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The Monetary Approach to an Open Economy: The Fundamental Theory Revisited

Michael Connolly

"Suppose four fifths of all the money in Great Britain to be annihilated in one night," David Hume speculated in 1752 ". . . must not the price of all labor and commodities sink in proportion," giving England a competitive advantage in trade which must quickly "bring back the money we had lost, and raise us to the level (of prices) of all the neighboring nations?"[1] This adjustment process was to be christened the Hume specie-flow mechanism, and is, in a fundamental sense, the earliest known statement of a monetary approach to the balance of payments. Hume's statement also raised specific issues such as the now-controversial, so-called law of one price. This law, apparently contradicted in particular for traded goods by Hume's theoretical adjustment process, was, however, firmly held by him:

> Any man who travels over Europe at this day, may see, by the prices of commodities, that money . . . has brought itself nearly to a level; and that the difference between one kingdom and another is not greater in this respect, than it is often between different provinces of the same kingdom.[2]

(This latter criterion has in fact provided the basis for one of the first modern empirical tests of the law of one price.[3] Hume further noted: "The only circumstance that can obstruct the exactness of these proportions is the expense of transporting the commodities from one place to another."[4])

This is so because "the same causes, which would correct these exorbitant inequalities, were they to happen miraculously, must prevent their happening in the common course of nature."[5] Consequently, price

differences would not be an observed part of the specie-flow adjustment process, and the apparent contradiction with the law of one price is resolved.[6]

While the first statements of a monetary approach to the balance of payments stressed commodity trade more than adjustment in asset markets, they nevertheless laid out the fundamental principle of a demand for money that, if not satisfied, led to a surplus to provide the additional money desired or, if exceeded, led to a deficit, thereby depleting the excess balances. This is the basic modern monetary view. It consists of three elements: a theory of the demand for money, a money supply process, and balance of payments surpluses in instances of excess demand for money and deficits in cases of excess supply.

In the context of flexible exchange rates, an excess supply of money would induce an exchange depreciation rather than a loss in foreign reserves, and an excess demand results in an appreciation in lieu of a reserve accumulation. Finally, the monetary model has offered an explanation of both reserve and exchange rate changes in the context of a managed float.[7] Once again, the fortunes of a country's reserves and/or exchange rate depend upon the balance between the supply of and the demand for money.

In what follows, we try to develop somewhat more formally a minimum monetary model for the uninitiated. Modern monetary views are stated more completely elsewhere in a number of articles by Harry Johnson, Robert Mundell, and some of their former students, such as Rudiger Dornbusch and Jacob Frenkel.[8]

A MODERN MONETARY MODEL

The most succinct monetary model is that of the "small, open economy" facing given world prices and interest rates.* We can write a straightforward Cagan demand for money equation:

$$L = kPY \exp(-\alpha i) \tag{1a}$$

$$= kPY \exp(-\alpha \varrho) \tag{1b}$$

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*Empirically, this model has been fruitfully applied to a number of seemingly large countries, so that it applies to most large ones, if not the United States.

where P is the domestic price level, Y permanent income, i the nominal interest rate, ϱ the expected rate of inflation, and $-\alpha i$ and $-\alpha\varrho$ the interest rate and expected inflation rate elasticities of the demand for money. Note that with the Fisher equation, $i = u + \varrho$, where u is the real rate of interest, assumed to be constant. Consequently $k^* = k \exp(-du)$.

A stable demand for money, no matter what the variant it assumes,* is the cornerstone of the monetary approach to an open economy. If one agrees that the demand for money is stable in the Friedman sense, the monetary approach to the balance of payments is the natural consequence.[9] Put more forcefully, the notion of a stable demand for money and the monetary approach to an open economy are one and the same thing. Harry Johnson put it this way in his nontechnical guide to the monetary approach to the balance of payments: "A proper test of the monetary approach must be essentially a test of the stability of the demand for money (in Friedman's terminology)."[10]

The second essential ingredient of the modern monetary model is a specification of the money supply process. The simplest one, that of Robert A. Mundell,[11] is:

$$M = A(R + D) \tag{2}$$

where R is net foreign reserves in terms of domestic currency of the central bank, D is domestic credit of the central bank, and A the money multiplier. The sum R + D equals H, the high-powered money base. This identity states that changes in the money stock are from foreign or domestic sources or from a change in the money multiplier: that is, from a change in foreign reserves via the balance of payments, dR/dt, or a change in domestic credit extended by the central bank, dD/dt, or a change in the money multiplier, dA/dt.

The third relationship essential to the simple monetary model is the link between domestic and international prices via the exchange rate. It is assumed to hold partly because of arbitrage and partly because of the monetary adjustment process. The purchasing-power parity relationship is shown by

$$P = EP^o \tag{3}$$

where P is domestic prices, P^o is foreign prices, and E is the exchange rate.

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*An alternative one used in empirical studies is $L = kPY^{\varepsilon}i^{-\eta}$, where ε and η are income and interest rate elasticities of the demand for money, respectively.

This relationship, while it need only hold in terms of changes (for example $p = e + p^o$, where small letters denote percentage changes), is perhaps one of the more controversial ones in the monetary model. Further, it is an important one in that it is part of the transmission mechanism whereby exchange rate changes and world price movements disturb domestic prices and, consequently, the demand for money. In favor of the purchasing-power parity relationship, one can invoke commodity arbitrage and/or the neutrality of money in an adjustment process. Against it, one can argue that it holds only for purely monetary disturbances. Empirically, the evidence on this law of one price is mixed.* In some instances, the weakness of the evidence on the law of one price has diminished the predictive power of the money model.†

Finally, it simplifies matters greatly to assume that the money stock in existence adjusts rapidly to the quantity demanded, either by a deficit (running down the money stock) or by an exchange depreciation (increasing the demand) or by some combination of the two, so that monetary equilibrium holds:‡

$$L = M \tag{4}$$

With fixed exchange rates, the nominal money supply adjusts to the demand via payments imbalances, while with flexible exchange rates the demand for money adjusts to the nominal supply via changes in the

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*J. M. Keynes was the first to dub purchasing-power parity the law of one price, in his comment on Gustav Cassel's 1916 paper: "The effect of Professor Cassel's interesting calculations . . . seems to me to be that even with the hindrances to free movements of goods which prevail in war time, real price levels in different countries tend to equality. That is to say, the index numbers of local prices corrected by the world-value of local money, as measured by the exchanges, tend to equality."[12] Keynes' later empirical studies in monetary reform, despite his theoretical reticence regarding real disturbances, such as in Germany, found that the "Purchasing Power Parity Theory, even in its crude form, has worked passably well"[13] for the United Kingdom, Italy, and France relative to the United States between August 1919 and June 1923.

†On the side of integrated markets and one-price are H. Genberg, P. Isard, D. McClosky, and R. Zecher, while against is R. M. Dunn. Richardson reports mixed results. M. Connolly and J. da Silveira find that purchasing-power parity predicts well for postwar Brazil where disturbances were frequently monetary.[14]

‡A more sophisticated model allows for less than immediate adjustment. Specifically, in R. Dornbusch's notation, $H = \pi(L - M)$, where H is hoarding, for example, the change in reserves, and π the speed of adjustment. Here we suppose $\pi = \infty$, which implies $L = M$. The Dornbusch model is of interest also because it provides a two-country monetary framework.

exchange rate. In a mixed system, both the demand and the supply of money adjust to achieve equilibrium.

Substituting equation 3 into 1, and equations 1 and 2 into 4, taking logarithms of both sides, differentiating with respect to time, we have after manipulation, $r - e = -a - d + p^o + Y - \alpha\varrho'$, where r is the change in foreign reserves (the balance of payments) as a percent of the money base, d is the increase in central bank credit as a percent of the money base, a is the percentage change in the money multiplier, e is the percentage depreciation of the home currency, p^o the world rate of inflation, Y the rate of growth of permanent income (assumed to be determined exogenously),* and ϱ' the change in the expected rate of inflation.

Two polar cases of the monetary model can be distinguished. First, with fixed exchange rates, e = 0, giving:

$$r = -a - d + p^o + Y - \alpha\varrho' \tag{5}$$

which states that an increase in the rate of growth of domestic credit will cause an equiproportionate loss in reserves, holding other variables constant. Similarly, a rise in the expected rate of inflation causes a loss in reserves. (Parenthetically, the higher income growth is, the more favorable the balance of payments as a result of the increase in the demand for money, contrary to post-Keynesian import demand arguments.) This relationship (or variants of it) has been tested for a good number of countries under fixed exchange rates. The majority of the studies strongly support the negative relationship between domestic credit (for example, monetary policy) and the state of the balance of payments. Put briefly, monetary expansion is at the expense of foreign reserves.

A second polar case is that of fully flexible exchange rates, that is r = 0, with no intervention on foreign exchange markets, giving:

$$e = a + d - p^o - Y + \alpha\varrho' \tag{6}$$

With fully flexible rates any increase in the growth rate of domestic credit causing an excess supply of money results in an equiproportionate depreciation of the home currency. Consequently, the monetary approach

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*Note that for notational simplicity both the change in reserves and the change in domestic credit are expressed as a proportion of the money base, that is, r = (dR/dt)/H and D = (dD/dt)/H, since d log (R + D)/dt = (dR/dt)(R − D) = (dD/dt)/(R − D) and R = D = H.

provides a theory of exchange rate determination in the event of flexible rates.*

Finally, a mixed case in which exchange market pressure is absorbed partly by reserve losses and partly by exchange depreciation is given by

$$r - e = -a - d + p^o + Y - \alpha\varrho' \tag{7}$$

where, once again, r and d are changes in reserves and domestic credit as a proportion of the money stock, while the other variables are percentage changes.

This model was first proposed by L. Girton and D. Roper for the Canadian-managed float from 1952 to 1962, and is an extremely useful way of viewing the current mixed exchange regime. Basically, the monetary authorities have, for a given rate of growth of domestic credit, world prices, and permanent income, a choice between reserve losses and exchange rate changes that will absorb a given level of pressure on the exchange market. Or it makes clear that an expansionary domestic credit policy will cause a loss in reserves, an exchange depreciation, or a combination of the two.†

For example, with a preannounced rate of depreciation e^*, the path of reserves is given by $r = -(d - e^*) - a + Y - \alpha\varrho'$, so for consistency of monetary and fiscal policy, domestic credit should not grow faster than the rate of crawl in the exchange rate. Put differently, for a given rate of credit growth, d^*, the rate of currency crawl, e, must be greater than or equal to d^* to avoid runs on reserves and a collapse.

When, on the other hand, domestic credit growth is expansionary relative to exchange rate depreciation (the case of Argentina from January 1979 to March 1981), a speculative attack depleting remaining foreign reserves in one fell swoop will occur at t^* and force the country onto a freely floating exchange rate, where:

$$t^* = -\alpha + \frac{\ln(\bar{R}/\bar{D} + 1)}{\varepsilon} \tag{8}$$

where α is the sensitivity of the demand for money with respect to the

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*This formula applies to freely floating rates, and not to the discrete, discontinuous devaluations of the adjustable peg system of the postwar period until the 1970s. Such one-and-one-for-all exchange rate adjustments are analyzed by M. Connolly and D. Taylor for 18 devaluations that took place in the 1960s.[15]

†Connolly and da Silveira have applied the exchange market pressure model to Brazil.[12]

expected rate of inflation, $\bar{R}/\bar{D}$ is initial central bank reserves as a proportion of initial domestic credit, and ε is the difference between growth in domestic credit and depreciation in the exchange rate, or $\varepsilon = d - e$ (equal to 4.5 percent per month in the case of Argentina).

Consequently, the speculative attack causing a collapse is sooner:

1. the more sensitive the demand for money is with respect to the expected rate of inflation (the larger α);
2. the smaller initial foreign reserves are as a proportion of domestic credit (the smaller $\bar{R}/\bar{D}$); and
3. the greater the inconsistency of monetary and exchange rate policy (the greater $d - e$).

(For a more rigorous treatment, see Connolly and Taylor [1984].[16])

The fundamental monetary model presented here captures, I believe, the essential elements of the monetary approach to an open economy. To sum up, its foundation is a stable demand for money in the Friedman sense coupled with a money stock composed of an external component (foreign reserves) and an internal component (domestic credit). In cases of excess money supply over demand, exchange market pressure results in a loss of foreign reserves, thereby reducing the supply of money, and/or an exchange depreciation which restores equilibrium by increasing the demand for money.

FURTHER ISSUES AND EXTENSIONS

Two-country Model

In the context of a two-country world, the exchange market pressure model can be generalized to:

$$r_1 - r_2 - e_{12} = -(a_1 - a_2) - (d_1 - d_2) + (Y_1 - Y_2) - \alpha_1 \varrho'_1 + \alpha_2 \varrho'_2 \quad (9)$$

where the variables are defined as before.

In the special case where $\alpha_1 = \alpha_2$, the expectations term can also be collected to give $-\alpha(\varrho'_1 - \varrho'_2)$. In terms of interest rate differentials, with no change in the real rates of return in either country, the impact is $-\alpha(i'_1 - i'_2)$. On the other hand, a rise in the real rate of return in, say, country 1, would lead to an improved level of reserves or currency appreciation in an asset model (see Frankel); that is, a positive $\alpha(i'_1 - i'_2)$, which is ruled out by the monetary model.

In short, from equation 9, it is the relative rates of growth of domestic credit, real income, the money multipliers, and the change in the expected inflation rate differential that determine the path of reserves in the two countries and the rate of increase in the price of currency 2 in terms of currency 1: that is, e_{12}.

Expectations

Probably the most important issue regarding exchange rates in particular has to do with expectations. Some recent studies in this area are suggestive of the delicate problems involved. R. Barro, for instance, has devised a scheme of exchange rate dynamics that revolves around individuals and firms distinguishing between a permanent and a transitory component of any exogenous change in the rate of monetary expansion.[18] The greater the permanancy perceived by the public of an increased monetary expansion rate, the more immediate and the greater the exchange depreciation. This raises the quesion of the formation of expectations, which has been explored in a number of interesting papers by John Bilson in the context of rational expectations.[19]

The basic principle is that the spot and forward rates fully incorporate all current information and expectations regarding the future. In this light, J. Frenkel has devised a clever shortcut for measuring expectations in the demand for money by using the forward exchange rate rather than, for example, adaptive expectations.[20] For the German hyperinflation, the forward rate for the mark performs well as an explanatory variable in the demand for money, and has the property of conforming to rational expectations theory, in that spot exchange rates are correlated with the last period's forward rates but not with previous ones. That is, the most recent forward rate incorporates all currently available market information.

A different approach in a monetary context is that of Rudiger Dornbusch.[21] The main interest of his approach is that it provides a "monetary shock" rationale for overshooting of exchange rates. Consider increasing the domestic monetary stock by means of open market purchases in a flexible exchange rate regime. This lowers domestic interest rates instantaneously through a liquidity effect, and immediately depreciates the exchange rate, but by more than its ultimate depreciation. That is, overshooting takes place. The reason for this is the Fisherian relationship:

$$i = i^o = \varrho \tag{10}$$

which states that domestic interest rates, i, must equal foreign ones, i^o, plus ϱ, the expected rate of depreciation of the home currency. (Irving Fisher

puts it succinctly, ". . . two rates of interest in . . . two diverging standards will, in a perfect adjustment, differ from each other by an amount equal to the rate of divergence between the two standards."[22]) Consequently, if monetary expansion depresses domestic interest rates through a liquidity effect, and foreign interest rates remain unchanged, the home currency must initially depreciate more than its eventual decline. Thus the expectation is that it will recover somewhat in value, but not return to its initial value. This satisfies the Fisher rule since it implies $\varrho = 0$. Of course, not all reversible exchange rate swings are necessarily caused by monetary supply shocks; they can also arise from shifts in demands for national monies as assets. This latter view, while admittedly not entirely new, possibly sheds light upon current exchange rate swings. Further, it shifts the emphasis away from relative rates of inflation (or purchasing-power parity) toward an asset or stock market determination of exchange rates. While purchasing-power parity may in the long run (and occasionally in the short run) be a good predictor in instances of widely diverging monetary policies, it cannot account for dramatic, sometimes reversible swings in short periods of time.

Neutralization

In the framework of the monetary approach to the balance of payment under fixed exchange rates it has been suggested that the direction of causation may be from changes in reserves to changes in domestic credit rather than, as the monetarists would have it, the other way around.[23] This occurs with a policy of neutralizing the effects of payments surpluses or deficits upon the high-powered money base via an offsetting credit policy. In the notation of the minimum monetary model:

$$d = a - \beta r \tag{11}$$

where β, the sterilization coefficient, ranges from zero (no offsetting) to unity (complete sterilization) and a is a constant.

This argument merits further attention. As Pentti Kouri and Michael Porter[24] note, neutralization would tend to bias empirical tests in favor of the domestic credit aspect of the monetary model. (Their study stresses capital outflows in response to monetary expansion. A framework for the analysis of this problem is found in Alexander Swoboda.[25]) In separate tests by Hans Genberg for Sweden, Lance Girton and Don Roper for Canada, and Michael Connolly and Dean Taylor for a cross-section of 27 countries, the evidence suggests that some neutralization takes place,

particularly in developed countries, but that even in its presence, the bias in favor of the monetary view is negligible. Further tests would, however, be in order.*

CURRENCY SUBSTITUTION AND COMPETITION AMONG NATIONAL MONIES

Recent theoretical developments have stressed the importance of currency substitution among asset holders. A number of papers provide a theory of multiple currencies that circulate within the same region (or rather are held by individuals within the same region) and are viewed as substitutes by holders of money. Russell Boyer's early "nickel and dime" paper neatly posed the problem, which, in the context of stability, involves Gresham's Law. Girton and Roper find that the greater the degree of substitution among national monies, the less stable the exchange rate. G. Calvo and E. Rodriguez add rational expectations to the picture, and find that exchange rate responses to monetary shocks exceed price responses but that, with perfect foresight paths, instability does not result. David King, Bluford Putnam, and D. Sykes Wilford examine exchange rate stability and the independence of monetary policy with currency substitution. Finally, John Cuddington has done a complete review recently.[26]

A natural companion to currency substitution is the implied existence of competition among issuers of national monies. (On this, see Benjamin Klein and Gordon Tullock for opposing views.[27]) The situation is similar to the era of state banking in the United States, during which states issued monies and exchange rates between state currencies were flexible (see Friedman and Schwartz.[28]) In principle, there exists an optimal rule for issuing national money, given that competition from other issuers exists. Not surprisingly, currency competition leads to at least a partial internalizing of the well-known negative externality (see Friedman)[29] imposed by overissue in the case of monopoly issue of currency, and imparts a greater degree of price stability to an international monetary system (see Girton and Roper.)[30] Other considerations may well override the competitive one—particularly the debt-financing motive in some instances—but the principle is a sound one, meriting further theoretical and empirical work.

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*See Chapter 6 of this book for further treatment of this issue.

Marc Miles, using a constant elasticity of substitution (CES) production framework, estimated the elasticity of substitution between U.S. and Canadian dollars and found it greater during floating than during fixed periods, significantly different from zero, but not infinite. (From 1960 to 1975, the elasticity of substitution was estimated to be 5.4.[31])

EXCHANGE RATES AND THE RELATIVE PRICE OF TRADED GOODS

The minimum monetary model discussed here makes no distinction between traded and nontraded goods: domestic prices of all goods are simply assumed to be kept in line with international prices. This assumption does not hinge upon arbitrage in goods, but rather upon the idea of the long-run neutrality of nominal magnitudes, namely the exchange rate and the money stock, in a monetary system. However, in the short-run adjustment period to, for example, an exchange depreciation, the relative price of traded goods will rise, and consequently there will be not only liquidity effects as outlined in the minimum monetary model, but also substitution effects along the lines of the elasticity approach. The role of such substitution effects between traded and nontraded goods during the adjustment period to monetary shocks is stressed in a monetary framework in a number of papers that build upon the so-called Australian or Swan-Salter model.[32] This model is, once again, one of a small, open economy that produces two composite goods, a traded one (exports and imports) and a nontraded one. In addition, individuals hold domestic money as their sole asset. Exchange depreciation thus has a liquidity effect, increasing the demand for money, and also a substitution effect, as individuals substitute traded goods for nontraded ones. Both effects work toward improving the balance of payments. However, as money flows in during the adjustment period these effects diminish and the system returns to its initial equilibrium. Consequently, real effects due to substitution take place only during the transitional adjustment process, while in the long run there are none. These transitional real effects are highlighted in Dornbusch, while the adjustment process itself has been dealt with by P. D. Jonson and H. Kierzkowski graphically and by Connolly and Taylor (1979) algebraically.[33] The latter model has been extended recently (Connolly and Taylor [1984]) to the problem of speculative attack and collapse models. It is shown that the relative price of nontraded goods rises prior to a dramatic fall at the point of collapse.

A SHORT GUIDE TO EMPIRICAL STUDIES

A masterful survey by S. P. Magee of empirical work on the monetary approach to an open economy appeared in 1976, and another has been written by M. Kreinen and L. Officer.[34] Consequently we need touch upon only a few studies that an interested reader might consult. The considerable amount of empirical work done to date in the area and the rapid rate of appearance of new statistical tests is testimony to the strong empirical thrust of the monetary approach. It is unfortunate that some early reviewers, such as G. Haberler, either neglect the first empirical studies altogether or, as does Marina Von Neuman Whitman, incorrectly dismiss them as "the estimation of an accounting identity rather than a true behavioral relationship," in an otherwise excellent, well-balanced review.[35] (For an empirical rejection of the view that empirical studies of the monetary approach are estimating only an accounting identity, see Putnam and Wilford.[36]) For, as stressed by Rudolf Rhomberg and H. R. Heller in the introduction to an International Monetary Fund volume, the possibility of empirical measurement of monetary and balance of payments aggregates fostered in part the development of the monetary framework.*

Here is a short list of selected empirical studies. (Full references are contained in the bibliography.[37])

1. Surveys
   - Magee
   - Kreinen and Officer
2. Case Studies
   - Fixed exchange rate periods
     - Australia: Zecher
     - Canada: Cox and Wilford
     - Canada: Cox
     - Germany: Kouri
     - Germany: Porter

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*In Rhomberg and Heller's terms: "In view of the availability of these two sets of data (on monetary statistics and balance of payments accounts) in a large number of countries for which other statistical information was scarce, the thought naturally presented itself to develop a framework that could take full advantage of this data base." Regarding the IMF studies in that volume, on one hand, it would be too generous to credit the IMF with the empirical, back-of-the-envelope discovery of the monetary approach. On the other, it would be unfair not to note their numerous empirical studies regarding money in an open economy. Further, J. J. Polak's early theoretical essay and the IMF's actual lending practice stress the importance of domestic credit restraint to the state of the balance of payments.[38]

Honduras: Wilford and Wilford
Jamaica: Beals and Collery
Japan: Bean
Mexico: Wilford and Zecher
Mexico: Wilford, Connolly, and Lackey
Mexico: Blejer
Spain: Guitian
Sweden: Genberg
United Kingdom: Jonson
Venezuela: Khan
Eight European countries: Putnam and Wilford

Flexible exchange rate periods:
Afghanistan: Fry
Germany: Frenkel, Frankel
United States–United Kingdom: Putnam and Woodbury, Clements and Frenkel
United States–Germany: Frankel
Peru: Edwards

Mixed exchange rate periods:
Brazil: Connolly and da Silveira, Blejer and Leiderman
Canada: Girton and Roper
England: Bilson

3. Cross-section studies

Capital flows offsetting monetary policy (four countries):
Kouri and Porter

Monetary approach to devaluation (18 countries):
Connolly and Taylor

Exchange rate determination with rational expectations (34 countries):
Bilson

Exchange market pressure model (five countries):
Sargen

Balance-of-payments determination (39 countries):
Aghevli and Khan

NOTES

1. David Hume, "Of the Balance of Trade," in *Essays, Moral, Political, and Literary* (1752), essay V, part II, reprinted in *International Trade Theory: Hume to Ohlin*, ed. W. R. Allen (New York: Random House, 1965), p. 34.

2. Ibid., p. 36.

3. See, for instance, Donald McClosky and J. Richard Zecher, "How the Gold Standard Worked 1880–1913," in Jacob Frenkel and Harry G. Johnson, eds., *The Monetary Approach to the Balance of Payments* (Toronto: University of Toronto Press, 1976).

4. Hume, op. cit., p. 36. See Paul Samuelson, "An Exact Hume–Ricardo–Marshall Model of International Trade," *Journal of International Economics* 1 (February 1971), for further discussion of this matter.

5. Hume, op. cit., p. 36.

6. See J. A. Frenkel and Harry G. Johnson, "The Monetary Approach to the Balance of Payments; Essential Concepts and Historical Origins," in J. A. Frenkel and H. G. Johnson, eds., *The Monetary Approach to the Balance of Payments* (Toronto: University of Toronto Press, 1976), and J. A. Frenkel and Harry G. Johnson, *The Economics of Exchange Rates* (Reading, Mass.: Addison-Wesley, 1978).

7. See L. Girton and D. Roper, "A Monetary Model of Exchange Market Pressure Applied to the Post-War Canadian Experiences," *American Economic Review* 60 (September 1977): 537–48.

8. Standing as two landmarks in the theoretical development of the monetary approach to the open economy are Robert A. Mundell, *International Economics* (New York: Macmillan, 1969); and Robert A. Mundell, *Monetary Theory* (Pacific Palisades, Calif.: Goodyear, 1971). Frenkel and Johnson's *The Monetary Approach to the Balance of Payments*, op. cit., contains a good number of key theoretical articles on the monetary approach, such as R. Dornbusch, "Devaluation, Money and Non-Traded Goods, "*American Economic Review* 61 (December 1973): 871–80. In addition it has a stimulating set of empirical studies. See also Harry G. Johnson, "The Monetary Approach to Balance of Payments Theory," in M. Connolly and A. Swoboda, eds., *International Trade and Money* (London: Allen and Unwin, 1973).

9. The following works are pertinent references: Milton Friedman, "The Optimum Quantity of Money," in the *Optimum Quantity of Money and Other Essays* (Chicago: Aldine, 1969): Milton Friedman, *A Program for Monetary Stability* (New York: Fordham University Press, 1960); and Milton Friedman and A. Schwartz, *A Monetary History of the United States 1867–1960*, National Bureau of Economic Research (Princeton, N.J.: Princeton University Press, 1963).

10. Harry G. Johnson, "The Monetary Approach to the Balance of Payments: A Non-technical Guide, "*Journal of International Economics* 7 (August 1977);263.

11. Mundell, *Monetary Theory*, op. cit.

12. Gustav Cassel, "The Present Situation of the Foreign Exchanges, "*The Economic Journal* (March 1916);62–65.

13. J. M. Keynes, "Theory of Money and the Exchanges," in J. M. Keynes, *Monetary Reform* (London; Macmillan, 1924), p. 111.

14. H. Genberg, "Aspects of the Monetary Approach to Balance of Payments Theory: An Empirical Study of Sweden," in Frenkel and Johnson, op. cit., pp. 198–326; P. Isard, "How Far Can We Push the Law of One Price," *American Economic Review* 65 (December 1977): 942–48; D. McClosky and R. Zecher, "How the Gold Standard Worked, 1880–1913," in Frenkel and Johnson, op. cit.; R. M. Dunn, "Flexible Exchange Rates and Oligopoly Pricing: A Study of Canadian Markets," *Journal of Political Economy* 78 (January 1970): 146–51; M. Connolly and J. da Silveira, "Exchange Market Pressure in Postwar Brazil," *American Economic Review* (June 1979); M. Connolly and Charles Lackey, "Presiones en el Mercado Cambiario de Mexico: 1955–82," in A. Violante and R. Davila, eds., *Mexico: Una Economia en Transición*, (Mexico City: Editorial Limusna, 1984); and D. Sykes Wilford, "Politica Monetaria en Mexico: Examen Retrospectivo y Perspectiva," in A. Violante and R. Davila, eds., *Mexico: Una Economia en Transicion* (Mexico City: Editorial Limusna, 1984).

15. M. Connolly and D. Taylor, "Testing the Monetary Approach to Devaluation in Developing Countries," *Journal of Political Economy* 84 (August 1976): 849–59.

16. Two recent articles containing an analysis of the timing of speculative attacks are M. Connolly and D. Taylor, "The Exact Timing of the Collapse of an Exchange Rate Regime and Its Impact upon the Relative Price of Traded Goods," *Journal of Money, Credit, and Banking* 16 (May 1984): 194–207; and Robert Flood and Peter Garber, "Collapsing Exchange Rate Regime: Some Linear Examples," *Journal of International Economics* 17 (August 1984): 1–13.

17. Connolly and da Silveira, op. cit.

18. R. Barro, "A Simple Flexible Exchange Rate Model with Uncertainty and Rational Expectations." Mimeographed, November 1975.

19. John Bilson, "A Simple Long-Run Model of Exchange Determination." Mimeographed, 1977; and John Bilson, "Rational Expectations and the Exchange Rate," in J. A. Frenkel and H. G. Johnson, eds., *The Economics of Exchange Rates: Selected Studies* (Reading, Mass.: Addison-Wesley, 1978).

20. See J. Frenkel, "A Monetary Approach to the Exchange Rate: Doctrinal Aspects and Empirical Evidence," *Scandinavian Journal of Economics* 78 (1976): 200–24; and J. Frenkel, "The Forward Exchange Rate, Expectations and the Demand for Money: The German Hyperinflation," *American Economic Review* 65 (September 1977): 653–69.

21. R. Dornbusch, "Exchange Rate Dynamics," *Journal of Political Economy* 84 (December 1976): 1161–76.

22. Irving Fisher, *The Theory of Interest* (New York, 1930).

23. See, for example, M. Whitman, "Global Monetarism and the Monetary Approach to the Balance of Payments," Brookings Papers on Economic Activity 3 (1975): 491–556.

24. P. Kouri and M. Porter, "International Capital Flows and Portfolio Equilibriums," *Journal of Political Economy* 82 (May-June 1974): 443–67.

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37. Some recent studies focusing on the monetary approach to floating exchange rates are: Kenneth Clements and Jacob Frenkel, "Exchange Rates, Money and Relative Prices: The Dollar-Pound in the 1920's," *Journal of International Economics* 10 (May 1980): 249–62, Jeffrey A. Frankel, "On the Mark: A Theory of Floating Exchange Rates Based on Real Interest Differentials," *American Economic Review*, 69 (September 1979): 610–22, Maxwell Fry, "A Monetary Approach to Afghanistan's Flexible Exchange Rate," *Journal of Money, Credit, and Banking* 8 (May 1976): 219–25, and Sebastian Edwards, "Floating Exchange Rates in Less Developed Countries: A Monetary Analysis of the Peruvian Experience, 1950–54," *Journal of Money, Credit, and Banking* 15, no. 1 (February 1983): 73–81. A recent monetary model of the managed float in Brazil is contained in Mario Blejer and Leonard Leiderman, "A Monetary Approach to the Crawling-Peg System: Theory and Evidence," *Journal of Political Economy* 89 (February 1981): 132–51.

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The modern theory of international adjustment--the monetary approach--has been developing through both the Bretton Woods fixed exchange rate period and the present flexible rate regime, but its genesis is embedded in the history of economic thought. History provides the roots of the theory needed to appreciate fully the flowering of this literature. As many authors have noted, the monetary approach traces its roots back to David Hume classic essay, Of the Balance of Trade, in his Essays, Moral, Political and Literary, published in 1752.Â 1: The Monetary Approach to an Open Economy: The Fundamental Theory Revisited 11. 2: Of Money and Prices: Some Historical Perspectives 27. CONCLUSIONS 51.