inflation is a consequence of growth in the money supply rather than of floating exchange rates.[10]

[10] This point is alluded to by Claassen (1976), who provides a skeptical exposition of the Mundell-Laffer hypothesis. His analysis is criticized by Genberg (1976c). Another qualification, raised by both Claassen and Corden (1977, Chap. 5), relates to the ratchet effect itself. In a world where all countries are inflating, it is necessary only that the appreciating country lower its rate of inflation—rather than reduce prices absolutely—in order for the ratchet to disappear.

Further criticisms and assessments of the Mundell-Laffer ratchet hypothesis, as well as references to the empirical literature bearing specifically on this approach, are provided by Crockett and Goldstein (1976, pp. 523-530), Haberler (1978), Goldstein (1977), and Kreinin (1977, pp. 299-301). The latter two authors also present some further empirical testing of the Mundell-Laffer hypothesis. The evidence to date does not support the hypothesis.

4 POLICY IMPLICATIONS

What are the implications of the monetary approach for balance-of-payments policies? Since external imbalances are viewed as self-correcting, such policies are generally considered unnecessary. They are also considered ineffective, except in the short run. The only possible long-run remedy to a deficit is a reduction in the rate of credit creation, that is, in the rate of increase of D. In any case, the effectiveness of balance-of-payments measures must be evaluated in the light of their effect on money-market equilibrium.

Devaluation

Only through possible effects on the demand for and supply of money balances can devaluation have an impact on the balance of payments. Any such effect must come about through the increase in domestic prices caused by a downward adjustment in the exchange value of the country's currency.

Through its direct effect, devaluation raises domestic-currency prices of importables and exportables; because of interproduct substitution, the prices of nontraded goods also rise, although to a lesser degree. The general price rise increases the demand for nominal money balances, which is a stable function of money income. If that stock demand is not satisfied from domestic sources (i.e., by domestic credit expansion, by increasing D), an inflow of money from abroad will occur, producing a balance-of-payments surplus and therefore a gain in international reserves. Devaluation reduces real domestic balances and forces residents to restore them through the international credit or commodity markets. However, the resulting balance-of-payments surplus continues only until the stock money-market equilibrium is restored. In other words, the effect of devaluation is strictly transitory. In the long run, devaluation has no effect on real economic variables: it merely raises the price level.

By the same reasoning, revaluation or currency appreciation produces a transitory balance-of-payments deficit by lowering domestic prices. The demand for monetary balances is thereby reduced, producing a stock excess supply of money.

In sum, exchange-rate changes are incapable of bringing about a lasting change in the balance-of-payments position. Operating strictly through the domestic price level, they produce a temporary stock disequilibrium in the money market and can create a surplus or deficit that lasts only until money-market equilibrium is restored. Furthermore, since—given enough time—all external disequilibria produced under fixed exchange rates are self-correcting through currency flows, the adherents to the monetary approach view exchange-rate changes as unnecessary. They might acknowledge that devaluation hastens the process of restoring balance-of-payments equilibrium by absorbing excess money balances.

The transitory surplus effected by devaluation depends neither on variations in relative prices (i.e., on changes in the country's terms of trade) nor on product-market elasticities. Even if the law of one price applied universally to all commodities, so that no change in the terms of trade was possible—the domestic prices of both importables and exportables rising in proportion to the devaluation—a salutary effect on the balance of payments could occur in the short run. For the monetarists, devaluation operates through a totally different mechanism—the stock demand for and supply of money. The only condition postulated by the monetary approach is that a reduction in real balances (caused by an increase in domestic-currency prices following a devaluation) would produce a reduction in real expenditures, or absorption, out of a given real income.[1] This is offered as an alternative to the "elasticity conditions" for balance-of-payments improvement.

There is an additional element in the monetary analysis of devaluation. In the view of some monetarists, the real-balance effect is supplemented by an increase in the domestic-currency prices of traded goods (exports and import substitutes) relative to those of nontraded goods. Although all prices increase, those of nontraded goods tend to rise less than those of traded goods. As a result, resources shift from nontraded- to traded-goods industries, while demand shifts in the opposite direction. These changes in the production and consumption mixes help increase exports and reduce imports. The term "switching policies" used to refer to relative-price changes between importables and exportables. Under the global-monetarist law of one price, such changes are not possible, and the "switching" terminology is now used by monetarists to describe internal shifts between traded- and nontraded-goods industries.

Tariffs, Quotas, and Exchange Control

The effect of an import tariff is analyzed in a fashion similar to that of devaluation. Because a tariff increases domestic prices, it raises the demand for nominal money balances. If that demand is not satisfied from domestic sources, that is, by an increase in D, it will produce a transitory

[1] It would appear easier to reconcile the monetary with the absorption approach than with the elasticities or Keynesian-multiplier approaches. In fact, the absorption approach contains the embryo of the monetary approach when it discusses mechanisms by which devaluation can reduce absorption relative to income when undertaken at full employment.

balance-of-payments surplus until money-market stock equilibrium is restored. Any exogenous rise in domestic prices not accompanied by expansion of the domestic component of the monetary base will have the same consequence.

Import quotas directly restrict the volume of imports and therefore increase their price in the importing country. This raises the demand for nominal money balances and creates a transitory balance-of-payments surplus, lasting until money-market stock equilibrium is restored.

Exchange control is a mechanism of rationing foreign currencies while maintaining an overvalued domestic currency. By restricting foreign-currency allocation for imports, the government reduces the volume of imports below its free-market level. This raises the domestic price of importables and, through substitution, the general price level. The consequence is a rise in stock demand for money balances. In the absence of an increase in D, this increased demand will be satisfied from abroad, producing a balance-of-payments surplus or reducing a deficit. However, this effect is temporary, lasting only until money-market stock equilibrium is restored.

Effects on Commodity Markets

We have shown that monetarists view devaluation and various forms of trade and payments restrictions as affecting the balance of payments only to the extent that they raise domestic prices and the rise is not offset by domestic credit expansion. However, any effect is purely temporary. Because its entire focus is on the money market, the monetary approach does not explain the temporary nature of this effect in terms of factors operating on the commodity markets. In fact, it is completely silent on this issue. A possible explanation, in terms of commodity markets, is as follows: Devaluation, tariffs, quotas, and exchange control all improve the balance of payments by restricting imports; in the process, they raise the internal prices of importables relative to exportables. This changes the consumption mix away from importables in favor of exportables, while the production mix shifts in the opposite direction, from exportables to import substitutes. As a result, exports eventually decline to the new lower level of imports, eliminating the improvement in the balance of payments. This mechanism could be the commodity-markets counterpart to the monetarist reasoning in terms of stock equilibrium in the money market.

Economic Growth

When the economy is growing in real terms with an unchanged price level, there is growth in the demand for real, and therefore nominal, money balances. The portion of this growth not supplied from domestic sources is reflected in a balance-of-payments surplus. Under the simplest form of the money-demand function, a deficit must develop if the rate of expansion in the domestic component of the monetary base exceeds the growth rate in real income. In a multicountry context, the monetarists maintain that the growth rate of a country's reserves will be faster than the growth rate in world reserves if the country's real growth rate is faster than the world real growth rate.

This assertion of a positive relation between the rate of income growth and the balance of payments, other things being equal, is diametrically opposed to the prediction of the income/absorption theory of the balance of payments, where imports are a function of income. However, the income/absorption prediction refers only to the balance on current account; it can be reconciled with the monetarist result for the balance of payments via the capital account (see Chap. 9 on the effect of a change in income).

Exogenous Change in the Price Level

An exogenous rise in the price level, such as the one caused by quadrupled energy prices, with real income held constant, increases the demand for money in accordance with the demand-for-money function. The portion of this increase not supplied from domestic sources is reflected in a balance-of-payments *surplus*. As in the case of economic growth, this result conflicts with the traditional approaches, which forecast, rather, a deterioration in the balance of payments. Again, the traditional prediction refers strictly to the current-account component of the balance of payments and can be reconciled with the monetarist result via the capital account (see Chap. 9 on the effect of a change in the price level).

Change in the Rate of Interest

An increase in the domestic rate of interest raises the opportunity cost of holding money, producing a decrease in the demand for money. The resulting excess supply of money is dissipated abroad in the form of an external deficit, lasting until stock equilibrium is restored.[2] Conversely, a decline in the domestic interest rate lowers the opportunity cost of holding money, producing an excess demand for money. In turn, that creates

[2] Although monetarists are not explicit on the issue, they appear to adhere to the Keynesian, or "flow," theory rather than to the portfolio, or "stock," theory of capital movements. Certainly, those who believe in the law of one price in financial markets would have to assume, at least implicitly, continuous capital flows until interest differentials are eliminated. This is not to deny that international equalization of interest rates can occur in a stock-adjustment world. However, it is not obvious in the monetarist literature how equal interest rates can occur within such a framework.

a balance-of-payments surplus, which lasts until the stock imbalance is eliminated.

Once again, this prediction of the monetary approach is diametrically opposed to that of the traditional theories. According to the latter, a rise in domestic interest rates relative to interest rates abroad produces an external surplus, while a decline in domestic interest rates produces a deficit.[3]

[3] It is possible that the two apparently opposite conclusions could be reconciled in a model that distinguishes between changes in interest rates generally (domestic and foreign)—the monetarist focus—and changes in domestic interest rates relative to those abroad—the nonmonetarist viewpoint.

5 FLUCTUATING EXCHANGE RATES

The Balance-of-Payments Adjustment Process

According to both monetarists and nonmonetarists, freely floating (not managed) exchange rates maintain continuous equilibrium in the balance of payments. Since reserve changes (ΔR) are held at zero, the monetary authorities maintain control over the money stock. In the fixed-exchange-rate case such control is absent, because any change in the domestic component of the monetary base (D) is offset by a change in the international component (R). Thus, the nominal money supply, an endogenous variable when a country's exchange rate is fixed, becomes a policy variable when the country's currency floats freely in the foreign exchange market.[1]

Monetarists emphasize that floating rates are unnecessary for the maintenance of balance-of-payments equilibrium in the long run. Because imbalances are self-correcting even under fixed exchange rates, a preference for a fixed-rate system is indicated. To many monetarists, it follows that countries should enjoy the efficiency of a single worldwide currency area.[2]

While the adjustment of a balance-of-payments deficit or surplus takes place via money-market equilibrium under both the fixed and floating-rate systems, there is a difference in how this equilibrium is attained. Under fixed exchange rates, quantities of money adjust *gradually* through reserve flows to bring equality between actual and desired money stock. Under floating rates, money-market equilibrium occurs *quickly*, if not instantaneously, through domestic price changes that alter the valuation of the money stock.

Determination of Market Exchange Rates

The problem can now be turned around by asking: What determines the market exchange rate? In terms of the analysis of Chapter 3, a shortcut answer to this question would be: Whatever causes a balance-of-payments deficit under a fixed exchange rate will result in a depreciation of a floating currency; whatever causes a balance-of-payments surplus under a fixed rate will result in an appreciation of a floating currency. In a regime of managed floating, the first set of influences will cause a combination of currency depreciation and reserve losses while the second set will cause a combination of currency appreciation and reserve gains.

[1] Miles (1978) modifies the conclusion that freely floating exchange rates confer on the central bank complete independence in the conduct of monetary policy. He introduces currency substitution on the demand side of the money market, assuming that economic agents wish to diversify their portfolios by holding foreign currencies. A change in monetary policy can trigger an adjustment in this portfolio composition and generate an intercountry movement of currencies that can offset part of the policy change.

[2] Paradoxically, in this position followers of the monetary approach to the balance of payments turn their backs on Milton Friedman, who has been a persistent supporter of freely floating exchange rates.

Such an answer constitutes, at best, a general framework; a specific answer to the question of exchange-rate determination requires a more precise formulation. In the mid-1970s, the modern monetarist literature abandoned its preoccupation with the fixed-exchange-rate regime and began to develop models of exchange-rate determination. These models are potentially capable of explaining the variability and even the volatility of exchange rates in the post–Bretton Woods era. What follows is the extension of the monetary analysis to a regime of floating exchange rates.

In accordance with the general principles of the monetary approach, exchange rates are regarded as the relative prices of different national moneys. They are determined by equilibrium conditions between demand for and supply of the stocks, rather than flows, of various national moneys.[3] Under freely floating exchange rates, the foreign-source component of the money supply is fixed, so that the demand for money can be satisfied only from the domestic-credit component. Expectations, of the "rational" variety, play an important role in exchange-rate determination. While exchange rates are considered mainly a monetary phenomenon, they are also influenced by "real" factors, operating through monetary channels. (The same statement holds true for the balance of payments when the exchange rate is fixed.)

A convenient point of departure is the purchasing-power-parity (PPP) theory. As interpreted by monetarist authors, and by many nonmonetarists, this theory states that a unit of the domestic currency commands the same quantity of goods and services abroad, when converted into the foreign currency, as it can purchase at home. The implication is that the exchange rate (r), defined as the price of foreign exchange in terms of domestic currency, is the ratio between the home and foreign price levels (P):

$$r = P/P^w \ , \tag{5.1}$$

where the superscript w denotes foreign variables. This relationship implies acceptance of the law of one price in the commodities market, or global monetarism.[4]

[3] This is alleged to be in contrast to the traditional, nonmonetarist, approach, which is said to view the exchange rate as the relative price of national *outputs* and assumes that the exchange rate is determined by equilibrium conditions in the markets for *flows* of funds.

[4] Dornbusch (1976) presents a modified version of the equation, where the law of one price is applied not universally but only to internationally traded goods. The numerator and

It is commonly observed that the PPP theory is incorporated into global monetarism and into the monetary approach to exchange-rate determination, and indeed that the theory is a harbinger of the monetary approach. However, there are important differences between the monetarist interpretation of equation (5.1) and what this equation represents to the nonmonetarist proponents of PPP. For monetarists, equation (5.1) is simply an expression of the law of one price at the aggregate level: $P = r \cdot P^{w}$, that is, the price levels of all countries are equal when expressed in a common currency. There is no implicit hypothesis about the direction of causation, whether from prices to the exchange rate or from the exchange rate to prices. In contrast, the PPP theory asserts that the exchange rate is *determined* by the ratio of the domestic to the foreign price level. Furthermore, nonmonetarist proponents of PPP would consider equation (5.1) simplistic. They would insist that it be amended to include both a random error term and other explanatory variables that help determine the exchange rate.[5]

The price level in each country must also satisfy a purely domestic relationship. With real income (y) exogenously determined, as it is in the classical quantity theory of money, the price level in each country clears the market for real cash balances. The domestic demand for real cash balances (m^d)—the stock of price-deflated cash balances that the public wishes to hold—equals the nominal money stock (M^s) divided by the price level: $m^d = M^s/P$, where M^s is exogenously determined by the central bank. Therefore,

$$P = M^s/m^d \; . \tag{5.2}$$

The equilibrating mechanism works as follows. If the actual money stock exceeds the desired level, cash holders will attempt to get rid of their excess balances by spending on goods and services. Given an exogenously determined real output, the price level will adjust upward, thereby reducing the real value of the money stock to the level the public wishes to hold. A similar argument applies when the money stock falls short of desired money holdings, in which case the switching is from spending on goods and services to accumulating cash balances. In either

denominator of equation (5.1) are adjusted by the shares of traded goods in the price indexes of the domestic and foreign countries, respectively, and subsequently an internal price ratio between traded and nontraded goods for each country is incorporated into the analysis. Global monetarists might recognize that commodity arbitrage, even for traded goods, takes time. Consequently, Dornbusch presents a short-run, or "impact," version of the model, where only interest rates and not commodity prices are equalized internationally. However, in the main body of monetarist analysis these reservations and modifications are ignored and equation (5.1) is adopted.

[5] For a survey of the nonmonetarist PPP literature, see Officer (1976).

case, the equilibrating process is viewed as virtually instantaneous, so that continuous money-market equilibrium is maintained. Substituting equation (5.2) and the analogous equation for the other country into equation (5.1), we obtain:

$$r = \frac{M^s/m^d}{M^{sw}/m^{dw}} \; . \tag{5.3}$$

A defect in the equilibrating mechanism outlined above is the requirement that switching be between (a) money balances and (b) goods and services. While the purely commodities alternative to money balances is an established postulate of domestic monetarism, it is at variance with the general monetary approach to the balance of payments, which envisages switching between (a) money balances and (b) *both* commodities and financial assets such as bonds. This nonrestrictive alternative to money balances is an important reason why only the overall balance-of-payments surplus or deficit and not its component sub-balances is a characteristic of the monetary approach. However, nonrestrictive switching alternatives might imply that equation (5.2) is not satisfied or, at the least, holds only subject to longer adjustment lags than would otherwise exist. Also, the assumption of a given real output presumably holds only in the long run. In its absence, equation (5.2) need not hold continuously.

Fortunately, the adjustment mechanism expounded above—although common to monetarists' presentations of their theory of exchange-rate determination—is not necessary for development of the theory. In Chapter 7 we show that a simple statement of money-market equilibrium for *nominal* money demand and supply, with no restriction on how this equilibrium is maintained, can substitute for equation (5.2) and its underlying equilibrating mechanism. This alternative hypothesis has the property that it is identical to the monetarist view of money-market equilibrium under a fixed exchange rate.

Returning to the presentation at hand, the demand for real money (m^d) depends on two factors: real income (y), where, for simplicity, a unitary income elasticity of demand for money is assumed to prevail in both countries; and the interest rate (i), where the quantity of real cash balances demanded varies inversely with the interest rate, with an elasticity of e assumed for both countries. Thus, for the domestic country,

$$m^d = kyi^e \; , \tag{5.4}$$

where k is a constant. Substituting function (5.4) and an analogous one for the foreign country into equation (5.3), we obtain

$$r = \frac{k^w}{k} \cdot \frac{M^s}{M^{sw}} \cdot \frac{y^w}{y} \cdot \frac{(i^w)^e}{i^e} \, . \tag{5.5}$$

Equation (5.5) summarizes what may be called the "pure" monetary theory of exchange-rate determination in the sense that inflationary expectations are not incorporated into the analysis, just as they are excluded from the monetary approach for a fixed exchange rate. However, for a floating rate, monetarists immediately proceed to introduce inflationary expectations into the model. With the money supply and real income exogenously determined, it is through the interest rate that expectations enter the analysis. Within each country, the nominal rate of interest (i) is the sum of the real rate of interest (i^r) and the expected rate of inflation (π). In turn, the real rate of interest is assumed to be equalized across countries by integrated world capital markets, in accordance with global monetarism, so that $i^r = i^{rw}$. Thus the nominal interest rate can vary between countries, with the differential reflecting intercountry differences in the expected future rate of inflation. Equation (5.5) then becomes:

$$r = \frac{k^w}{k} \cdot \frac{M^s}{M^{sw}} \cdot \frac{y^w}{y} \cdot \frac{(i^{rw} + \pi^w)^e}{(i^{rw} + \pi)^e} . \tag{5.6}$$

How are inflationary expectations formed? Generally, the "rational expectations" hypothesis is invoked: Rather than being merely projections of past rates of inflation, expectations center on the variables that determine the actual rate of inflation in the model.[6] These variables are the nominal money supply (M^s) and real money demand (m^d), in accordance with equation (5.2). Therefore, the public's expectations of inflation are given by its expectations of a greater future growth in the nominal money supply than in real money demand. That perception depends, in particular, on the current observable growth in the money stock and on available information concerning imminent political and economic changes (such as, in the United States, replacement of the chairman of the Federal Reserve Board) that are expected to have a bearing on future growth of the money supply. Although inherently unobservable, the state of inflationary expectations can sometimes be gleaned from the forward exchange market.

Equation (5.6) embodies the fundamental relationships of the monetary approach. It implies unidirectional channels of influence running from the exogenously determined money stock and real income through prices to the exchange rate. Reverse causality is effectively ruled out in the context of the model by the exogeneity of the money-stock and income variables. In addition, exogenous variables influence the exchange rate indirectly through the price-expectations component of the nominal-interest-rate variable.

[6] For an exception, see Knight (1976).

While the demand and supply of money are the *proximate* determinants of the exchange rate, the *ultimate* determinants are incomes, interest rates, price expectations, money stocks and their growth rates, and other exogenous information.

The model can be criticized on two levels. First, it may be valid only for freely floating exchange rates. In a period of managed rather than free floating, there can actually be reverse causality running from the exchange rate to money, at least in the short run. The reason is that a managed float can partake of the characteristics of an adjustably pegged exchange rate. It is an accepted proposition that, should a changing exchange rate influence the domestic price level (a direction of causation inconsistent with the PPP theory), the current account, and therefore the overall balance of payments, is affected. If the government intervenes to peg the exchange rate at its current level, the incipient balance-of-payments deficit or surplus becomes an actual one, leading to flows of reserves, that is, changes in the foreign component of the monetary base. Through the money multiplier, the money supply is affected. Of course, under the monetary approach, the change in the money supply may be only temporary, as discussed in Chapter 3. It is also unlikely that depreciation of a country's currency can engender inflation via a wage-price spiral unless the central bank accommodates the process by increasing the monetary base and thence the money supply.[7]

Second, on a more general level, some critics argue that, over periods longer than a quarter, real income cannot be regarded as independent of the money supply and exchange rate, and the exchange rate might influence the price level.[8] It is therefore necessary to develop models that explain the determination of income and prices simultaneously with the exchange rate. On the other hand, for very short periods, measured in weeks or months, the demand for money may not be a stable function of a few variables, contradicting another monetarist proposition.

In what senses can this model be characterized as monetarist? First, all variables, including "real" variables, that affect the exchange rate run through monetary channels. Second, the expected signs of the partial derivatives are those embedded in the monetary approach to the balance of payments: Holding all foreign variables constant, a rise in the home country's income leads to *appreciation* of its currency, and a rise in its interest rate leads to *depreciation* of its currency. Third, in the commodity and real-interest markets the model is based on the law of one price, adopted from global monetarism.

However, there are differences, subtle or otherwise, between the

[7] See Yeager (1976, pp. 223-226) for an elucidation of this argument.

[8] See, for example, Parkin (1976).

monetary approach to the balance of payments under fixed rates and the monetary approach to exchange-rate determination under floating rates. First, in the fixed-rate case, the causal relation works directly from the demand and supply of money stock to the balance of payments. In the floating-rate case, the monetary influence is channeled through relative price levels. Second, with respect to the capital markets and to the use of PPP, the monetary explanation of exchange rates relies on the law of one price and consequently implies global monetarism. In the fixed-exchange-rate case, perfect arbitrage is not necessary for the explanation of imbalances. Third, inflationary expectations are incorporated in the monetary approach to exchange-rate determination but not in the monetary analysis of the fixed-rate case (except insofar as inflationary expectations affect the demand for money).

Policy Implications

Three policy implications are suggested by the model. First, the most effective way of arresting, and perhaps reversing, the depreciation of a currency is to carry out a preannounced permanent reduction in the rate of growth of the domestic money stock. The announcement itself will have an immediate impact on the exchange rate through the price-expectations channel. For this effect to be sustained beyond the initial impact period, however, the actual rate of growth in money supply must conform to the newly announced target. Only then will the public regard the target as an indicator of the future rate of money expansion.

A second implication becomes evident by rewriting equation (5.5) as

$$r = \frac{k^w}{k} \left[\frac{M^s/y}{M^{sw}/y^w}\right] \left[\frac{(i^w)^e}{i^e}\right]. \tag{5.7}$$

Divergent money/output ratios, caused by dissimilar monetary policies, will cause exchange-rate variations both directly, as indicated by the first bracketed term in equation (5.7), and through the creation of divergent inflationary expectations (thus affecting the nominal interest rates), as indicated by the second bracketed term. Exchange-rate stability requires consistent and coordinated monetary policies between countries so as to keep the countries' money/output ratios constant or growing at the same rate. An internationally coordinated monetary-growth rule therefore seems advisable. Coordination of fiscal policies is essential to the extent that budgetary deficits are financed by the creation of new money or have an impact on money demand.

These stated requirements for exchange-rate stability, while derived from a model of freely floating exchange rates, nevertheless have a serious implication for international policy coordination in the current system of

managed exchange rates. To avoid the problems of competitive depreciation and inconsistent intervention in a regime of managed floats, the traditional, nonmonetarist approaches call for surveillance and coordination of central-bank direct intervention in the foreign-exchange market.[9] Under the monetary approach, such procedures would not adequately guard against competitive depreciation or ensure consistency of intervention targets. Indeed, even turning managed floats into "free" floats by barring direct government intervention in the foreign-exchange market would not be sufficient. The reason is that a central bank can bring about a depreciation of its currency by buying domestic bonds as well as by buying foreign currency. Recall the observation in Chapter 3 that the monetary approach obviates the distinction between central-bank intervention in the foreign-exchange market and open-market operations in the domestic bond market. So policy coordination requires rules to induce compatibility not only of interventions in foreign-exchange markets but also of domestic monetary policies. This contention implies greater restrictions on national economic sovereignty.

Third, even disregarding the Laursen-Metzler effect,[10] flexible exchange rates do not completely insulate an economy from foreign disturbances and therefore do not permit total independence of national stabilization policies. This conclusion follows from the law of one price in the commodity and capital markets. Traditional theory suggests that a fall in U.S. aggregate demand will lower imports from Europe, but that will be offset by depreciation of European currencies, making their goods cheaper for Americans. Under the law of one price, however, European goods can no longer be made cheaper through exchange-rate adjustment; the domestic prices of European goods will rise in full proportion to the depreciation, leaving their dollar prices unaffected.

Moreover, a fully offsetting European depreciation is unlikely to occur: the European deficit resulting from the U.S. recession may be financed in whole or in part by an outflow of funds from the United States to Europe, because of a decline in money demand in the United States. This capital flow mitigates the depreciation of European currencies. Thus, a reduction in U.S. aggregate demand will be transmitted to Europe. In sum, the monetary approach implies that the problem of intercountry policy conflict existing under fixed exchange rates is modified rather than eliminated by floating rates, whether of the free or managed variety.

[9] See, for example, the proposals of Ethier and Bloomfield (1975), Mikesell and Goldstein (1975), and Tosini (1977).

[10] The reference is to the effect of the terms of trade on desired saving and therefore on aggregate demand (see Laursen and Metzler, 1950).

6 DOCTRINAL HISTORY

Proponents of the monetary approach present it as a unified theory that applies to the balance of payments under a regime of fixed exchange rates and to exchange-rate determination under a regime of floating rates. Although there are certain differences in the assumptions of the two cases, as noted in Chapter 5, the emphasis on the supply of and demand for money as a stock is certainly common to both. Monetarists maintain that their approach is deeply rooted in the classical tradition. A short doctrinal review therefore appears in order.

Early History

A distinction must be made in the pre–World War II doctrinal literature between that relating to fixed and that relating to floating exchange rates. In the fixed-rate case, the classical antecedents appear mainly as scattered vignettes, while in the case of exchange-rate determination one can discern a cohesive body of analysis that resembles the monetary approach.

With respect to fixed exchange rates, one finds in the classical literature references to the following features of the monetary approach:[1]

a. *The law of one price in the commodities and, to some extent, money markets* (Ricardo, Bagehot, Laughlin, Mill, Wicksell, Hawtrey).

b. *The idea that money will be distributed among different countries of the world to accommodate "natural traffic,"* an unspecified concept (Gervaise, Hume, Ricardo). Ricardo, Mill, and subsequently Hawtrey, developed further this idea of the spillover of money across national boundaries, almost to the point of implying that the money supply in any country is endogenous. The spillover occurs through the balance of *payments*, not just the balance of trade, and the mechanism for inducing it was said to be the rate of interest. Changes in the domestic money stock affect the rate of interest, and in turn variations in the rate of interest induce international money flows.

c. *Scattered suggestions that money creation has a direct effect on the balance of payments* (Oswald, Cantillon, pre-1930s Keynes, Hawtrey).

d. *An occasional insight that commercial policy, such as a tariff, affects the balance of payments through its effect on the demand for money* (Hawtrey).

[1] For specific citations to the classical literature, see Frenkel (1976c) and Frenkel and Johnson (1976a).

While these ideas are incorporated in the modern version of the monetary approach, they do not in themselves represent a cohesive theory. In contrast, the monetary approach to floating exchange rates is more deeply rooted in early economic writings. This tradition can be traced back to the U.K. bullionist controversy at the beginning of the nineteenth century, exploring the causes of the depreciation of the pound. At that time, the "anti-bullionists" offered a balance-of-payments view of exchange-rate determination, attributing the depreciation to changes in the various components of the balance of payments. In contrast, the "bullionists" (led by Thornton and later by Ricardo) offered what might be considered a monetary view, attributing the decline of the pound to excessive printing of money by the Bank of England.[2] Interestingly enough, a parallel debate had taken place in Sweden sixty years earlier.[3]

By the time of World War I, the balance-of-payments view appears to have prevailed. However, during and after the war, Gustav Cassel propounded an essentially monetary approach, for his purchasing-power-parity theory held that the exchange rate of the currencies of two countries reflects the ratio of the price levels in these countries. When combined with the prevailing quantity theory of money, under which the quantity of money in each country determines that country's price level (with velocity and real output constant), this view yields the essence of the monetary approach to exchange-rate determination.[4]

During the 1920s, Keynes was very much in sympathy with this view. In the preface to the French edition of *A Tract on Monetary Reform*, he attributes the exchange value of the franc, first, to the quantity of francs in circulation (which, however, is said to depend "on the loan and budgetary policy of the French Treasury") and, second, to the amount of purchasing power it suits the public to hold in that form (Keynes, 1924, p. xviii). In other words, supply of and demand for money stock are the crucial factors in exchange-rate determination. However, fiscal rather than monetary policy is viewed as the active partner in determining the money supply.

> In this case the fall of the franc will not be prevented even by a reformed budget or a favourable surplus of trade. For it would be necessary for the government to absorb the redundant bank-notes and franc-bonds and -bills, which the public no longer cared to hold, a task unavoidably beyond the government's power. We have the experience of many countries to demonstrate that unbalanced budgets are the initial cause of collapse, but that the real *dégringolade* only comes when the confidence of the general public is so far undermined that they begin to contract their holdings of the legal-tender money.

[2] The standard discussion of the controversy is that of Viner (1937).

[3] This fact is emphasized by Myhrman (1976).

[4] For a bibliography of Cassel's writings, see Officer (1976).

The central task of the French government at this moment is, therefore, to preserve confidence in the franc in the minds of the widest circles of the French public (Keynes, 1924, p. xix).

Keynes's view of the depreciation of the franc is in the same vein as the following 1978 *Wall Street Journal* editorials embracing the monetarists' position concerning the depreciation of the dollar:

The Carter administration's decision to support the dollar is a welcome step, but if it remains only a first step the experiment will be a disaster. Intervention makes eminent sense, but only on one huge condition. The administration must be prepared to redirect its efforts toward bringing other economic policies, and above all the rate of domestic money creation, into line with the new exchange rate policy. . . .

But meanwhile the Fed is also conducting domestic monetary policy through the open market desk, expanding or contracting bank reserves by buying or selling bonds. These transactions will either complement or offset what *is* happening at the foreign exchange desk. If the open market desk expands the supply of dollars as fast as the foreign exchange desk contracts it, the intervention will be defeated.

For that matter you can defend—or undermine—the dollar through one desk even if the other is closed. The dollar is in trouble today primarily because the open market desk has created too many of them. . . .

While the supply of dollars is more directly under the control of monetary authorities, the foreign exchange rate also of course depends on the demand for them. . . .

We ourselves think the balance of trade deficit has been vastly overemphasized, being mostly the result of faster growth here than abroad. But surely part of the dollar's weakness can be ascribed to the renewed expansion of government spending and the resulting claims on future economic growth (*Wall Street Journal*, Jan. 6, 1978, p. 4).

The Carter administration's decision to intervene in the foreign exchange markets has unleashed a whirlwind of commentary on the dollar. Nearly all of it missed the main point, which is that what exchange rates are basically about is monetary policy—though the Federal Reserve Board made the connection explicitly in increasing the discount rate. But most analysts have focused not on money, but on the U.S. trade deficit. . . .

The key to this puzzle is that trading nations not only sell goods. They also sell bonds, financial assets carrying a claim to future goods. Unless you think of goods and bonds together—connecting the real sector and the financial sector—you cannot start to understand what happens in the international marketplace (*Wall Street Journal*, Jan. 9, 1978, p. 12).

Finally, after discussing and dismissing the neo-Keynesian explanation of the dollar depreciation in 1977-78, an editorial concludes:

Exchange rates are a monetary phenomenon. The dollar does not decline in value because we import too much oil or grow too fast. The dollar declines in value because we print too many dollars. Unless you understand this, you will be raging at the tides with your drowning breath (*Wall Street Journal*, Mar. 8, 1978, p. 20).

Modern Developments

In the post–World War II period, renewed interest in the monetary approach dates from the work of the International Monetary Fund in the 1950s.[5] Several practical needs provided impetus to this development. First, many developing countries in which the Fund had to work lacked sufficiently detailed national income and product accounts to make possible the application of Keynesian tools. However, financial statistics were usually available at their central banks. At the same time, only aggregative balance-of-payments data could be obtained. Thus the elasticities and Keynesian approaches were generally ruled out on pragmatic grounds, and emphasis on monetary analysis immediately suggested itself. Second, work with monetary aggregates could be carried out relatively swiftly and was therefore appropriate for the short-lived Fund missions to foreign countries. Third, having simple financial structures, developing countries could hardly engage in sterilization policies, making a major monetarist assumption a reasonably appropriate approximation to reality. Fourth, developing countries, particularly in Latin America, relied upon monetary policy as an instrument of balance-of-payments control.[6]

As a consequence, the Fund tended to set quantitative ceilings on domestic credit expansion as a condition for a country's access to the Fund's resources. The analytical foundation of that policy has been described in a manner perfectly reminiscent of the monetary approach:

The central element of this approach was the estimation of the prospective demand for money on the basis of forecasts of real gross domestic product (GDP), an assumption about future price inflation, and any other relevant information. By controlling domestic credit creation during the period under review so as to equal the estimated change in the demand for money, the authorities could keep the external accounts in balance and the change in international reserves to zero. If an external surplus was to be achieved, perhaps in order to permit repayment of indebtedness, domestic credit creation would to that extent have to be kept below the forecast change in the demand for money;

[5] The Fund's initial published work in the area was an article by Polak (1957). This study and subsequent ones that developed the monetary approach at the Fund are reprinted in International Monetary Fund (1977).

[6] These explanations for the Fund's development of the monetary approach are provided by Rhomberg and Heller (1977).

and if a deficit could be temporarily tolerated, domestic credit creation could be allowed to exceed the anticipated change in the demand for money (Rhomberg and Heller, 1977, pp. 7-8).

To overcome difficulties in forecasting the domestic price level in many cases where nontraded goods and services were unimportant, reliance was placed on forecasts of the *international* price level. The law of one price was thereby accepted as a central postulate.

The Fund's work was not limited to the determination of long-run equilibrium, however. Policy analysis requires an assessment of the short-run effects of policy measures and other exogenous events, and an understanding of the time path of balance-of-payments adjustment. The Fund's models therefore included specification of time lags and behavioral relationships that can be left unarticulated in long-term equilibrium models.

Modern academic work on the monetary approach is often traced to the Meade-Tinbergen classification of internal and external balance in the early 1950s, developed further by Mundell in the 1960s.[7] Divorcing himself from the exclusive concentration on the current-account component of the balance of payments, Mundell demonstrated that monetary policy is more effective than fiscal policy in attaining external balance. The two types of policy affect income in the same direction, but they influence the rate of interest in opposite directions. Consequently, their impacts on capital movements, which are sensitive to the rate of interest, are also in diametrically opposite directions. Thus, while monetary policy improves both the current and capital accounts of the balance of payments, fiscal policy is effective only with respect to the current account (and, in fact, causes the capital account to deteriorate). Presumably, it was this concentration on monetary policy and on the overall balance-of-payments position, coupled with the gradual realization that with perfect capital mobility the money supply ceased to be controlled by the monetary authorities even in the short run, that led Mundell and Johnson to develop the modern monetary approach.

In addition, there may have been developments that stimulated Mundell and Johnson to think in this direction. Why, they may have wondered, did Germany and Japan experience both high growth rates and external surpluses throughout much of the 1960s and 1970s? The Keynesian analytical framework suggests that a high growth rate would produce *deficits*—much less, phenomenal surpluses! In an important paper that predates some of the later ideas, Komiya (1969) suggests that Japan's phenomenal growth rate produced surpluses rather than deficits in its balance of payments by increasing the demand for money balances. This was an important building block, but the policy questions did not end there. Why did successive revaluations of the mark and yen fail to eliminate the external surpluses? Also, why did changes in the rate of interest sometimes affect capital flows in the direction opposite to that predicted by conventional theory?

[7] The references are Meade (1951), Tinbergen (1952), and various articles collected in Mundell (1968, Parts II and III; 1971, Part II).

Traditional approaches to the balance of payments did not explain these and other phenomena of the 1960s. Thus Mundell and Johnson, with the help of graduate students at the University of Chicago, were led to develop an entirely different analytical framework and offer it as a substitute for the traditional approaches. What emerged is a cohesive body of theory that became known as the monetary approach to the balance of payments. The approach has since been embraced by certain segments of the financial press, notably the *Wall Street Journal*. Although the theory, in its modern version, borrows certain features of domestic monetarism and was developed at the University of Chicago, Johnson (1977b, p. 4) disclaims association with the school of "domestic monetarism," led by Milton Friedman.

Professional writings on the new approach expanded by leaps and bounds in the 1970s. Theoretical refinements were accompanied by analysis of the policy implications of the approach, as outlined earlier in this study. Not the least important of these writings have been numerous attempts to subject the monetary approach to empirical tests. These tests will be reviewed in detail in the next four chapters, culminating in an assessment of the degree to which the new approach is supported by the data.

7 EMPIRICAL TESTING OF THE MONETARY APPROACH: INTRODUCTION

Methodology of Surveying the Empirical Literature

Any theory can be judged by the accuracy of its predictions or by the validity of its assumptions. The following survey of empirical studies of the monetary approach covers both types of test. The survey is comprehensive but not exhaustive; certain studies were excluded deliberately. Thus we do not consider tests of propositions relating to domestic monetarism, such as the stability of the demand function for money. We also exclude nonquantitative studies and tests involving historical periods antedating the Bretton Woods system. Further, we ignore tests of global monetarism that involve "world" endogenous variables, where the "world" may be defined as the group of countries considered. We view such testing as premature; it is best undertaken only after the monetary approach can be shown to be relevant to country-specific endogenous variables. Of course, "world" *exogenous* variables are quite appropriate within our framework. On the other hand, the survey includes studies that test the monetary approach even if the authors do not focus on this issue. Finally, even though the PPP theory expresses the global monetarist "law of one price" at the aggregate level and is an integral part of the monetary theory of exchange-rate determination, we do not review here the voluminous literature that tests the PPP theory.

Studies of the predictions of the monetary theory generally test the conventional monetary approach and only occasionally deal with global monetarism. On the other hand, investigations of the assumptions of the monetary approach uniformly pertain to global monetarism: they all test the law of one price in one or more of its manifestations. Salient features of studies that test the predictions of the monetary approach are presented in Table 1. Studies that test the fundamental assumption of global monetarism, the law of one price, are summarized in Table 2. It should be noted that the summary evaluation of the results of each study (the final column of the tables) is based on our own interpretation of the findings, which might be at variance with the author's.

The principal techniques of testing the predictions of the monetary approach to the balance of payments are the formulation and estimation of reserve-flow, capital-flow, exchange-rate, or exchange-market-pressure equations. The conceptual framework of these equations is outlined in the next section. The discussion in Chapters 8 and 9 is organized in accordance with specific predictions of the monetary approach. A given prediction under the monetary theory is compared with the corresponding prediction of the other approaches in order to judge whether a test of the monetarist prediction is capable of discriminating between the monetary approach and alternative theories. Particular attention is paid to the biases and other limitations of the test under consideration. Once the results of all the studies in Table 1 that bear on a given prediction are reviewed, an overall assessment makes it possible to accept or reject the monetarist prediction under consideration. A similar procedure is used in Chapter 10 for reviewing investigations of the law of one price.

Reserve-Flow, Capital-Flow, Exchange-Rate, and Exchange-Market-Pressure Equations

Reserve-flow equations. A major premise of the monetary approach is that, under a fixed exchange rate, changes in a country's reserves are a result of excess demand for or supply of money as a stock. This proposition is tested by what have become known as "reserve-flow equations." A reserve-flow equation is an equation in which the dependent variable is either the level of the country's international reserves (R), the change in reserves (ΔR), or the rate of change in reserves ($\Delta \log R$).[1] Explanatory variables vary from study to study but, in any event, are determinants of the demand for or supply of money. A common version of the equation is derived as follows: The demand for nominal money balances is a function (L) of the price level (P), real income (y), and the interest rate (i). The supply of nominal balances is the product of the money multiplier (m) and the sum of the domestic (D) and international (R) components of the monetary base (B). Money-market equilibrium is maintained within the time span of the unit of observation used in the regression (e.g., for annual observations, the balance-of-payments adjustment to restore money-market equilibrium occurs within one year):[2]

$$L(P, y, i) = m(D + R)\,.$$

Logarithmic differentiation yields the following reserve-flow equation:[3]

$$(R/B)\Delta \log R = a_1 \Delta \log P + b_1 \Delta \log y + c_1 \Delta \log i + d_1 \Delta \log m + e_1 (D/B) \Delta \log D. \tag{7.1}$$

[1] In the first case, the equation is better described as a reserve-*stock* equation. Further transformations of R may also serve as the dependent variable. For example, Connolly and Taylor (1976) use the variable $\Delta(\Delta R/M^s)$, where M^s is the money stock. See also equation (7.1).

[2] Restoration of money-market equilibrium within the period of observation (under the change-in-stock model) is at variance with the theoretical postulate of the monetary approach that adjustment through ΔR takes a lengthy period to complete.

[3] The constant and error terms are omitted from this and subsequent equations.

TABLE 1
TESTS OF THE PREDICTIONS OF THE MONETARY APPROACH

Study	Dependent Variable	Relevant Explanatory Variables	Countries	Number and Frequency of Observations	Time Period	Technique	Results
Reserve-Flow Equation							
Courchene (1973)	ΔR, R/R_{-1}	E or E_{-1}, E^w or E^w_{-1}	15 industrial	10, annual	1958-68	Regression analysis (LS)	Negative
Cheng and Sargen (1975)	$\Delta \log R$	$\Delta \log D$	3 industrial, 5 less developed countries	14-24, annual	1948-73	Regression analysis (LS)	Negative
Bean (1976)	$(R/B)\Delta \log R$	$\Delta \log P$, $\Delta \log y$, $\Delta \log i$ or $\Delta \log i^w$, $\Delta \log m$, $(D/B)\Delta \log D$	Japan	48, quarterly	1959-70	Regression analysis (LS)	Mixed
Connolly and Taylor (1976)	$\Delta \frac{\Delta R^c}{M^s}$	$\frac{\Delta r}{r}$, $\Delta \frac{\Delta D^c}{M^s}$	13 less developed countries plus Finland	18, cross-sectional	1957-72	Regression analysis (LS)	Mixed
Connolly and Taylor (1977)	$\Delta \frac{\Delta R^c}{M^s}$	$\frac{\Delta r}{r}$, $\Delta \frac{\Delta D^c}{M^s}$	13 less developed countries plus 7 developed countries	27, cross-sectional	1957-72	Regression analysis (LS)	Mixed
Courchene and Singh (1976)	ΔR	E, E^w	14 industrial	38, quarterly	1960-69	Regression analysis (LS)	Positive
De Grauwe (1976)	ΔR	ΔD, ΔD_{-1}	7 European industrial	48, quarterly	1959-70	Regression analysis (TS)	Negative
Genberg (1976b)	$(R/B)\Delta \log R$	$\Delta \log M^d - \Delta \log m - (D/B)\Delta \log D$	Sweden	74, quarterly	1950-68	Correlation analysis	Mixed
Guitian (1976)	ΔR	P, $r \cdot P^w$, Y, ΔD	Spain	17, annual	1955-71	Regression analysis (LS)	Mixed
Zecher (1976)	$(R/B)\Delta \log R$	$\Delta \log P$, $\Delta \log y$, $\Delta \log i$, $\Delta \log m$, $(D/B)\Delta \log D$	Australia	19, annual 79, quarterly	1950-71	Regression [illegible]	Mixed
Aghevli and Khan (1977)	$\frac{\Delta R}{R_{-1}}$	$\frac{B}{R}\left[M^d - \frac{\Delta m}{m_{-1}}\right] - \frac{D}{R} \cdot \frac{\Delta D}{D_{-1}}$	39 less developed countries	39, cross-sectional	1957-66	Correlation analysis	Mixed
	$\frac{R}{B} \cdot \frac{\Delta R}{R_{-1}}$	$\frac{\Delta P}{P_{-1}}$, $\frac{\Delta y}{y_{-1}}$, $\frac{\Delta m}{m_{-1}}$, $\frac{D}{B} \cdot \frac{\Delta D}{D_{-1}}$	39 less developed countries	39, cross-sectional	1957-66	Regression analysis (LS)	Mixed
Akhtar, Putnam, and Wilford (1977)	$(R/B)\Delta \log R$	$\Delta \log y$, $\Delta \log i$, $\Delta \log P$, $\Delta \log m$, G/B, T/B, S/B	U.K.	20, annual	1952-71	Regression analysis (LS)	Positive
Cox and Wilford (1977)	$(R/B)\Delta \log R$	$\Delta \log y$ or $(\Delta \log y - \Delta \log y^w)$, $\Delta \log i$, $\Delta \log P$, $\Delta \log m$ or $(\Delta \log m - \Delta \log m^w)$, $\Delta \log M^{sw}$, $(D/B)\Delta \log D$, $(D^w/B^w)\Delta \log D^w$	Canada, Mexico	28, quarterly 21, annual	1963-69, 1954-74	Regression analysis (LS)	Positive
Putnam and Wilford (1977)	$(R/B)\Delta \log R$	$\Delta \log y$, $\Delta \log i$ or $\Delta \log i^w$, $\Delta \log P$ or $\Delta \log P^w$, $\Delta \log m$, $(D/B)\Delta \log D$	U.K. and 7 European industrial countries	20, annual	1952-71	Regression analysis (LS and GS)	Positive
Capital-Flow Equation							
Porter (1972)	SK	$-\Delta RR$	Germany	97, monthly	1963-70	Regression analysis (LS)	Negative
Kouri and Porter (1974)	K	ΔY, Δi^w, CA, ΔD	Australia, Italy, Netherlands	28-44, quarterly	1960-70	Regression analysis (LS)	Mixed
	K or SK	ΔY, Δi^w, CA or $(CA + LK)$, ΔD, $-\Delta RR$	Germany	44, quarterly	1960-70	Regression analysis (LS)	Mixed
Kouri (1975)	K or SK	ΔY, Δi, Δi^w, CA or $(CA + LK)$, ΔD, $-\Delta RR$	Germany	50, quarterly	1960-72	Regression analysis (LS)	Mixed

TABLE 1 (*Continued*)

TESTS OF THE PREDICTIONS OF THE MONETARY APPROACH

Study	*Dependent Variable*	*Relevant Explanatory Variables*	*Countries*	*Number and Frequency of Observations*	*Time Period*	*Technique*	*Results*
Hodjera (1976)	K or SK	ΔY, ΔY_{-1}, Δi^w, Δi^w_{-1}, CA or $(CA+LK)$, CA_{-1} or $(CA+LK)_{-1}$, ΔD, ΔD_{-1}	Austria, France	33-45, quarterly	1960-71	Regression analysis (LS)	Mixed
Neumann (1978)	K or SK	ΔY, Δi, Δi^w, $(CA+\Delta D-\Delta RR)$ or $(CA+\Delta D-\Delta RR+LK)$	Germany	28-50, quarterly	1960-72	Regression analysis (LS)	Mixed
Simultaneous-Equation System							
Argy and Kouri (1974)	K	ΔY, Δi^w, CA, ΔD or $(\Delta D-\Delta RR)$	Italy, Netherlands, Germany	28-30, quarterly	1963-70	Regression analysis (TS)	Mixed
	ΔD or $(\Delta D-\Delta RR)$	K, CA					
Connolly and Taylor (1977)	$\Delta\frac{\Delta D^c}{M^s}$	$\Delta\frac{\Delta R^c}{M^s}$	7 developed countries, 13 less developed countries	10 and 17, cross-sectional	1957-72	Regression analysis (TS)	Negative
Genberg (1976b)	$(R/B)\Delta\log R$	$\log y-\alpha\log y_{-1}$, $\log i-\alpha\log i_{-1}$, $\log P-\alpha\log P_{-1}$, $\Delta\log n$, $(D/B)\Delta\log D$	Sweden	74, quarterly	1950-68	Regression analysis (TS)	Mixed
	$(D/B)\Delta\log D$	$(R/B)\Delta\log R$					
Hodjera (1976)	K or SK	ΔY, ΔY_{-1}, Δi^w, Δi^w_{-1}, CA or $(CA+LK)$, CA_{-1} or $(CA+LK)_{-1}$, ΔD, ΔD_{-1}	France	33, quarterly	1963-71	Regression analysis (TS)	Negative
	ΔD	ΔR, ΔR_{-1}					
Miller and Askin (1976)	R	Y, D	Brazil, Chile	17, annual	1955-71	Regression	Negative
	D	R					
Ujiie (1978)	BP	ΔD, Δy (11-quarter moving average), Δi^w, CAB	Japan	54, quarterly	1959-72	Regression analysis (LS)	Negative
	ΔD	R^*-R_{-1}, $\Delta\log P$, OR, Δy, BP		18-54, quarterly			
Exchange-Rate Equation							
Fry (1976)	$\log r$	$\log M^s$, $\log Y$, $\log P^w$	Afghanistan	18, annual	1955-72	Regression analysis (LS)	Positive
Humphrey and Lawler (1977)	$\log r$	$\log(M^s/M^{sw})$, $\log(y^w/y)$, $\log(i/i^w)$	U.S./Italy, U.S./U.K., and three others	14, quarterly	1973-76	Regression analysis (LS)	Mixed
Knight (1976)	$\log r-\log M^s+\log P^w$	$\log M^{sw}$, $\log y$, $\log y^w$	Canada	42, 18, quarterly	1951-61 1970-74	Regression analysis (3S)	Positive
Bilson (1978a)	$\log r$	$\log M^s$, $\log M^{sw}$, $\log y$, $\log y^w$, $\log r_{-1}$	Germany/U.K.	85, monthly	1970-77	Regression analysis (LS and ME)	Mixed
Bilson (1978b)	$\log r$	$\log M^s$, $\log M^{sw}$, $\log y$, $\log y^w$, $\log r_{-1}$	Germany/U.K.	52, monthly	1972-76	Regression analysis (LS and ME)	Mixed
Blejer (1978)	$\Delta\log r$	$\frac{D}{D+R}\Delta\log D+\Delta\log n-\Delta\log m^d-\Delta\log P^w$, $(\frac{D}{D+R}\Delta\log D+\Delta\log n-\Delta\log M^d-\Delta\log P^w)_{-1}$	Brazil, Chile, Colombia	16-22, annual	1952-73	Regression analysis (LS)	Positive
Frankel (1977)	$\log r$	$\log(M^s/M^{sw})$, $\log(y/y^w)$, $\log[(1+i)/(1+i^w)]$, $\log[(1+i)/(1+i^w)]_{-1}$	Germany/U.S.	36, monthly	1974-77	Regression analysis (LS and IV)	Mixed
Putnam and Woodbury (1977)	$\log r$	$\log(M^s/M^{sw})$, $\log(y/y^w)$, $i-i^w$	U.K./U.S.	20, quarterly 60, monthly	1972-76	Regression analysis (LS)	Mixed

TABLE 1 (*Continued*)
TESTS OF THE PREDICTIONS OF THE MONETARY APPROACH

Study	Dependent Variable	Relevant Explanatory Variables	Countries	Number and Frequency of Observations	Time Period	Technique	Results
Hodrick (1978)	$\log r$	$\log(M^s/M^{sw})$ or $\log M^s$ and $\log M^{sw}$, $\log(y/y^w)$ or $\log y$ and $\log y^w$, $\log(1+i)$, $\log(1+i^w)$	U.S./U.K., U.S./Germany	36, 30, monthly	1972-75	Regression analysis (LS)	Mixed
Putnam and Van Belle (1978)	$\log r$	$\log M^s$, $\log Y$, $\log P^w$	Afghanistan	18, annual	1955-72	Regression analysis (LS)	Mixed
Exchange-Market-Pressure Equation							
Girton and Roper (1977)	$\Delta R/B + \Delta(1/r)/(1/r)$	$\Delta D/B$, $\Delta Y/Y_{-1}$, $(\Delta Y/Y_{-1})_{-1}$, $(\Delta Y/Y_{-1})_{-2}$, $(\Delta Y/Y_{-1})_{-3}$, $\Delta Y^w/Y^w_{-1}$, $(\Delta Y^w/Y^w_{-1})_{-1}$, $(\Delta Y^w/Y^w_{-1})_{-2}$, $(\Delta Y^w/Y^w_{-1})_{-3}$	Canada	23, annual	1952-74	Regression analysis (LS)	Positive
Connolly and da Silveira (1977)	$\Delta R^c/M^s + \Delta(1/r)/(1/r)$	$\Delta D^c/M^s$, $\Delta P^w/P^w_{-1}$ $\Delta y^*/y^*_{-1}$ where $y^* = (y_{-1} + y + y_{+1})/3$	Brazil	14 and 21, annual	1955-75	Regression analysis (LS)	Positive
Sargen (1975)	$\Delta R/B + \Delta(1/r)/(1/r)$	$\Delta D/B$, 8-period distributed lag on $\Delta y/y$ or $\Delta Y/Y$ and on $\Delta y^w/y^w$	Australia, Canada, Germany, Japan, U.K.	42-89, quarterly	1952-75	Regression analysis (LS)	Mixed

LIST OF SYMBOLS:

Variables

B = monetary base ($B \equiv D + R$)
BP = balance of payments (includes ΔR as a component)
CA = current-account balance plus net official capital inflow (excluding change in international reserves)
CAB = current-account balance
D = domestic component of monetary base
D^c = net domestic assets of central bank and commercial banks
E = excess demand for real money balances
G = government expenditure
i = interest rate
K = net private capital inflow ($K \equiv LK + SK$)
LK = net private long-term capital inflow
m = money multiplier ($M^s = m \cdot B$)
m^d = demand for real money balances (from estimated money-demand equation)
M^d = demand for nominal money balances (from estimated money-demand equation)
M^s = money stock ($M^s \equiv D^c + R^c$)
OR = operation ratio (ratio of production index to production-capacity index in manufacturing)
P = price index
r = exchange rate (number of units of domestic currency per unit of foreign currency)
R = international reserves ($\Delta R \equiv CA + K$)
R^* = desired international reserves (5-quarter moving average of R)
R^c = net holdings of international reserves by central bank and commercial banks
ΔRR = policy-induced change in average required reserves of commercial banking system
S = purchases of government securities by the private sector
SK = net private short-term capital inflow
T = government tax revenue
y = real income
Y = nominal income

Subscripts

$-k$ = lagged k periods
$+k$ = led k periods

Superscripts

w = foreign or world variable

Parameters

α = stock-adjustment coefficient

Methods of estimation

GS = generalized least squares
IV = instrumental variables
LS = ordinary least squares
ME = mixed estimation
TS = two-stage least squares
3S = three-stage least squares

TABLE 2

TESTS OF THE LAW OF ONE PRICE

Study	*Dependent Variable*	*Relevant Explanatory Variables*	*Countries*	*Number and Frequency of Observations*	*Time Period*	*Technique*	*Results*
Goods Market							
Genberg (1976a, 1976b)	$C\dot{P}I$	$C\dot{P}I^{w}$	16 OECD	47-254 df, pooled quarterly	1959-70	Analysis of variance	Positive
Genberg (1976b)	$C\dot{P}I$	$C\dot{P}I^{w}$	Sweden	44, quarterly	1959-70	Regression analysis (LS)	Negative
Pattison (1976)	Dispersion of $P\dot{G}NP$		17 OECD	18, annual	1956-73	Inspection of dispersion measures over time	Negative
Genberg (1977)	CPI, $C\dot{P}I$	Principal components	21 industrial	420, 1344, pooled quarterly	1955-70	Principal components analysis	Positive
Isard (1977)	$r \cdot WPI^{G}/WPI^{US}$, $r \cdot XPI^{G}/XPI^{US}$ (individual commodity groups)	r	United States, trading with Germany	32, quarterly 6, annual	1968-75	Inspection of time series	Negative
	IUV/XUV (individual commodity groups)	r	United States, trading with Canada, Germany, Japan	29, quarterly	1968-75	Regression analysis (LS)	Mixed
Kravis and Lipsey (1971, 1977)	PL (individual commodity groups)	PL^{US}	Germany, Japan, United Kingdom	6, annual	1953-64	Calculation of purchasing power parity	Negative
Kravis and Lipsey (1977)	XPI, WPI (machinery & equipment)	WPI^{UK}, WPI^{UK}_{-1}	United States	21, annual	1954-74	Regression analysis (LS)	Negative
	XPI, WPI (manufacturing)	WPI^{US}, WPI^{US}_{-1}	Germany				
Richardson (1978)	$\log(SPI/SPI_{-24}) - \log(SPI_{-1}/SPI_{-25})$ (individual commodity groups)	$\log(SPI^{US}/SPI^{US}_{-24}) - \log(SPI^{US}_{-1}/SPI^{US}_{-25})$, $\log(r/r_{-24}) - \log(r_{-1}/r_{-25})$	Canada	72-114, monthly	1965-74	Regression analysis (LS)	Negative
Bond Market							
Cooper (1971)	Dispersion of iS, iL		10 industrial	6, annual	1958-68	Inspection of dispersion measures over time	Mixed
Argy and Hodjera (1973)	Dispersion of iS		10 industrial	14, annual	1958-71	Inspection of dispersion measures over time	Mixed
	$(iE - iS)/iE$, $(iS^{US} - iS)/iS^{US}$	Trend	10 industrial	14, annual	1958-71	Regression analysis (LS)	Mixed
	iS, ΔiS	iS^{US} or iE, ΔiS^{US} or ΔiE	9 industrial	56, quarterly	1958-71	Correlation analysis	Mixed
Bisignano (1975)	ΔiS	ΔiS^{US} or ΔiE	7 industrial	60, quarterly	1959-73	Correlation analysis	Mixed
Laffer (1975)	iS	iS^{US} or iE	Canada, U.K.	146, monthly	1964-74	Correlation analysis	Mixed
Equity Market							
Agmon (1972)	$P\dot{E}QD$	$P\dot{E}Q^{US}$	Germany, Japan, U.K.	55-78, monthly	1955-66	Regression analysis (LS)	Mixed
	$P\dot{E}QD$	$P\dot{E}Q^{US}_{-3}$, $P\dot{E}Q^{US}_{-2}$, $P\dot{E}Q^{US}_{-1}$, $P\dot{E}Q^{US}$, $P\dot{E}Q^{US}_{+1}$, $P\dot{E}Q^{US}_{+2}$, $P\dot{E}Q^{US}_{+3}$	Germany, Japan, U.K.	about 130, monthly	1955-66	Regression analysis (LS)	Positive

TABLE 2 (*Continued*)
TESTS OF THE LAW OF ONE PRICE

Study	*Dependent Variable*	*Relevant Explanatory Variables*	*Countries*	*Number and Frequency of Observations*	*Time Period*	*Technique*	*Results*
Laffer (1975)	$\dot{PEQ}$		Canada, France, Germany, Italy, Japan, U.K., U.S.	204, monthly	1957-73	Correlation analysis	Mixed
Genberg (1976b)	$\dot{PEQD}$	$\dot{PEQ}^{US}$, $\dot{PEQD}^{G}$	Germany, Sweden	about 135, monthly	1959-70 (apparently)	Regression analysis (LS)	Mixed

LIST OF SYMBOLS:

Variables

- CPI = consumer price index
- iE = Eurodollar rate
- iL = long-term interest rate
- iS = short-term interest rate
- IUV = unit-value index of imports
- PEQ = stock-market price index
- $PEQD$ = stock-market price index converted to dollars
- $PGNP$ = GNP deflator
- PL = price level
- r = exchange rate (number of units of domestic currency per unit of foreign currency)
- SPI = industry selling price index
- WPI = wholesale price index
- XPI = export price index
- XUV = unit-value index of exports

Dotted variable: denotes rate of change

Subscripts

- $-k$ = lagged k periods
- $+k$ = led k periods

Superscripts

- G = Germany
- UK = United Kingdom
- US = United States
- w = world

Estimation

- df = degrees of freedom
- LS = ordinary least squares

In equation (7.1), the dependent variable is the rate of change of the monetary base induced by the rate of change in reserves, while the last explanatory variable is the rate of change of the monetary base attendant upon the rate of change of its domestic (i.e., autonomous) component. Changes in prices, real income, the interest rate, and the money multiplier are the other independent variables. This equation will be referred to as the "standard reserve-flow equation."

Capital-flow equations. A variant of the reserve-flow equation is proposed by those who argue, in effect, that the dependent variable in the equation is wrongly specified as the change in reserves (ΔR). In accordance with the balance-of-payments identity, ΔR is the algebraic sum of all other transactions in the balance of payments, in particular, (a) the balance on current account, (b) the net inflow of official capital (other than international reserves), and (c) the net inflow of private capital, where in (b) and (c) "capital" incorporates unilateral transactions. For the authors embracing this variant, the only balance-of-payments transaction induced by an excess demand for money is an inflow of private capital, while an excess supply of money induces an outflow. It follows that an exogenous shift in the demand for or supply of money has no effect on (a) or (b); hence the only balance-of-payments transaction induced is a private capital flow.[4]

Letting CA denote the sum of the current-account balance and the net flow of official capital (excluding international reserves) and K denote the net private capital inflow, the balance-of-payments identity is $\Delta R \equiv CA + K$; K replaces ΔR as the dependent variable in the reserve-flow equation, which we will now call a "capital-flow equation." In other words, private capital flows constitute the dependent variable in this equation. What are the explanatory variables? As in the conventional reserve-flow equation, the independent variables are the determinants of the demand for and supply of money. Regarding the demand for money, these authors select the change in nominal income (ΔY) and the change in the world interest rate (Δi^{w}), generally represented by the Eurodollar rate, as explanatory variables. Because the income variable is in nominal rather than real terms (unlike the standard reserve-flow equation), the price level does not appear as a distinct explanatory variable. Also, since the capital-flow equation is a reduced form, the domestic interest rate does not enter the equation (see below).

[4] Thus, unlike most monetarists, these authors take a stand regarding the *composition* of the balance-of-payments surplus or deficit generated by an excess demand for or excess supply of money. The surplus or deficit is confined to the private capital account, while the current account—together with official capital exclusive of international reserves—is viewed as the autonomous component of the balance of payments. This approach originated with Kouri and Porter (1974).

To represent the supply side of the money market, the variables ΔD and CA are used. If ΔD is the policy-induced change in the domestic component of the monetary base, then the current-account balance (extended to include nonfinancing official capital flows) is viewed as the autonomous source of a change in the international component of the monetary base, for a positive current-account balance involves a reserve inflow, and a negative balance an outflow. Sometimes ΔD is adjusted for any change in the required reserves of commercial banks (ΔRR) induced by a central-bank change in required reserve ratios, with reductions in the amount of required reserves increasing ΔD and increases decreasing ΔD.[5] Alternatively, $-\Delta RR$ and the unadjusted ΔD may enter the equation as separate variables. So the "standard capital-flow equation" is

$$K = a_2\Delta Y + b_2\Delta i^w + c_2CA + d_2\Delta D - e_2\Delta RR\ . \tag{7.2}$$

Equation (7.2) can be derived as a reduced-form equation from a simultaneous-equation model of portfolio-balancing behavior. This is the approach followed by Kouri and Porter (1974), the originators of this capital-flow equation. They postulate a system with three financial assets: the domestic monetary base (the money multiplier is assumed equal to unity), domestic bonds, and foreign bonds. These give rise to three domestic demand functions and one foreign demand function, that for domestic bonds. Each country's demand for the other country's bonds is formulated as a net demand function. All demands depend on domestic and foreign interest rates, exogenous risk factors, and the demander's nominal wealth and income. There are two market-equilibrium conditions—for base money and domestic bonds (the third condition follows from the wealth constraint)—and identities for the monetary base, balance of payments, net capital inflow, and domestic wealth. With the exception of the foreign demand for domestic bonds, all foreign variables are exogenous.

The model reduces to two reduced-form equations—one for the change in the domestic interest rate, the other for the net capital flow. This is advantageous for estimating purposes; the problem of simultaneity between the domestic interest rate and the capital flow (the latter a component of the change in reserves) in equation (7.1) is thereby avoided. The wealth and foreign-income variables are dropped from the reduced-form equation for the net capital flow, yielding equation (7.2).

[5] To obtain the adjusted ΔD variable, the original ΔD is increased by $-\Delta RR$, where ΔRR is the product of (a) the change in the required reserve ratio and (b) commercial banks' deposit liabilities subject to reserve requirements. Of course, this adjustment to ΔD may also be used in a reserve-flow equation, as by De Grauwe (1976). In general, $-\Delta RR$ may be viewed as the policy-induced change in required reserves of the commercial banking system. The most refined measure of ΔRR is provided by Neumann (1978).

Exchange-rate equations. The reserve-flow and capital-flow equations are used to test propositions of the monetary approach under a pegged exchange rate. With a floating exchange rate, these equations give way to an "exchange-rate equation" in which the dependent variable is the exchange rate (r), defined as the domestic-currency price of foreign exchange. The most important explanatory variable is the ratio of the domestic to the foreign nominal money supply (M^s/M^{sw}), where both numerator and denominator are under the control of the respective monetary authorities. Other appropriate explanatory variables are the ratios of domestic to foreign real income (y/y^w) and of the domestic to foreign interest rate (i/i^w). Generally, all variables are expressed in logarithms, so that the "standard exchange-rate equation" is

$$\log r = a_3\log(M^s/M^{sw}) - b_3\log(y/y^w) - c_3\log(i/i^w)\ . \tag{7.3}$$

Equation (7.3) can be derived as follows. Consider the following nominal money demand function for a given country:

$$M^d = kPyi^e\ , \tag{7.3a}$$

in which e is the interest elasticity of the demand for money and k is a constant. A similar function pertains to a second country or the rest of the world. Denoting foreign variables and parameters with the superscript w and assuming that the elasticity e is the same at home and abroad, the foreign demand-for-money function is

$$M^{dw} = k^wP^wy^wi^{we}\ . \tag{7.3b}$$

There is money-market equilibrium at home and abroad:

$$M^d = M^s \qquad M^{dw} = M^{sw}\ . \tag{7.3c}$$

The exchange rate enters the model via the law of one price in the form of the PPP relationship:

$$P = rP^w\ . \tag{7.3d}$$

Substituting (7.3a) to (7.3c) into (7.3d) and taking logarithms, equation (7.3) is obtained.

We offer the above derivation as a substitute for the one in the literature, as presented in Chapter 5. Because equation (7.3) is the logarithmic equivalent of equation (5.5), the coefficients a_3, b_3, and c_3 are all expected to be unity. The presentation differs from that in Chapter 5 in two respects. First, money-market equilibrium is stated in nominal rather than real terms. Second, no specific mechanism is imposed to attain money-market equilibrium, apart from demand equaling supply. In this respect, the theory is analogous to the fixed-rate case.

Equation (7.3) may be extended by incorporating an explanatory variable representing the differential inflationary expectations at home and abroad. In Chapter 5, we discussed inflationary expectations from a purely theoretical standpoint. In what follows, we show how these expectations have been measured in empirical studies. Letting π denote expected inflation, the domestic/foreign expected-inflation differential is $\pi - \pi^w$. Several authors have developed the exchange-rate equation in this direction, but with diverse proxy variables to represent the unobserved $\pi - \pi^w$. One such approach is taken by Humphrey and Lawler (1977) and by Putnam and Woodbury (1977). The nominal interest rate (i) has two components: the real interest rate (defined residually), denoted as i^r, and the expected inflation rate. In symbols:

$$i = i^r + \pi \qquad i^w = i^{rw} + \pi^w . \tag{7.3e}$$

The global-monetarist law of one interest rate is then invoked to equalize real interest rates across the world, $i^r = i^{rw}$. Thus, the nominal interest-rate differential $i - i^w$ serves as a proxy variable for $\pi - \pi^w$. In this usage, there is no operational distinction between the resulting reduced-form equation and the standard exchange-rate equation (7.3), where no account is taken of inflationary expectations. However, there is a difference in the operative mechanism of the postulated negative effect of the interest-rate differential on the exchange value of the domestic currency: In the "pure" monetary theory of exchange-rate determination (where expectations play no role), an increase in $i - i^w$ involves a higher opportunity cost of holding money *rather than bonds* for domestic residents than for foreign residents. Under the assumption that the interest elasticity of the demand for money is the same worldwide, domestic residents engage more heavily in switching from money to bonds than do foreign residents. Therefore, there is a greater reduction in the demand for domestic money than for foreign money. The result is an incipient balance-of-payments deficit for the home country and a consequent depreciation of its currency. In the case where $i - i^w$ proxies $\pi - \pi^w$, an increase in the former variable represents an expectation of greater inflation at home than abroad. This increases the opportunity cost of holding money *rather than goods* for domestic residents over foreign residents. There is now greater switching from money to *goods* at home than abroad. The result, as before, is a greater reduction in the demand for domestic money than for foreign money and a depreciation of the domestic currency in the foreign-exchange market. In sum, the use of the nominal-interest-rate differential alone in the equation does not distinguish between the opportunity cost of holding money versus bonds and the influence of inflationary expectations.

An alternative measure of inflationary expectations is offered by Frenkel (1976b). In his study of the German hyperinflation of the 1920s, he uses the forward premium on foreign exchange to represent the domestic/foreign expected-inflation differential. The forward premium is $(r^f - r^s)/r^s$, where r^f is the forward and r^s the spot exchange rate, both defined as the price of foreign exchange in domestic currency. Suppose that the law of one interest rate is extended to take account of the existence of a forward as well as a spot exchange rate. Then the "law" becomes the interest-rate-parity theory:

$$(r^f - r^s)/r^s = i - i^w . \tag{7.3f}$$

Thus, under the interest-rate-parity theory, which is a global-monetarist proposition, the forward premium is equal to the nominal-interest-rate differential. Then the above discussion of proxying $\pi - \pi^w$ by the nominal-interest-rate differential applies to proxying it by the forward premium as well.[6] In fact, Bilson (1978a) explicitly uses the forward premium as a proxy for the nominal-interest-rate differential, where the latter is, in turn, the proxy for the expected-inflation differential.

The proxy variables employed by Frankel (1977) to represent the expected-inflation differential are past inflation differentials and long-term interest-rate differentials. Although Frankel's reduced-form equation is a simple extension of the monetarist equation (7.3) to include an expected-inflation variable, his *theory* involves a postulated positive rather than negative influence of the nominal-interest-rate differential ($i - i^w$) on the exchange value of the domestic currency. The reason for this contra-monetarist effect is that Frankel's model involves a positive influence of the *real* interest-rate differential ($i^r - i^{rw}$) on the exchange value of the domestic currency. From (7.3e),

$$i^r - i^{rw} = (i - i^w) - (\pi - \pi^w) .$$

Thus the expected-inflation differential has the normal monetarist and nonmonetarist negative effect on the exchange value of the domestic currency: anticipated inflation erodes the value of a country's currency in the exchange market. But the nominal-interest-rate differential has the *positive* effect that is predicted by the income-absorption approach, using quite a different model, but denied by the monetarists.

In sum, it is clear that inflationary expectations play an important role in exchange-rate determination. However, development of appropriate proxy measures of these expectations is still at an early stage.

We now turn to the relationship between the estimating equation for testing the PPP theory and that for testing the monetary theory of

[6] It should be noted that, from a nonmonetarist standpoint, there are several reasons for divergences from interest-rate parity, i.e., reasons why equation (7.3f) does not hold. For a survey of this literature, see Officer and Willett (1970).

exchange-rate determination, equation (7.3). The PPP theory asserts that the equilibrium exchange rate is primarily determined by the ratio of the domestic to the foreign price level or price index. Equation (7.3d), with no other explanatory variable and no error term, is the strictest possible form of that theory.

The PPP theory can be tested empirically by means of an estimating equation in which the exchange rate is the dependent variable and the domestic/foreign price ratio the principal explanatory variable.[7] In contrast, it would be inappropriate to include the domestic/foreign price ratio as an explanatory variable in testing the monetary approach to exchange-rate determination. To the monetarists, the domestic/foreign price ratio is the vehicle through which the explanatory variables have their effect on the exchange rate. Equation (7.3d) is a simplified structural equation for the proponents of PPP; it is merely a means of obtaining the reduced-form equation (7.3) for the monetarists.

Exchange-market-pressure equations. In an impressive extension of the aforementioned monetary models, Girton and Roper (1977) derive an equation that integrates the reserve-flow and exchange-market equations. Their resulting "exchange-market-pressure equation" has as the dependent variable the sum of (a) the change in reserves as a percentage of the monetary base and (b) the rate of appreciation of the domestic currency. The equation is therefore usable for periods encompassing fixed rates, freely fluctuating rates, and managed floats.

Elements of the Girton and Roper model are the monetary-base identity, an exponential demand-for-monetary-base function, and an equation that makes changes in the foreign component of the monetary base the product of the prevailing exchange rate and changes in official reserves. Unlike the case of the standard exchange-rate equation, the PPP theory is not a necessary ingredient for the model. Using very clever but involved definition and manipulation of variables, the authors demonstrate, in effect, that their model is superior to the three other approaches—the reserve-flow, capital-flow, and exchange-rate equations—in two important respects. It applies not only to various exchange-rate regimes but also to the case in which the reserve-currency country is one of the countries considered in a two-country model. In such a situation, the authors derive the following exchange-market-pressure equation for the non–reserve-currency country:

$$[\Delta R/B + \Delta(1/r)/(1/r)] = a_4(\Delta D/B) + b_4(\Delta B^w/B^w) + c_4(\Delta y/y) + d_4(\Delta y^w/y^w)\,, \qquad (7.4)$$

[7] For a survey of the empirical testing of the PPP theory, see Officer (1976).

where variables with superscript w pertain to the reserve-currency country.

Tests of the predictive power of the monetary approach conveniently fall into two categories: (a) predictions of the effects of the supply of money or of determinants of this supply on the balance of payments or the exchange rate and (b) analogous predictions relating to the demand for money or its determinants. Under category (a) are predictions of the values of the "offset" and "sterilization" coefficients and predictions of the effects of changes in the money multiplier or the money supply on the balance of payments or exchange rate. These are reviewed in Chapter 8. Under category (b) are analogous predictions of the effects of the demand for money and of changes in income, the price level, or the interest rate. These are reviewed in Chapter 9. The studies that test a given prediction of the monetary approach can be identified from the first, second, and third columns of Table 1. The remaining columns present detailed information on the studies (countries examined, time period, etc.).

8 PREDICTIONS OF THE EFFECTS OF THE SUPPLY OF MONEY OR ITS DETERMINANTS

Offset Coefficient

Concept of the offset coefficient. Crucial to the monetary approach is the theory that a balance-of-payments surplus or deficit reflects an excess demand for or supply of money. This theory implies that, for a given amount of money demanded and a given money multiplier, changes in the domestic component of the monetary base (D) will cause opposite and equal changes in international reserves (R).

Consider a reserve-flow equation in which ΔR is explained by ΔD and other variables (representing the given factors). The coefficient on ΔD is known as the "offset coefficient." It shows the degree to which changes in the domestic component of the monetary base are offset by changes in the international component. The monetary approach postulates that under a fixed exchange rate the change in international reserves induced by a change in the domestic component of the monetary base is equal in magnitude but opposite in sign. The expected value of the offset coefficient is therefore -1, and monetary policy is completely neutralized by the balance of payments. In contrast, if the balance of payments provides no offset at all to monetary policy, a coefficient of 0 would result.[1]

The income/absorption theory of balance-of-payments adjustment postulates that an increase in the money supply or its growth rate, other things being equal, worsens the balance of payments, but not sufficiently to cancel completely the initiating change in the money supply. The mechanism is as follows: An increase in the money supply, caused by an increase in the domestic component of the monetary base, raises income. The rise in income is reflected only partially in an increased demand for imports of goods and services, since the marginal propensity to import is positive but less than unity. Therefore, the current account deteriorates. Furthermore, the rise in the money supply lowers domestic interest rates relative to foreign rates, producing a portfolio capital outflow. The outcome is a net deterioration in the balance of payments. But the values of the relevant propensities and elasticities are such that an initial increase in the monetary base is only partly counteracted by a reserve outflow,

[1] Although discussion here is in terms of ΔR and ΔD, the comments on the value of the offset coefficient apply irrespective of the expressions for R and D, so long as these variables are identically transformed, e.g., R and D, $(R/B)\Delta \log R$ and $(D/B)\Delta \log D$, $\Delta(\Delta R/M^s)$ and $\Delta(\Delta D/M^s)$. The comments are applicable to $\Delta \log R$ and $\Delta \log D$ provided R and D are equal initially.

thus retaining a net positive change in the monetary base and hence in the money supply.

According to the nonmonetarist analysis, therefore, an initiating change in D results in an opposite but smaller movement in R. In monetarist terms, the offset coefficient is predicted to be negative but with an absolute value below unity: complete offsetting is not expected. Thus a negative estimate of the offset coefficient does not by itself distinguish the monetary from the standard income/absorption approach to the balance of payments; only an estimate of -1 can make the distinction.

It can be argued that if (a) a long enough period is allowed to elapse (a very long period indeed—longer even than that envisaged by proponents of the monetary approach), (b) sterilization is totally absent or ineffective over this time period, and (c) the Keynesian (flow) rather than portfolio (stock) approach to capital movements is applicable, then the offset coefficient would be unity even under the income/absorption approach. But, even aside from the fact that the traditional theory is not concerned with so long a run, assumptions (b) and (c) stretch the theory beyond the usual expositions.

In the standard capital-flow equation, there are three offset coefficients, two pertaining to the domestic component of the monetary base (ΔD and $-\Delta RR$, which may be combined as one variable), the third pertaining to the current-account balance (CA). In this model, private capital is the only balance-of-payments flow responsive to an excess demand for or excess supply of money. Therefore, the monetary approach predicts that the change in the monetary base effected by private capital flows (the induced change in reserves) completely offsets the change in the autonomous components of the monetary base, whether in the policy component (ΔD) or the balance-of-payments component (CA, constituting the autonomous change in reserves). Thus the monetary approach predicts a value of -1 for each offset coefficient.

Under the assumption of an autonomous current account, adherents of the income/absorption approach would expect a capital-account, and therefore a reserve, outflow if there is either an increase in ΔD or a positive current-account balance, and an inflow if there is either a decrease in ΔD or a negative current-account balance. The latter are sources of exogenous changes in the monetary base, and the values of parameters are again expected to be such that the reserve flow is less than the originating change in the monetary base. (The effect would now be exclusively via a change in the domestic/foreign interest-rate differential). Thus the nonmonetarist prediction is always a negative offset coefficient, but one below unity in absolute value.

In sum, it is the value of the offset coefficients rather than their sign that provides a discriminating test between the monetary and the other approaches.

Biases in estimating offset coefficients. Consider an equation in which ΔD is a function of ΔR and other variables. The stated variables have reversed their causal roles, so that ΔD is the dependent variable and ΔR an explanatory variable. The coefficient on ΔR is called the "sterilization coefficient." It measures the use of monetary policy to sterilize the impact of reserve flows on the monetary base. Under complete sterilization, this coefficient would be -1. However, the monetary approach assumes that no sterilization at all takes place and therefore postulates a 0 value for the sterilization coefficient—precisely the reverse of the forecast for the offset coefficient. Consequently, the use of ordinary least squares (LS) to estimate either an offset or a sterilization coefficient will involve a simultaneous-equation bias unless the true value of the other coefficient happens to be 0. It can be shown that the existence of sterilization biases the LS estimate of the offset coefficient in an upward direction in absolute value, that is, toward (or even beyond) -1 rather than 0.[2] This criticism applies in full whether the offset coefficients are estimated in the capital-flow or the reserve-flow equation.

Even in the absence of sterilization, a simultaneous-equation problem arises in using ΔD as an explanatory variable in the reserve-flow or capital-flow equation, because certain identities involving ΔD and the dependent variable are ignored in LS estimation. In the case of the reserve-flow equation, the "monetary-base identity," $\Delta R \equiv \Delta B - \Delta D$ is relevant. (Recall that ΔB is the change in the monetary base.) What does this identity imply? By definition, a change in D results in an opposite change in R of the same amount, unless the monetary base increases or decreases. Therefore, the monetary-base identity causes the LS estimation to bias the offset coefficient toward unity from either direction—not merely in an upward direction as under sterilization. Also, the algebraic t value of the offset coefficient is biased in an upward direction, so that the statistical significance of the offset coefficient is overstated.[3]

In the case of the capital-flow equation, the balance-of-payments identity is also relevant and two (or possibly three) offset coefficients are involved. The identities $\Delta B \equiv \Delta D + \Delta R$ and $\Delta R \equiv K + CA$ imply a third identity, namely, $K \equiv \Delta B - CA - \Delta D$. By definition, a positive balance on current account or an increase in D results in a capital outflow of

[2] This result of econometric theory is demonstrated rigorously by Kouri and Porter (1974, pp. 453-454). For an intuitive proof, see Magee (1976, p. 165).

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the same amount, while a negative balance or a decrease in D results in an inflow of the same amount, except to the extent that the monetary base increases or decreases. Consequently, LS estimation of the capital-flow equation biases *both* offset coefficients toward unity (from either direction) and overstates the statistical significance of these coefficients.[4]

Taken together, *the simultaneous-equation problems emanating from sterilization and the monetary-base/balance-of-payments identity bias a test of any offset coefficient in favor of the monetarist prediction of -1.* The appropriate solution to these problems is to use a method like two-stage least squares (TS) that leads to consistent estimates. Unfortunately, in the empirical studies to date, only the simultaneity due to sterilization has been so corrected.[5]

Another source of bias in estimating offset coefficients arises from the fact that the loss of reserves arising from a country's expansionary monetary policy (represented by a positive ΔD) must flow to other countries. Therefore, a country's change in reserves is influenced not only by its own ΔD variable, with a negative (and presumed unitary) coefficient, but also by the ΔD variables of each of its trade and payments partners, with positive coefficients. Accordingly, the ΔD for each of the latter countries should enter the reserve-flow or capital-flow equation of the domestic country—and as separate variables, because they are likely to have differential effects on the change in reserves of the domestic country.[6]

In empirical studies, reserve-flow equations almost invariably omit foreign ΔD variables, perhaps in an effort to avoid multicollinearity or the loss of degrees of freedom. But then the estimate of the offset coefficient is biased because of a specification error of omitted variables. It can be shown that the direction of this bias is downward in absolute value.[7] In

[4] This bias is noted by Fratianni (1977), but he refers only to the coefficient of ΔD. Fratianni may be consulted for several other criticisms of the capital-flow equation from a theoretical standpoint.

[5] A distinctive feature of the Porter (1972) capital-flow equation is the fact that $-\Delta RR$—the only monetary-policy variable in the equation—is in effect a predetermined variable, because changes in reserve requirements in Germany, the country examined, are instituted at the beginning of the month. Therefore, the study does not suffer from the sterilization-induced simultaneous-equation bias. Unfortunately, a monthly model is required in order to solve the bias in this manner, which means that variables available at best quarterly—such as national income—cannot be entered in the equation. Furthermore, inclusion of a complete measure of the change in the domestic component of the monetary base, by incorporating ΔD in the equation, would vitiate the solution to the simultaneous-equation problem, as open-market operations of the central bank follow no such periodic timing.

[6] Of course, in the case of the capital-flow equation, the same argument is applicable also to reserve changes emanating from current-account deficits or surpluses.

[7] This proposition is proved by De Grauwe (1975, 1976) and rests on the assumption that the ΔDs of the various countries are positively correlated. De Grauwe argues that such positive correlation is to be expected, because in a world of inflation and growth the domestic

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In empirical studies, reserve-flow equations almost invariably omit foreign ΔD variables, perhaps in an effort to avoid multicollinearity or the loss of degrees of freedom. But then the estimate of the offset coefficient is biased because of a specification error of omitted variables. It can be shown that the direction of this bias is downward in absolute value.[7] In

[4] This bias is noted by Fratianni (1977), but he refers only to the coefficient of ΔD. Fratianni may be consulted for several other criticisms of the capital-flow equation from a theoretical standpoint.

[5] A distinctive feature of the Porter (1972) capital-flow equation is the fact that $-\Delta RR$—the only monetary-policy variable in the equation—is in effect a predetermined variable, because changes in reserve requirements in Germany, the country examined, are instituted at the beginning of the month. Therefore, the study does not suffer from the sterilization-induced simultaneous-equation bias. Unfortunately, a monthly model is required in order to solve the bias in this manner, which means that variables available at best quarterly—such as national income—cannot be entered in the equation. Furthermore, inclusion of a complete measure of the change in the domestic component of the monetary base, by incorporating ΔD in the equation, would vitiate the solution to the simultaneous-equation problem, as open-market operations of the central bank follow no such periodic timing.

[6] Of course, in the case of the capital-flow equation, the same argument is applicable also to reserve changes emanating from current-account deficits or surpluses.

[7] This proposition is proved by De Grauwe (1975, 1976) and rests on the assumption that the ΔDs of the various countries are positively correlated. De Grauwe argues that such positive correlation is to be expected, because in a world of inflation and growth the domestic

other words, the omitted ΔD variables of other countries bias the offset coefficient toward 0 rather than -1—in the opposite direction from the bias introduced by sterilization.

A solution to this specification error would be to use a proxy variable for the omitted ΔD variables of other countries. A world interest rate, such as the Eurodollar rate, could serve as such a proxy, as an indicator of foreign monetary policies, but this measure is inadequate in several respects.[8] An alternative proxy variable would be a weighted average of foreign ΔDs, the weights being proportional to the foreign countries' shares in the domestic country's international trade and payments. Of course, the ΔD variables would have to be converted to a common currency. A third possible proxy variable would be the change in world reserves, in accordance with the hypothesis—consistent with global monetarism—that the change in the world money supply or monetary base is proportional to the change in world reserves. The change in world reserves is introduced as an explanatory variable by some who use reserve-flow equations, but without the justification suggested here. The optimal solution to the problem of omitted variables is to estimate, simultaneously for n countries, the $n \times n$ matrix of offset coefficients (d_{ij}), where i and j denote countries and d_{ij} is the effect of ΔD_j on ΔR_i. The monetary approach predicts $d_{ij} = -1$ for $i = j$ and $d_{ij} \geq 0$ for $i \neq j$.[9]

Results of estimating offset coefficients. How can one assess whether a statistical estimate of an offset coefficient, or any coefficient, is consistent with the monetarist prediction? A point estimate of the predicted value—in this case, -1—is too harsh a criterion, for there is zero probability that an estimated coefficient would take on any particular value. Many authors therefore adopt the position that the monetarist prediction is validated as long as the estimated coefficient is (a) statistically significant, that is, significantly different from 0, and (b) not significantly different from the theoretically expected value (in this case, -1). This rule is too favorable to the monetary approach; an imprecise estimate could be statistically significant while not significantly different from a wide range of values, including -1. We would suggest that a third criterion be included in the assessment: (c) considered as a point estimate, the coefficient is close to the predicted value. Using the three criteria together in the case of the offset coefficient, acceptance of the monetarist hypothesis

component of the monetary base is likely to be increasing in every country. This presumption is confirmed by De Grauwe's calculation of the correlation matrix of the ΔDs for seven European countries.

[8] These inadequacies are pointed out by De Grauwe (1975, p. 1079).

[9] Such a multicountry model is formulated and discussed by De Grauwe (1976) but not estimated.

might require that the estimated coefficient be significantly different from, say, -0.80 or -0.90, while not being significantly different from -1.[10]

The problem is that the hypothesis testing of classical statistics may be incapable of discriminating between the monetary and nonmonetary theories. Letting β be the parameter of interest, in this case the offset coefficient, consider the monetarist hypothesis that $\beta = -1$ versus the alternative and nonmonetarist hypothesis that $0 > \beta > -1$. If the monetarist hypothesis cannot be rejected, it is likely that the nonmonetarist hypothesis also cannot be rejected. So the test does not discriminate between the monetarist and nonmonetarist alternatives. We might emphasize that *no* economist, to our knowledge, has stated the belief that β is 0.

What offset coefficients were obtained from LS estimation? Nineteen studies covering a large number and variety of countries test for the offset coefficient on ΔD (or some other transformation of D) or on $-\Delta RR$. Of these studies, four (Akhtar, Putnam, and Wilford, 1977; Cox and Wilford, 1977; Girton and Roper, 1977; and Connolly and da Silveira, 1977) are clearly favorable to the monetary position, obtaining offset coefficients that are significant and close to -1. The first two studies involve reserve-flow equations and the latter two exchange-market-pressure equations.

The generality of the results of these four studies might be questioned. In particular, the Girton and Roper result should be interpreted in the context of their particular study. These authors estimate their equation only for Canada and strictly in relation to the United States. Given the openness of the Canadian economy vis-à-vis the United States, especially regarding the capital market, the Girton and Roper result is not surprising. Indeed, Sargen (1975) finds that the model does not test successfully for developed countries beyond Canada. While he obtains offset coefficients significant and close to -1 for 2 of 4 additional countries examined, in 3 of these countries all other explanatory variables in the exchange-market-pressure equation are nonsignificant or have the wrong sign, and, in the fourth country, all but one other variable are nonsignificant or have the wrong sign.

In a similar vein, Cox and Wilford confine themselves to Canada, again, and Mexico, both of which are highly dependent economically on the United States. Finally, the Akhtar, Putnam, and Wilford study is unique among all the studies surveyed in specifying fiscal-policy "offset variables"—government spending, tax revenue, and sales of government

[10] Throughout the survey, we use the term "significant" to mean at the 5 per cent level.

securities to the private sector, all deflated by the monetary base—rather than the usual monetary-policy variable, a transformation of ΔD. The authors do state, however, that if domestic credit is substituted for the five variables, "essentially the same results" are obtained. Their estimated offset coefficients are all on the order of 0.90 in absolute value. It is conceivable, however, that the exchange-market-pressure model is more appropriate for less developed countries. Certainly, Connolly and da Silveira obtain good results for Brazil.

Three other studies (Guitian, 1976; Zecher, 1976; and Putnam and Wilford, 1977) yield results partially favorable to the monetary approach. About half their point estimates of the offset coefficient are within 10 per cent of -1. Except for the Porter (1972) equation (which does *not* yield results favorable to the monetary theory), it is known that simultaneity problems bias the estimated offset coefficients toward -1, but even so the monetarist prediction receives little additional support in the 12 remaining studies that use LS as the method of estimation.

Five studies use two-stage least squares (TS) to correct the bias due to sterilization. Of these, one (Genberg, 1976b) yields results about half of which are favorable to monetarism; two others (Argy and Kouri, 1974, and De Grauwe, 1976) provide support for the monetarist position in only a minority of the equations estimated.

In sum, the clear majority of estimates result in offset coefficients that are negative and statistically significant but distinctly below unity in absolute value. These findings favor the income/absorption theory over the monetary approach.

In view of the inadequacies of the conventional statistical tests of significance, we have adopted criterion (c) in the form of a point estimate within 10 per cent of the theoretically expected value. This criterion is suggested as a complement to, rather than a substitute for, the usual tests of statistical significance, criteria (a) and (b). Apart from tests of statistical significance, it is just not possible to overlook the estimated *size* of the offset coefficient. By any reasonable standard, the point estimate of this parameter should approximate -1. We have chosen an absolute value of 0.90 to represent the lower limit of closeness to unity. While we acknowledge that this number is necessarily arbitrary, most results that we do not consider supportive of the monetary approach actually fall below—in some cases, far below—that level. For example, out of a total of 23 studies that estimate offset coefficients, with results either favorable or unfavorable to the monetary approach, in 12 studies at least half the estimates are even below 0.80 in absolute value. Indeed, a figure as low as -0.16 has been estimated for Japan (Ujiie, 1978). And all the offset coefficients that Neumann (1978) estimates for Germany are below 0.80, with many well

below that threshold. His preferred offset coefficient for that country is -0.53.

In contrast, most estimates of the offset coefficient on the current-account balance (CA) are statistically significant and close to -1. Thus results for this offset coefficient, which is specific to the capital-flow equation, are generally favorable to the monetary approach. But they cannot salvage the findings on the ΔD offset coefficient, which is the one that directly measures the effectiveness of monetary policy.

Sterilization Coefficient

The reserve-flow or capital-flow equation cannot test the monetarist assumption that the sterilization coefficient is 0 in the long run. In order to test this hypothesis, a second equation is required—a "sterilization equation," in which ΔD or its equivalent is the dependent variable and ΔR or its equivalent is an explanatory variable. Where the model is based on a capital-flow equation, the single sterilization coefficient on ΔR may give way to two sterilization coefficients, on K and CA, recalling the identity $\Delta R \equiv K + CA$. While the monetary approach predicts a value of 0 for the sterilization coefficient, the income/absorption theory would suggest a nonzero negative value, probably below unity in absolute value. A coefficient greater than unity would indicate a policy of "oversterilization," which is possible under the income/absorption approach but unlikely.

Typically, the sterilization equation is coupled with a reserve-flow or capital-flow equation in a simultaneous-equation system, and TS is used to obtain consistent estimates in the face of the bias introduced by simultaneous offsetting and sterilization. The sterilization equation is conventionally called the "reaction function" of the monetary authorities.[11] If ΔR or its equivalent constitutes the balance-of-payments target of monetary policy, at least one other variable must enter the equation to represent the domestic target. This gives rise to a further simultaneous-equation problem, because the variable representing the domestic monetary-policy target is almost by hypothesis not independent of ΔD, the dependent variable. Capacity utilization or income is the variable generally used to proxy the domestic monetary-policy target.[12] The appropriate solution

[11] The term "sterilization equation" is used here to highlight the fact that the sterilization coefficient is the only parameter of interest in the reaction function for the purpose of testing the monetary approach.

[12] An exception is the variable used by Genberg (1976b), the rate of change in outstanding government debt, based on the hypothesis that government deficits are largely financed by the central bank's printing of money. This variable would seem to embody the stipulated one-way direction of causation vis-à-vis the domestic target variable, $(D/B)\Delta\log D$, and the reserve-flow variable, $(R/B)\Delta\log R$—thereby avoiding the problem of simultaneity. It is hardly a target variable of the monetary authorities, however. Such a variable or set of vari-

to the problem would be to extend the simultaneous-equation model three-equation system in which—along with, say, ΔD and ΔR— domestic target variable is an endogenous variable.[13]

Results of estimating sterilization coefficients uniformly favor income/absorption approach and run counter to the monetary theory. of the 6 relevant studies, statistically significant sterilization coefficients appear in all equations, indicating the presence of sterilization. The remaining studies are by Connolly and Taylor (1977) and Ujiie (1978). the former, the absence of sterilization is found for only 1 of 4 samples and that sample consists solely of less developed countries. In the latter, which pertains to Japan, the existence of sterilization is confirmed for majority of the equations estimated and its absence suggested only for short subperiod. In most cases, over all 6 studies, the estimated sterilization coefficient is negative, significant, and below unity in absolute value. On occasion, the coefficient is not significantly different from -1, suggesting full sterilization of the effect of reserve flows on the monetary base.

Effect of a Change in the Money Multiplier

In the standard reserve-flow equation (7.1), the coefficient d_1 on $\Delta \log$ is an elasticity coefficient with an expected value of -1, because the money multiplier (m) is a multiplicative factor in the supply of money. This is the prediction of the monetary approach. Nonmonetary theories would accept a negative coefficient on the grounds that, other things being equal, increasing the money supply causes the balance of payments to deteriorate. But the coefficient is expected to be below unity in absolute value, because a unitary coefficient implies complete offsetting of an increase in the money supply through an outflow of reserves.

The findings of the relevant studies are mixed regarding the validity of the monetary approach to the balance of payments. The estimated coefficient is usually negative and statistically significant, but distinctly below unity in absolute value. Some authors point out that the coefficient is not significantly different from -1, but this result is usually caused by the imprecision of the estimate.

Effect of the Money Supply

Can the influence of the money supply on a floating exchange rate discriminate between the monetary approach and alternative theories? A proper test would pertain to a given country relative to the rest of the world. However, because of data problems, testing is usually performed relative to the United States, which is taken to represent the world economy. Fry (1976) estimates a positive coefficient for the domestic nominal money supply in his exchange-rate equation, implying that an increase in a country's money supply would cause its currency to depreciate in the foreign-exchange market. This result is consistent with the monetary approach but no less consistent with nonmonetary theories of the balance of payments.

For a test that discriminates between the monetary approach and other theories, the money-supply variable must be expressed not only in logarithmic form, as in Fry, but also as the ratio of the domestic to the foreign money supply, as in the standard exchange-rate equation (7.3). Then, assuming the global-monetarist law of one price in the commodity market, the coefficient on the money-supply variable (a_3) is expected to be unity (see Chap. 5). Humphrey and Lawler (1977) fit equation (7.3) for five countries in the managed-float period of the 1970s, and in only one case do they find a statistically significant estimate of a_3 that is close to unity.[14] Frankel (1977) estimates an essentially unitary coefficient in only 1 of 20 alternative regressions for the German/U.S. exchange rate in the same managed-float period. In an examination of the pound/dollar exchange rate from 1972 to 1976, Putnam and Woodbury (1977) find coefficients of 0.55 and 0.71 for their monthly and quarterly regressions, respectively. On balance, at least for recent periods of floating rates, estimates of the effect of the money supply on the exchange rate are consistent with the monetary approach. But since they are also consistent with the income/absorption approach, they do not discriminate between the two.

ables surely must encompass strategic measures of the economy's performance, such as capacity utilization, income, unemployment, or inflation.

[13] This extension is performed by Miller and Askin (1976), but in a peculiar fashion. Income, the domestic target variable of monetary policy, is not determined via a structural equation; if it were, the variable D would surely enter the equation as an explanatory variable, but it does not. Rather, the estimated equation for income is a reduced form, with only exogenous explanatory variables.

[14] Indeed, results are so poor for three of the countries that Humphrey and Lawler do not even show the estimated equations.

9 PREDICTIONS OF THE EFFECTS OF THE DEMAND FOR MONEY OR ITS DETERMINANTS

Effect of the Demand for Money

To test the monetarist position regarding the overall influence of demand for money on the balance of payments, the predicted value of can be assigned to the coefficients of variables relating to the supply of money in the standard reserve-flow equation (7.1) or a related equation. The influence of the demand-for-money variables is obtained by direct estimation of a demand equation for money, leading to a predicted time series of the dependent variable in the reserve-flow equation. The predicted variable is correlated with the actual variable. The monetary approach would predict a correlation coefficient of unity. Using this technique, Genberg (1976b) and Aghevli and Khan (1977) obtain coefficients between 0.70 and 0.87.

An alternative approach is to test for the influence of the excess demand for money on the balance of payments by directly entering the domestic and foreign excess demand for money (denoted as E and E^w, respectively) as explanatory variables in a reserve-flow equation. The practice is to define E and E^w in real terms and to use ΔR as the dependent variable in the equation. According to the monetary approach, the coefficient on E is expected to be positive and that on E^w negative. In particular, the former coefficient is expected to have a value of P/m, where P is the domestic country's price level and m its money multiplier. The essence of the monetary approach is that an excess demand for nominal money $(P \cdot E)$ will give rise to a reserve inflow (ΔR) such that $m \cdot \Delta R = P \cdot E$. Thus the stated result for the coefficient of E is analogous to an offset coefficient of -1.[1]

Adherents to nonmonetary theories would reject the view that the excess demand for money has a direct and exclusive effect on the balance of payments. They would admit to an indirect effect through the price level and real income and would therefore accept the direction of the effects predicted by the monetarists for E and E^w. However, they would certainly deny that P/m is the expected value of the coefficient of E; a value this high implies complete offsetting of monetary policy via the balance of payments.

There are several problems with including excess-demand-for-money variables directly in a reserve-flow equation. First, the excess demand for money is not observable and must therefore be estimated. The method is to subtract the time series of the actual money stock, preferably exclusive

[1] For a rigorous proof of the result, see Courchene and Singh (1976, pp. 191-193).

of the influence of the current reserve flow, from the predicted values of an estimated demand-for-money equation. Measurement errors are possible in the variables E and E^w, with consequent biased estimates of their coefficients.

Second, using the excess demand for real money balances as an explanatory variable in a regression equation explaining changes in reserves requires the assumption that the price level and money multiplier—or, more precisely, their ratio—are constant over the sample period. Without this invariance, the constant coefficient of E dictated by the regression model is inconsistent with the monetary approach. It is an advantage of the standard reserve-flow equation that it avoids this inconsistency.

A third problem with the model again relates to the coefficient of E. The proof that this coefficient has the expected value P/m assumes equilibrium; it ignores any time lags in the adjustment of reserve flows to the excess demand for money and in the expansion or contraction of the money supply attendant upon a change in the monetary base.

What are the results when the excess demand for money is used directly in the reserve-flow equation? The findings of Courchene (1973) are contrary to the monetary approach: for only 3 of 15 countries is an excess-demand variable statistically significant with the correct sign.[2] Results favorable to the monetary approach are provided by Courchene and Singh (1976), with the coefficient on E positive and significant for 12 of 14 countries. Courchene and Singh also make the quantitative test to determine if the coefficient on E equals P/m—or, rather, $1/m$—by assuming the law of one price. The cross-country rank correlation coefficient between the estimated coefficient and $1/m$ is an impressive 0.85. This result supports the monetary approach, but it is a weak test because it uses only ordinal information.

Blejer (1978) uses the excess *flow* supply of money directly as the explanatory variable in an exchange-rate equation. His finding of a negative effect of this excess supply on the exchange value of the country's currency is consistent with both the monetary and income/absorption approaches to the balance of payments.

Effect of a Change in Income

Including income as an explanatory variable in a reserve-flow, capital-flow, or exchange-rate equation provides a clearly discriminating test of

[2] In fairness to Courchene, we should state that he reaches the opposite conclusion from his results. The reason for the contrary interpretations is twofold. First, for 6 of 15 countries, results are not reasonable enough even to be reported, and Courchene resorts to an alternative model in these cases. We consider these results to be evidence against the original hypothesis. Second, Courchene's criterion of statistical significance is apparently less strict than our 5 per cent level of significance.

the monetary approach. Other things being equal, an exogenous rise in a country's real income will cause a balance-of-payments surplus or a currency appreciation according to the monetary approach and a deficit or currency depreciation (via an actual or incipient deterioration in the current account) according to nonmonetarist theories.

The nonmonetarist postulate requires a qualification. The exogenous increase in real income will induce an increase in the domestic interest rate and consequently a capital inflow. It is possible that this inflow could be large enough to swamp the current-account effect, yielding an overall surplus or a currency appreciation—the prediction of the monetary approach. However, this result is unlikely under the portfolio theory of capital movements, where the capital flow induced by interest-rate differentials is only temporary. If the estimating equation includes both income and the domestic/foreign interest-rate differential as explanatory variables, the income coefficient will capture the differentiating prediction of the two theories, because the interest-induced capital flow will be captured by the relative-interest variable.

Furthermore, under certain circumstances, the monetary approach can make quantitative predictions about the effect of a change in income. In the standard reserve-flow equation (7.1), the coefficient on the income variable (b_1) is expected to be unity under the tenets of domestic monetarism: this coefficient is the income elasticity of the demand for money, which equals unity given a constant income velocity of money.[3] In the standard exchange-rate equation, the elasticity coefficient on the income variable (b_3) is unity, assuming both a constant velocity and the global-monetarist law of one price in the commodity market.

The change in income is assumed to be exogenous, that is, independent of the change in reserves, the capital flow, or the exchange-rate change. Except to a global monetarist, this assumption might seem unreasonable, suggesting the existence of a simultaneous-equation bias in estimating the equation.

What do the results show? The monetarist qualitative position on the coefficient of the income variable is supported in a majority of the relevant studies, while a nonsignificant coefficient is obtained in the remaining cases. Rarely does the nonmonetarist prediction receive positive support. The monetarist quantitative prediction, where applicable, receives support in only a minority of cases. However, only some proponents of the monetary approach make the assumptions underlying the quantitative

[3] These monetarist qualitative and quantitative predictions are valid even if the income variable is expressed in nominal terms, because the monetary approach and domestic monetarism make analogous predictions concerning the effect of a change in the price level (see the next section).

prediction. Therefore, it is fair to say that the *sign* rather than the *size* of the income coefficient (the qualitative prediction of the effect of income on the balance of payments or exchange rate) is the fundamental hypothesis of the monetary approach in this context. Accordingly, the negative evidence on the quantitative prediction of the income effect should not by itself be considered to controvert the general monetarist position.

On balance, these studies show that an exogenous increase in income tends to have a positive effect on the balance of payments, which supports the monetary approach over the income/absorption theory. Is this balance-of-payments improvement via the current account, the capital account, or both? The Keynesian approach to the balance of payments asserts that an increase in income *worsens* the current account. This hypothesis has been confirmed in numerous empirical studies, and indeed there is nothing in the monetarist literature, theoretical or empirical, that refutes it. Thus the monetarist hypothesis concerning the effect of income on the overall balance of payments—supported by the evidence examined here—must involve an improvement in the capital account greater than the deterioration in the current account.[4] The issue then is whether the capital-account improvement takes place, predominantly or entirely, through the long-term or the short-term capital account.

The evidence on this issue derives from capital-flow equations that are fitted to a given data set with net total private capital inflow and net short-term private capital inflow as alternative dependent variables. Correspondingly, net long-term private capital inflow is added to the current-account balance in the latter regression. Four studies follow this procedure, but one (Neumann, 1978) does not report full regression results to make possible a comparison of the total and short-term private capital equations. The remaining three studies obtain similar regression results for the alternative specifications on a given data set, suggesting that the adjustment to an excess demand for or excess supply of money takes place through the short-term private capital account.

Thus, the available evidence, *based on the monetary approach*, is that an exogenous increase in income causes an improvement in the short-term private capital account greater than the deterioration in the current-account balance. If the income increase continues for some time, a persistent capital inflow—of sufficient magnitude to dominate the current-account deterioration—may be inconsistent with the portfolio theory of international capital movements. Global monetarists would not deny this assertion. With the domestic interest rate set by the world rate in an integrated capital market, a "flow" rather than "stock" or portfolio theory of

[4] To this point only, the argument on components of the balance of payments is made by Miller and Askin (1976, pp. 231-232).

capital movements follows logically.[5] On the other hand, the necessary swings on short-term capital account can be presumed to require changes in relative interest rates, and this is contrary to the global-monetarist law of one interest rate. Yet, in spite of any logical inconsistency implied by the empirical evidence on the income effect, there is no doubt that the evidence favors the monetary over the income/absorption approach.

Effect of a Change in the Price Level

Does an exogenous rise in the domestic price level, other things being equal, result in a balance-of-payments surplus, as the monetarists claim, or in a deficit, the standard nonmonetarist hypothesis? (The same qualification to the nonmonetarist prediction stated in the previous section applies here.) Also, in the standard reserve-flow equation (7.1), the coefficient on the price variable (a_1) is the price elasticity of the demand for money, which is expected to have a value of unity under the domestic monetarist assumption of no money illusion. The possibility of a simultaneous-equation bias is again present, because the assumption that inflation is independent of the change in reserves can be challenged by those who do not accept global monetarism.

Results from estimating the standard reserve-flow equation are uniformly favorable to the monetarist qualitative prediction regarding the coefficient of the domestic-price variable, and occasionally supportive even of its quantitative position.[6] Because many empirical studies have shown a current-account deterioration following an increase in the domestic price level, the implications of the monetarist prediction here can be combined with the implications of its prediction concerning real income in the preceding section.

In PPP theory, the domestic/foreign price ratio appears in the estimating equation for the exchange rate. The only studies we are aware of that test the monetary approach against an alternative compare it with the PPP theory, using the same data and observation period. Bilson (1978a) estimates several equations to explain the German/U.K. exchange rate for the managed-float period of the 1970s. First he estimates an unrestricted monetary equation in which the lagged exchange rate is an explanatory variable, with poor results. He then incorporates *a priori* restrictions on the coefficients in the form of probability limits. For example, the long-run elasticity of the exchange rate with respect to the money supply is assumed to be within 10 per cent of unity with 95 per cent confidence. The restricted equation yields results favorable to the monetary approach, and it outperforms a simplified PPP model in which the exchange rate is assumed to equal the domestic/foreign price ratio.

The monetary equation is inferior to the equation for a "dynamic" PPP theory, however. Like the monetary equation, the dynamic PPP equation incorporates a lagged adjustment mechanism, but no *a priori* restrictions on the coefficients are imposed. As Bilson (1978a, p. 65) writes, "The harsh truth is consequently that the monetary model does not improve upon a sophisticated PPP model as an exchange rate forecasting tool."

In a subsequent study of exchange-rate determination for the same countries but for a shorter period, Bilson (1978b) pits a monetary equation against (a) a PPP equation in which the German/U.K. relative-price ratio is the only explanatory variable, and (b) a random-walk model, in which the current exchange rate is regressed against its value lagged one period. The monetary equation again yields poor results when, like the alternative equations, it is estimated by LS: most explanatory variables have nonsignificant coefficients. This result is in contrast to the highly significant coefficient of the single explanatory variable in each of the alternative equations. The monetary equation does provide a better fit than the PPP—but not the random-walk—model. If the monetary equation includes the lagged exchange rate as an additional explanatory variable, the equation still exhibits a majority of imprecise coefficients, but it now fits the data better than either alternative model. Finally, when this monetary equation is estimated with *a priori* restrictions, as in the earlier study, it provides excellent results in all respects. Bilson's work should stimulate further empirical comparisons of monetary models with alternative equations.

Effect of a Change in the Interest Rate

According to nonmonetary theories, an increase in the domestic interest rate relative to the foreign rate produces a capital inflow, yielding a balance-of-payments surplus. In the portfolio theory of capital move-

[5] However, such a theory appears logically inconsistent with the monetarist emphasis on *stock* demand and supply of money, which is clearly a portfolio approach.

[6] However, these results do not invariably carry over to the law of one price: Guitian (1976) finds a nonsignificant coefficient on the foreign price level in his (nonstandard) reserve-flow equation. Furthermore, certain tests favorable to the monetary approach do not discriminate vis-à-vis alternative theories. For example, in Fry's (1976) exchange-rate equation, an increase in the foreign price level causes the domestic currency to appreciate. This result is consistent with both global monetarism (via the law of one price) and the elasticities approach.

Connolly and Taylor (1976, 1977) find that devaluation improves the balance of payments, given no policy-reactive increase in the money supply. They are correct in pointing out that this result is consistent with the monetary approach, but it is no less consistent with the income/absorption approach. Under the assumptions of continuous money-market equilibrium and the law of one price in the commodity market, their devaluation-percentage variable is expected to have a coefficient of slightly above unity in their reserve-flow equation, as they acknowledge. Although statistically significant, the estimated coefficient is always far below unity.

ments, the surplus would be only temporary. In contrast, the monetary approach views a rise in the domestic interest rate—or, indeed, in the foreign interest rate for the global monetarist—as increasing the opportunity cost of holding money. The increased cost reduces the demand for money and produces an excess supply of money, leading to a balance-of-payments deficit. Most estimates of the reserve-flow or capital-flow equation bear on this question.

In the standard reserve-flow equation (7.1), the coefficient on the interest-rate variable (c_1) is the interest-rate elasticity of the demand for money. Estimates of this coefficient are generally small and statistically nonsignificant. In the capital-flow equation, a world rather than domestic interest rate is invariably used. The equation becomes a test of the global-monetarist hypothesis of capital-market integration. Here, too, the estimated coefficient is usually nonsignificant, but it supports the monetarist position in a minority of cases. A mixed pattern of results is obtained under a floating rate using estimates of exchange-rate equations.

Logically, there should be a section discussing empirical estimates of the effect of differential inflationary expectations on the exchange rate. However, the inclusion of variables representing inflationary expectations in the exchange-rate equation does not test the monetary approach versus the nonmonetary alternatives. In all theories of the exchange rate, anticipated greater domestic inflation leads to currency depreciation, although the specific mechanism may differ.

10 TESTS OF THE LAW OF ONE PRICE ("GLOBAL MONETARISM")

The law of one price is also called the "market-integration hypothesis." Indeed, empirical testing of the law divides into three categories according to the market for which international integration is tested: the goods market, the bond market, and the equity market. Detailed information on the empirical studies in each category is provided in Table 2 of Chapter 7.

Goods Market

In the goods market, studies of the law of one price usually test for equality of inflation rates in various countries, or domestically and abroad. Genberg (1977) calculates that the first principal component accounts for 90 per cent of the variance of twenty-one individual-country consumer-price-index series, and for 98 per cent for a shorter time period devoid of exchange-rate changes. This result strongly supports a law of one price tying together inflation in different countries under a fixed exchange rate. Using analysis of variance, in two of three samples Genberg (1976a, 1976b) accepts the hypothesis of equal rates of inflation among countries.

All other empirical results suggest rejection of the law of one price in commodity markets. Regressing the Swedish on the world rate of inflation, Genberg (1976b) obtains a slope coefficient significantly below the value of unity that would be predicted by the law of one price. Pattison (1976) finds a reduction in the coefficient of variation in rates of inflation among OECD countries over time, but most of this reduction is attributable to the recent higher mean rate of inflation. As Pattison (1976, p. 527) points out, "Various countries were often several standard deviations from the mean, and the average range of inflation rates in the 1960's was six percent."

Isard (1977) shows that exchange-rate movements are associated with substantial changes in relative-price indices for a variety of commodity groups at a maximum level of disaggregation. The implication is that the commodities examined are differentiated products across countries, in accordance with the elasticities approach, rather than perfect substitutes, as the law of one price would postulate. In a similar vein, Kravis and Lipsey (1977) find that foreign prices have a greater impact on the export price index than on the domestic price index of the same commodity group, contradicting the law of one price.

Kravis and Lipsey also report on their earlier study (1971, Appendix E), which compared absolute price levels of exports. Differences among countries were found in every commodity category, and in some cases the difference between the price in the domestic country and in the United States was substantial. In addition, Richardson (1978) compares acceleration in inflation rates for twenty-three commodity groups in Canada and the United States. The hypothesis of perfect commodity arbitrage is rejected for every commodity group; the law of one price receives no support.

Although we are excluding empirical testing of the PPP theory from this survey, the work of Kravis and Lipsey (1978) warrants mention. These authors test PPP relationships in the context of discriminating between the assumptions and predictions of the monetary approach and those of the traditional theories. After performing a large number of tests, Kravis and Lipsey (1978, p. 243) conclude that the evidence is more supportive of the nonmonetary theories: ". . . we think it unlikely that the high degree of national and international commodity arbitrage that many versions of the monetarist theory of the balance of payments contemplate is typical of the real world."

Bond Market

The law of one price for capital implies an integrated bond market. Under fixed exchange rates, equal interest rates will prevail across the world. With floating or adjustably pegged exchange rates, anticipated exchange-rate changes—perhaps due to differential inflationary expectations domestically and abroad—will be reflected in domestic/foreign interest-rate differentials. This introduction into the law of one interest rate of the difference between nominal and real interest rates tends to be ignored by those who test the theory, perhaps because of the difficulty of obtaining accurate measures of inflationary or exchange-rate expectations.

A movement toward international bond-market integration will be seen in a reduction of the dispersion of interest rates across countries. Computations of the coefficient of variation (standard-deviation/mean) suggest a reduced international dispersion of interest rates over time, but complete bond-market integration remains far from realization. Argy and Hodjera (1973), fitting a trend to the domestic/world interest-rate differential, discover a negative and significant slope coefficient for only a minority of the countries examined. This result suggests that there is not even a steady movement toward bond-market integration.

Several studies compute correlation coefficients among countries' interest rates or between these rates and measures of the world interest rate. While the correlations are uniformly positive, they are not generally close to unity. Furthermore, when interest rates are expressed as first differences rather than in level form, correlation coefficients tend to be sub-

stantially below unity. In sum, while international integration in the bond market may have increased over time, the evidence indicates that it is far from complete, contrary to the global-monetarist hypothesis of perfect capital mobility.

Equity Market

Integration in the equity market means that stock-market prices in different countries will move together. Agmon (1972) and Genberg (1976b) regress the rate of change of countries' stock-market price indices on the rate of change of the U.S. index. The slope coefficient is uniformly positive and statistically significant, but substantially below unity—the value predicted by global monetarists. Furthermore, the explanatory power of the equation is invariably low.

Lead-lag analysis by these authors shows that the effect of the United States on the stock market in the countries studied is contemporaneous. They interpret this result as confirming the hypothesis of an integrated world market for equities. This conclusion is hardly warranted by the evidence. The low explanatory power of the stock-market regressions and the small size of their slope coefficients, coupled with the generally poor association of countries' stock-market prices shown in correlation analysis (see Laffer, 1975), indicate that equity-market integration is even further from perfection than is bond-market integration.

There is little doubt that highlighting the role of money in the adjustment process is a significant contribution, for it counteracts the common tendency to ignore money and concentrate exclusively on real variables. Furthermore, the monetary approach can be used to bring out inconsistencies and deficiencies in the income/absorption approach. (This exercise is performed admirably by Kuska, 1978). However, followers of the monetary approach may have gone too far in emphasizing monetary variables to the virtual exclusion of everything else, and in offering their approach as a complete substitute for the traditional approaches.

For example, it is true that the exchange rate is the price of one money in terms of another. Yet does it follow from this definition that exchange-rate policy is useless or that exchange-rate changes have no effect on real variables? First, even if the monetarists' postulates are accepted, changes in exchange rates are not necessarily a useless policy. Devaluation is usually undertaken not from an equilibrium position but from a position of balance-of-payments deficit, involving an initial excess supply of money. Instead of a lengthy wait for the self-correcting mechanism to eliminate the excess supply, devaluation will quickly mop it up. Because the time horizon of policy-makers is usually measured in months and not years, the speed of adjustment of the balance of payments to exchange-rate change is crucial, and devaluation can make a significant contribution. The speed of adjustment depends to some degree on product-market elasticities, which are dismissed as irrelevant by the monetary approach.

Second, even if we accept the law of one price for traded goods, devaluation will still raise the prices of traded goods (exports and import substitutes) relative to those of nontraded goods, thereby encouraging production and discouraging consumption of traded goods. There will be more consumption and less production of nontraded goods. That will expand exports and reduce imports. It should also be noted that output cannot be rigidly separated into the traded- and nontraded-goods components; what is traded and what is not traded depend at least in part on the exchange rate.

Even if *all* commodity prices were equalized in accordance with the law of one price, devaluation could still induce changes in the production mix by altering the profitability—the relation between price and production costs—of various industries. For example, when a country that exports small amounts of a homogeneous product devalues, the price of that product in foreign currencies is unchanged, but its domestic production

becomes more profitable and consequently a greater amount is exported. To avoid these effects on trade, it would be necessary for changes in exchange rates to leave unaltered not only the relation between product prices among countries but also the relation among *factor* prices both within countries and between countries. Such invariance cannot be deduced from international arbitrage alone for any period with which exchange-rate policy is concerned. Therefore, the law of one price arising from commodity arbitrage does not rule out the effects of devaluation on trade.[1]

By ignoring the composition of imbalances, does the monetary approach overlook issues that are significant to the economy? It matters for the generation of domestic output and employment whether the source of the disturbance is in the capital sector or in the goods-and-services sector. Also, if a deficit on goods and services is continuously financed by a private capital inflow, it will cause no imbalance according to the monetary-base-effect concept. Yet the country's foreign indebtedness will rise over time, and that may have serious economic implications.[2]

In a more general way, the monetarists maintain that, because deficits are self-correcting through stock adjustment, they present no problem. Is that necessarily so? As Corden (1977, p. 45) states: "I suppose that one might ask how anything in the economy can be a problem. If everyone does what he wants to do, and knows what he is doing, and adjusts to changing circumstances, where is the problem?" His answer is that all economic agents, including governments, make mistakes in the adjustment process. This is especially true because of the outside constraints to which they are subject and because adjustment is a painful procedure for both people and institutions. In sum, the "problem" is the cost of adjustment, and the policy issue is how to minimize that cost.

Thus far, little work has been done on reconciling, as opposed to comparing, the monetary with the traditional approaches. One possible conception of the various theories is as follows. The absorption approach highlights the fact that a balance-of-payments deficit, at least on current account, signifies that a country is living beyond its means. If imports of goods and services exceed exports, then absorption exceeds income, and by the same amount. To remove the deficit, the country must reduce absorption or increase output until the two are equal. This proposition

[1] This point is made by Salant (1975, p. 549). Note that it requires merely that changes in wage rates not be in proportion to exchange-rate changes. A sufficient but not necessary condition for this hypothesis is the Keynesian postulate of fixed money wage rates.

[2] For some other conceptual difficulties with the monetary approach, see the critiques by Corden (1977, Chap. 3), Hahn (1977), and Tsiang (1977). Within a monetarist framework, Isard and Porter discuss the limitations of the monetary theory of devaluation.

applies to all theories, but the monetary and elasticities approaches differ in the mechanism by which it is accomplished. Thus the absorption approach can be merged with either the elasticities or the monetary theories.[3] For example, a recent attempt by Lapan and Enders (1978) to analyze the effect of devaluation on the *trade* balance appears to be in the monetarist tradition; but it also fits well into the absorption approach, because it relies on the real-balance effect.

Since the monetary and traditional approaches have not been reconciled on a theoretical basis, it is all the more important to perform empirical tests that discriminate between the theories. A comprehensive review of 48 studies bearing on either the assumptions or the predictions of the monetary approach to the balance of payments was presented in Chapters 7 to 10. There are three ways to reach an overall evaluation of the validity of the general monetary approach (as distinct from global monetarism) based on the empirical findings. We use each of these ways in turn.

1. One can examine the study-by-study evaluations shown in the first column of Table 1. The number of studies we consider to yield negative results concerning the monetary approach is approximately equal to the number that produce positive results. Also, and perhaps more revealing, the vast majority of studies, viewed independently of one another, provide mixed findings. This suggests that the empirical evidence to date is inconclusive.

2. One can determine the nature of the overall inconclusive findings by assessing the empirical results according to the prediction-by-prediction procedure adopted in Chapters 8 and 9. With respect to the offset and sterilization coefficients, most results are negative for the monetary theory and those that are strongly positive appear to apply only to special cases. On the other hand, the evidence concerning the effect of exogenous changes in income and the price level favors the monetary approach. The results of testing for other predictions tend to be more unfavorable than favorable to the monetary theory, but more often they are mixed and therefore inconclusive.

It is interesting that Johnson (1977c, p. 13) reaches the same conclusion concerning the preeminence of the income effect among empirical findings favorable to the monetary approach: "The most robust specific proposition is that, contrary to Keynesian predictions, the fastest-growing countries will have the strongest (the surplus) balance-of-payments positions, because their demand for money will tend to grow faster than the supply of domestic credit."

3. One can consider the results of testing each of the various models of

[3] For an attempt at reconciliation of the various approaches, see Kyle (1976).

the monetary approach. Here, again, it seems to us that three of the models described in Chapter 7—the reserve-flow, capital-flow, and exchange-rate equations—do not produce conclusive results. The fourth model, the exchange-market-pressure equation, yields results that, while mixed on balance, are positive for certain countries. The findings for these few specific countries (principally Canada) tend to conform to the monetary theory with respect not only to the predicted effects of changes in income but also to the hypothesized value of the offset coefficient. The exchange-market-pressure model appears to be a promising direction for empirical work. It is uniquely suited to the current managed-floating system of exchange rates, where a payments imbalance is reflected in a combination of reserve changes and exchange-rate movements.[4]

We suggest four possible reasons for the inconclusive nature of the empirical findings on the monetary approach:

1. The monetary theory is faced with the fundamental methodological dilemma that its relationships, under a fixed exchange rate, are hypothesized to hold in the "long run," but the theory does not specify the length of the long run. It is conceivable that the units of observation used in empirical testing—the month, quarter-year, or full year—are too short to incorporate the "length of run" inherent in monetarist propositions. And yet the tests we are surveying were performed by monetarists themselves, since most tests of the monetary theory have been conducted by scholars who are identified with the approach. If monetarist propositions are presumed to hold only in the long run, the onus is on the empirical investigators to take that element into account.

2. The specific difficulties in testing the validity of domestic monetarism are not avoided when one tests the monetary approach to the balance of payments. Johnson (1977c, pp. 13-14) has stated this issue well:

> Second, in devising a proper test of the theory, which involves testing the existence and stability of the domestic demand for money, one runs into all the problems previously encountered in domestically oriented research on the quantity theory of money, most noticeably the interdependence of demand and supply of money, lags in the adjustment of actual to desired quantities on both sides, and the division of the effects of monetary changes between price changes and output changes.

3. A variety of statistical problems can adversely affect econometric testing of the monetary approach, just as they do the testing of any

[4] But note that this model is somewhat inconsistent with the principles of the monetary approach, because any intervention by the authorities will change the money supply. And that change necessarily spills over into the foreign-exchange market, leaving the pressure on the exchange rate unabated. A critical assessment of the exchange-market-pressure equation is provided by Sargen (1975).

theory. Problems of simultaneity and omitted variables are conspicu[ous] for the monetary theory. Some of these problems were discussed [in] Chapter 8.

4. With rare exceptions, the empirical studies undertaken so far test [the] new theory "in isolation"; in no way is it pitted against the tradition[al] approaches—approaches that have been tested extensively in [the] scholarly literature over a period of decades. We believe that future te[sts] should be oriented in this direction.

We need turn only briefly to global monetarism. By any strand of [ar]gument, there is almost no evidence to support the hypothesis of the l[aw] of one price in the commodity, bond, or equity markets. Glob[al] monetarism must be rejected in the present state of the globe.

Clearly, this survey is not the last word. It is a summary of only the fi[rst] decade of scholarly efforts. Future empirical studies should be formulate[d] in general terms rather than oriented solely to the monetary approach, [so] that the validity of rival theories can be compared and assessed. At th[e] same time, theoretical work must proceed in the direction of reconcilin[g] and merging the various approaches.

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