THE MONETARY APPROACH TO BALANCE OF PAYMENTS: A REVIEW OF THE SEMINAL LONG-RUN EMPIRICAL RESEARCH

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ABSTRACT

This paper provides a review of the seminal long-run empirical research on the monetary approach to the balance of payments with a comprehensive reference guide to the literature. The paper reviews the three major alternative theories of balance of payments adjustments. These theories are the elasticities and absorption approaches (associated with Keynesian theory), and the monetary approach. In the elasticities and absorption approaches the focus of attention is on the trade balance with unemployed resources. In the monetary approach, on the other hand, the focus of attention is on the balance of payments (or the money account) with full employment. The monetary approach emphasizes the role of the demand for and supply of money in the economy. The paper focuses on the monetary approach to balance of payments and reviews the seminal long-run empirical work on the monetary approach to balance of payments. Throughout, the paper provides a comprehensive set of references corresponding to each point discussed. Together, these references exhaust the existing long-run research on the monetary approach to balance of payments.

INTRODUCTION

This paper provides a review of the seminal long-run empirical research on the monetary approach to the balance of payments with a comprehensive reference guide to the literature. The paper reviews the three major alternative theories of balance of payments adjustments. These theories

are the elasticities and absorption approaches (associated with Keynesian theory), and the monetary approach. In the elasticities and absorption approaches the focus of attention is on the trade balance with unemployed resources. The elasticities approach emphasizes the role of the relative prices (or exchange rate) in balance of payments adjustments by considering imports and exports as being dependent on relative prices (through the exchange rate). The absorption approach emphasizes the role of income (or expenditure) in balance of payments adjustments by considering the change in expenditure relative to income resulting from a change in exports and/or imports. In the monetary approach, on the other hand, the focus of attention is on the balance of payments (or the money account) with full employment. The monetary approach emphasizes the role of the demand for and supply of money in the economy. The paper focuses on the monetary approach to balance of payments and reviews the seminal long-run empirical work on the monetary approach to balance of payments. Throughout, the paper provides a comprehensive set of references corresponding to each point discussed. Together, these references exhaust the existing long-run research on the monetary approach to balance of payments.

This study is organized in the following way: First it reviews three alternative theories of balance of payments adjustments. They are the elasticities and absorption approaches (associated with Keynesian theory), and the monetary approach. Then, the seminal long-run empirical work on the monetary approach is reviewed. It notes that the literature may be divided into two classes, long run (associated with Johnson) and short run (associated with Prais). Then, the review focuses on the seminal long-run literature. The theoretical model is described first, and then the estimated results are reported. At the end of the discussion, some of the shortcomings of the long-run approach and possible ways to reduce these shortcomings are pointed out.

DIFFERENT APPROACHES TO THE BALANCE OF PAYMENT ANALYSIS

Three alternative theories of balance of payments adjustment are briefly reviewed in this section. They are commonly known as the elasticities, absorption, and monetary approaches. Ardalan (2003) provides a more complete review of these three theories and reviews the short-run empirical work on the monetary approach to balance of payments. The current paper avoids repeating the references which already appear in Ardalan (2003).

The elasticities approach applies the Marshallian analysis of elasticities of supply and demand for individual commodities to the analysis of exports and imports as a whole. It is spelled out by Joan Robinson (1950).

Robinson was mainly concerned with the conditions under which devaluation of a currency would lead to an improvement in the balance of trade. Suppose the trade balance equation is written as:

X = value of exports
IM = value of imports
BT = balance of trade

$$BT = X - IM \qquad (1)$$

In this context, it is generally assumed that exports depend on the price of exports, and imports depend on the price of imports. These relations are then translated into elasticities, by differentiating the above equation with respect to the exchange rate. A criterion for a change of the balance of trade in the desired direction can be established, assuming that export and import prices adjust to equate the demand for and supply of exports and imports.

The effect of a devaluation on the trade balance depends on four elasticities: the foreign elasticity of demand for exports, and the home elasticity of supply, the foreign elasticity of supply of imports, and the home elasticity of demand for imports. For the special case where it is assumed that the trade balance is initially zero and that the two supply schedules are

infinitely elastic, the elasticities condition for the impact of a devaluation to be an improvement in the trade balance, is that the sum of the demand elasticities exceed unity. This has been termed the "Marshall-Lerner condition."

A notable shortcoming of the elasticities analysis is its neglect of capital flows. Even though the adherents of the elasticities approach were attempting to guide the policy-maker in improving the country's balance of payments, their focus, nevertheless, was on the balance of trade (net exports of goods and services).

The absorption approach was first presented by Alexander (1952). He sought to look at the balance of trade from the point of view of national income accounting:

Y = domestic production of goods and services
E = domestic absorption of goods and services, or domestic total expenditure
BT = balance of trade

$$BT = Y - E \qquad (2)$$

The above identity is useful in pointing out that an improvement in the balance of trade calls for an increase in production relative to absorption.

When unemployed resources exist, the following mechanism is visualized: the effect of a devaluation is to increase exports and decrease imports. This in turn causes an increase in production (income) through the multiplier mechanism. If total expenditure rises by a smaller amount, there will be an improvement in the balance of trade. Thus, the balance is set to be identical with the real hoarding of the economy, which is the difference between total production and total absorption of goods and services, and therefore equal to the accumulation of securities and/or money balances. In the presence of unemployment, therefore, devaluation not only aids the balance of payments, but also helps the economy move towards full employment and is, therefore, doubly attractive.

The absorption approach can be said to work only in the presence of unemployed resources. The absorption approach is a significant improvement

over the elasticities approach in one important sense, this is its view of the external balance via national income accounting. In this manner, the approach relates the balance to the happenings elsewhere in the economy rather than taking the partial equilibrium view of the elasticities approach in analyzing the external sector in isolation.

The elasticities and absorption approaches are concerned with the balance of trade while the monetary approach concerns itself with the deficit on monetary account. In principle, this balance consists of the items that affect the domestic monetary base.

The monetary approach, like the absorption approach, stresses the need for reducing domestic expenditure relative to income, in order to eliminate a deficit in the balance of payments. However, whereas the absorption approach looks at the relationship between real output and expenditure on goods, the monetary approach concentrates on deficient or excess nominal demand for goods and securities, and the resulting accumulation or decumulation of money.

The monetary approach looks at the balance of payments as the change in the monetary base less the change in the domestic component:

H = change in the quantity of money demanded
D = domestic credit creation

$$BP = DH - DD \qquad (3)$$

where the "italic D," i.e., *D*, appearing in front of a variable designates the "change" in that variable. That is, *D* is the first difference operator: $DX = X_{(t)} - X_{(t-1)}$.

Putting just monetary assets rather than all assets "below the line" contributes to the simplicity of the monetary approach. Other things being equal, growth in demand for money, and of factors that affect it positively should lead to a surplus in the balance of payments. Growth in domestic money, other things being equal, should worsen it. Thus, the growth of real output in a country with constant interest rates causes its residents to demand a growing stock of real and nominal cash balances. This means that the

country will run a surplus in the balance of payments. In order to avoid a payments surplus, the increase in money must be satisfied through domestic open market operations. To produce a deficit, domestic money stock must grow faster than the growth of real income.

This analysis suggests that if a country is running a deficit, then assuming that the economy is growing at its full-employment growth rate with a given rate of technological progress, it should curtail its rate of domestic monetary expansion. Use of other measures like the imposition of tariffs, devaluation or deflation of aggregate demand by fiscal policy can succeed only in the short run.

REVIEW OF THE SEMINAL LONG-RUN EMPIRICAL RESEARCH

Empirical work on the monetary approach to the balance of payments can be divided into two different approaches; one tests the theory in long-run equilibrium, the other considers the adjustment mechanism and the channels through which equilibrium is reached. The first approach is based on the reserve flow equation developed by H. G. Johnson (1972). Testing was undertaken by J.R. Zecher (1974) and others. The second approach is based on theoretical work of S.J. Prais (1961), with corresponding empirical work undertaken by R.R. Rhomberg (1977) and others. In this paper, seminal long-run approach is reviewed by representing the underlying theoretical model first, and then looking at a few well-known empirical estimations of the model.

First, this section introduces the reserve flow equation and two methods that can be used to evaluate the theory. Next, three representative and well-known tests are reviewed. Last, some of the shortcomings of this long-run approach are discussed and ways to reduce them are pointed out. For a comprehensive list of references which have estimated either the "reserve flow equation" or the "exchange market pressure equation" see appendix 1. For a comprehensive list of references which have estimated the "capital flow equation," which is a variant of the "reserve flow equation," see appendix 2.

At this point it is appropriate to note that in the long run there is no unemployment and no arbitrage opportunities exist; i.e., full-employment output is exogenous, and prices and interest rates are equal across countries. Since most of the literature considers small countries, prices and interest rates are, therefore, determined exogenously in the world commodity and capital markets.

Johnson's Theoretical Formulation and Its Empirical Implications

The reserve flow equation is associated with H.G. Johnson (1972). For a small country with a fixed exchange rate, the equation can be derived by the following system: The demand for money, equation (4), is dependent on the foreign and domestic price level, P, real income, Y, and the nominal interest rate, i. The supply of money, equation (5), is dependent on the magnitude of the money multiplier, m, and the sum of international, R, and domestic, D, assets of the central bank. Equation (6) specifies equilibrium in the money market.

$$M^d = P.L(Y,i) \quad (4)$$
$$M^s = m.(R+D) \quad (5)$$
$$M^d = m.(R+D) \quad (6)$$

In stationary steady state, this model implies that the balance of payments is zero. In order to obtain non-zero reserve flows, the model is reformulated in terms of steady state "growth." Letting "g" denote the percentage growth rate of a variable, i.e., $g_x = (1/x)(dx/dt)$, equation (6) implies the following equations:

$$g_{Md} = g_m + g_{(R+D)} \quad (7)$$
$$g_{Md} = g_m+[R/(R+D)].g_R+[D/(R+D)].g_D \quad (8)$$

Letting e_x signify elasticity of money demand with respect to x, the demand for money in growth terms is:

$$g_{Md} = g_P + e_Y.g_Y + e_i.g_i \quad (9)$$

Combining equations (8) and (9) with the equilibrium condition yields:

$$g_P + e_Y.g_Y + e_i.g_i = g_m + [R/(R+D)].g_R + [D/(R+D)].g_D \quad (10)$$
$$[R/(R+D)].g_R = g_P + e_Y.g_Y + e_i.g_i - g_m - [D/(R+D)].g_D \quad (11)$$

Equation (11) is the reserve flow equation developed by Johnson (1972). It is the foundation for almost all long-run analysis.

Ordinary least squares can be applied to the reserve flow equation if the following conditions hold; there is no sterilization of reserve changes, and real income, prices, and interest rates are exogenous. Given the earlier assumptions, all of these conditions must hold for a small country with a fixed exchange rate. In this model the domestic monetary authorities have no control over any real or nominal variables in the economy except the domestic component, D, of high-powered money, and, through reserve flows, international reserves. See Magee (1976).

Bijan Aghevli and Mohsin Khan (1977) point out that in utilizing the reserve flow equation, one can use basically two methods. For a comprehensive list of references which have applied either of the two methods see appendix 3. One method is to estimate the reserve flow equation directly, and then check the signs and values of the estimated coefficients. For a comprehensive list of references which have estimated either the "reserve flow equation" or the "exchange market pressure equation" and have discussed signs and values of the coefficients in the context of the monetary approach to balance of payments see appendix 4. For a comprehensive list of references which have estimated either the "reserve flow equation" or the "exchange market pressure equation" and have not only discussed signs and values of the coefficients in the context of the monetary approach to balance of payments but also contrasted them with those as expected by the Keynesian approach see appendix 5. For a comprehensive list of references which have estimated either the "reserve flow equation" or the "exchange market pressure equation" and have not only discussed signs and values of the coefficients in the context of the monetary approach to balance of

payments and contrasted them with those as expected by the Keynesian approach but also explicitly decided in favor of one theory or the other see appendix 6. The other is to estimate a demand for money function and substitute it into the reserve flow equation. Simulated values from this equation then can be compared with actual values to test the tracking ability of the model. For a comprehensive list of references which have applied this second method see appendix 7.

Using the first method, one has to know what signs and magnitudes to expect for the estimates of coefficients. The coefficient for g_Y is e_Y, the income elasticity of demand for money. It should be positive and in the neighborhood of unity. For given interest rates, price levels, money multiplier, and domestic credit, growth in income generates an increased demand for money, and a reserve inflow just sufficient to result in an increase in the nominal and real money stock. This result conflicts with the simple Keynesian model in which rising income increases imports and presumably generates a reserve outflow.

The coefficient for g_i is the interest elasticity of the demand for money, which is negative. Increases in the interest rate are associated with reserve outflows in this hypothesis. The interest rate is viewed as a proxy for world interest rates, and changes in this interest rate are taken to reflect similar movements in rates around the world. Given foreign price levels, an increase in interest rates reduces the demand for money and generates reserve losses.

The coefficient for g_P is unity because the elasticity of money demand with respect to the price level is unity. Domestic and world prices are assumed to be equal. As a result, price changes have a positive effect on reserve flows. An increase in prices reduces real money balances (increases demand for nominal balances) and, other things being equal, leads to a reserve inflow just sufficient to restore real money balances to their previous level.

The final two variables reflect domestic influences on the money stock, and both variables are responsive to policy actions by the monetary authorities. An increase in either variable tends to increase the stock of money and, other things being equal, should lead to an outflow of reserves

sufficient to restore the real money stock to its previous level. See Zecher (1974). As a result, the coefficient for g_m must be unity while the coefficient for g_D depends on the relative importance of domestic assets in the central bank's portfolio, i.e., [D/(R+D)].

Before turning to the empirical work on this approach, the following point should be made clear. The data used to measure changes in international reserves does not correspond exactly to the theoretical concept. The balance of payments measure in the monetary theory shows the effect of a deficit or surplus on the monetary base. In the case of the United States, the deficit or surplus is composed of: (a) changes in U.S. holdings of gold, convertible foreign currencies, and monetized Special Drawing Rights (with positive changes increasing the monetary base), and (b) changes in foreign deposits at the Federal Reserve Bank (with positive changes decreasing the monetary base).

The nearest, although imperfect, approximation to this measure in most official statistics is the Official Settlements concept of a deficit or surplus, or the very similar balance on Official Reserves Transactions. The major difference between these measures and the balance affecting the monetary base is that the official measures include changes in foreign official holdings of U.S. securities and commercial bank deposits in the United States.

Empirical testing of the monetary approach invariably uses the Official Settlements concept of the imbalance rather than the monetary base, because the latter concept is relatively new and, except for the United States, is not generally published in official statistics. Since most models developed to test the monetary approach pertain to countries other than the United States, in practice, the only recorded balance of payments measure that resembles a balance on the monetary account is the Official Settlements. The studies reviewed here, therefore, use the Official Settlement concept. See Kreinin and Officer (1978). The difference between the two measures is minimal or non-existent for small countries, especially under-developed ones.

Zecher's Results

The most frequently cited empirical work in the long-run literature is Richard Zecher (1974). Zecher (1974) estimates the reserve flow equation for Australia, using quarterly data for the period 1951-II through 1971-I, and annual data between 1951 and 1971. His results are reported in Table 1.

Table 1: Zecher: Reserve Flow Equations

Quarterly:

$$(R/R+D).g_R = 1.11\ g_Y - 0.035\ g_P + 0.65\ g_i - 0.89\ g_m - 1.06\ (D/R+D).g_D$$
$$(6.54)\quad (-1.08)\quad (3.70)\quad (-12.77)\quad (-20.92)$$

adjusted R-squared = 0.89 D-W = 1.69

Annual:

$$(R/R+D).g_R = 0.92\ g_Y - 0.11\ g_P + 1.38\ g_i - 1.14\ g_m - 1.23\ (D/R+D).g_D$$
$$(3.54)\quad (-0.75)\quad (2.56)\quad (-5.08)\quad (-7.97)$$

adjusted R-squared = 0.93 D-W = 2.13

The numbers in parenthesis are t-statistics.

Zecher's (1974) estimates, in both cases, support the monetary approach. The estimated coefficients of g_P, g_m, and $[D/(R+D)].g_D$ for the quarterly observations are all within two standard errors of their hypothesized values of +1 and -1. The coefficient for interest rates is negative, but not significant.

These results suggest that the Australian experience over the period 1950-71 has been consistent with the monetary approach to the balance of payments. The novel implications that both economic growth and increases in the price level lead to surpluses are supported by the evidence. The implication that rises in domestic interest rates lead to deficits, while not finding strong support, is consistent with the results of these regressions. Finally, the two variables reflecting domestic influences on the money stock,

g_m and $[D/(R+D)].g_m$, appear to have dependable, negative effects on reserve flows.

Wilford and Wilford's Results

Sykes Wilford and Walton Wilford (1978) examine the Honduran case. They estimate a reserve flow equation using annual data for the period 1950-1974, and quarterly data from 1966-IV to 1974-IV. Their results are reported in Table 2, respectively.

Table 2: Wilford and Wilford: Reserve Flow Equations

Annual:

$$(R/R+D).g_R = 1.11\ g_Y - 0.16\ g_i + 1.12\ g_P - 0.94\ g_m - 0.88\ (D/R+D).g_D$$
$$(4.09)\quad (-2.01)\quad (3.61)\quad (-3.47)\quad (-6.76)$$

R-squared = 0.81 D-W = 2.46

Quarterly:

$$(R/R+D).g_R = 1.155\ g_Y - 0.059\ g_i - 0.135\ g_P - 0.531\ g_m - 0.901\ (D/R+D).g_D$$
$$(2.011)\quad (-0.567)\quad (-0.779)\quad (-2.226)\quad (-9.372)$$

R-squared = 0.76 D-W = 2.04

The numbers in parenthesis are t-statistics.

When annual data are used, coefficients are significantly different from zero, have the appropriate signs and are not statistically different from their hypothesized values at the 5 percent level of significance. Results using quarterly data are not as strong as those using annual data. The coefficient for g_P is negative, but not significant and the coefficient for g_m is negative and significant, but well below one. Given the short-run nature of this data, the weaker results are not surprising.

Aghevli and Khan's Results

Bijan Aghevli and Mohsin Khan (1977) use cross-sectional data to estimate both a demand for money and reserve flow equation for 39 developing countries. After checking the signs and values of coefficients for money demand they are substituted into a reserve flow equation. Then, the simulated and actual values of the change in reserves are compared. The estimated money demand and reserve flow equations are reported in Table 3.

Table 3: Aghevli and Khan: Money Demand and Reserve Flow Equations

Money Demand:

$$g_M = -3.8100 + 0.2611\ g_P - 2.3575\ g_Y - 0.1142\ g_{IP}$$
$$(-1.22)\quad (2.19)\quad (4.20)\quad (-1.03)$$

adjusted R-squared = 0.3374

Reserve Flow Equation:

$$(R/R+D).g_R = -4.2476 + 0.2569\ g_P + 1.0276\ g_Y - 0.1214\ g_{IP} - 0.1452\ g_m - 0.4150\ (D/R+D)g_D$$
$$(-2.74)\quad (3.39)\quad (3.67)\quad (-2.00)\quad (-0.58)\quad (-6.62)$$

adjusted R-squared = 0.6244

The numbers in parenthesis are t-statistics.

The demand for real money balances is specified as a function of real income and the rate of inflation, where IP is defined as (1/P)(dP/dt). In those countries where interest rates are available, they are not very meaningful because they tend to be constant over substantial time periods. Results reject homogeneity in prices. The coefficient of the rate of growth in prices is significantly less than unity. What confidence should be placed in this result is uncertain. The coefficient for the rate of growth in inflation also is not significantly different from zero and this may be due to multi-collinearity between the level and rate of change in inflation. The size of the income

elasticity of demand for money is too large. Aghevli and Khan argue that this is to be expected for developing economies since the public holds most of its savings in money form owing to the absence of alternative financial assets. In so far as savings increase more than proportionately with economic growth, the estimated income elasticity will exceed unity. The general fit of the equation as measured by the coefficient of determination is poor, but that is not unusual for cross-sectional data.

The estimate of the reserve flow equation shows that all estimated coefficients have the expected signs, and, apart from the coefficient of the rate of growth in the money multiplier, all are significantly different from zero, at least at the 5 percent level. The coefficient of the rate of inflation is substantially less than unity, indicating a high degree of money illusion in the demand for nominal money balances. The income coefficient is now much closer to what would be expected, as its value is not significantly different from unity. The estimated coefficient of the rate of growth in domestic assets held by the central bank is significantly different from unity. This implies that all increases in this variable will not leak out in the balance of payments. Perhaps this is so because some of the assumptions behind the theory are not satisfied. If an open market operation leads to a change in either prices or real income, and thereby changes the public's demand for money, the effect on the balance of payments will be reduced. The fit of the equation is much better than is obtained for the demand for money, with more than 60 percent of the variation of the dependent variable being captured by this specification.

The money demand equation which is estimated above is substituted in a reserve flow equation and the actual and predicted values of reserve flows are then compared. The model does not do very well as the correlation coefficient between actual and predicted values is 0.7659.

Comments on the Long-Run Approach

As mentioned at the beginning of this section, ordinary least squares can be applied to the reserve flow equation if there are no sterilization

operations, and real income, prices, and interest rates are all exogenous. See Magee (1976). A few comments on these assumptions are in order.

a. *Sterilization*: The reserve flow equation cannot be used if the central bank sterilizes reserve flows. Sterilization leads to biased estimates of the coefficients of the reserve flow equation. If there is an exogenous increase in the home demand for money caused, for example, by an increase in world, and hence, domestic prices, then reserves flow in. If the monetary authorities sterilize even partially, they sell domestic assets as they buy foreign exchanges, generating an inverse relation between g_R and g_D. As a result, if we cannot exclude the possibility of sterilization, the coefficient for $[D/(R+D)].g_D$ will be biased toward unity and yields little or no support for the monetary approach. See Darby (1980).

b. *Exchange Rate*: The estimates of the coefficients in the reserve flow equation will not be as expected if some demand variables are excluded from the reserve flow equation. For example, an increase in domestic credit will lead to a depreciation of the (excluded) foreign exchange rate when the latter is within the band set by the exchange authorities. This absorbs some of the excess supply of dollars so that reserves do not fall by the same amount. Thus, ordinary least squares estimates of the coefficients will be biased. See Magee (1976). In particular, the coefficient for $[D/(R+D)].g_D$ will be biased away from unity.

c. *Simultaneity*: The small country, long-run, full-employment assumptions allow monetarists to assume that income, Y, prices, P, and interest rates, i, are exogenous and unaffected by the supply of money. But if they are not, ordinary least squares estimates of the reserve flow equation can lead to simultaneous equation bias. Consider causation the other way. In a typical Keynesian model, an autonomous increase in exports increases reserves, the money supply, real income, and possibly prices. Without proper specification and estimation, we do not know whether the coefficients in the reserve flow equation reflect just the interaction between the demand for and supply of money, or the influence of money on income and prices. See Magee (1976).

It is appropriate at this point to consider sterilization further. Consider the case in the previous paragraph. After the autonomous increase in exports

and the consequent increase in reserves (R), the money supply, real income, and money demand, assuming no sterilization, the coefficient for the domestic credit variable (D) in the reserve flow equation will be zero, since the increase in reserves (R) is absorbed by the demand for money while there is no change in domestic credit. However, if sterilization is complete, the coefficient will be -1. We should note that under the monetarist assumption of no sterilization, a non-monetarist result of zero coefficient for domestic assets, D, is obtained while under the non-monetarist assumption of complete sterilization, a monetarist result of a -1 coefficient for domestic asset, D, is obtained. These cases show that estimates of -1 for domestic assets, D, have little discriminatory power unless there is independent evidence about the degree of sterilization.

Due to these effects, ordinary least squares estimates of the coefficients of the reserve flow equation do not constitute a reliable empirical test of the monetary approach to the balance of payments. The following section discusses some of the ways that these problems have been dealt with in the literature.

Suggested Ways to Reduce the Problems

a. *Sterilization*: To account for sterilization by central banks, one can specify a central bank reaction function and estimate it simultaneously with the reserve flow equation. Genberg (1976), in his study of Sweden's balance of payments, considers the following central bank reaction function, together with a reserve flow equation:

$$[D/(R+D)].g_D(t) = b_0 + b_1.[R/(R+D)].g_R(t) + b_2.GT(t) + u_1(t)$$

$$[R/(R+D)].g_R(t) = a_0 + a_1.[D/(R+D)].g_D(t) + a_2.g_m(t) + a_3.[LOG\ P(t) - a.LOG\ P(t-1)] + a_4.[LOG\ Y(t) - a.LOG\ Y(t-1)] + a_5.[LOG_{\ i}(t) - a.LOG_{\ i}(t-1)] + a_6.LOG\ M(t-1) + u_2(t)$$

where GT is the government debt outstanding. The central bank reaction function assumes that open market operations are dictated by the change in

international reserves (the sterilization hypothesis) and the change in outstanding governmental debt (on the hypothesis that the central bank is a large source of finance for the government). For a comprehensive list of references in the context of the "reserve flow equation" and "exchange market pressure equation" of the monetary approach to balance of payments which discuss sterilization see appendix 8. For a comprehensive list of references in the context of the "capital flow equation" of the monetary approach to balance of payments which discuss sterilization see appendix 9. For a comprehensive list of references in the context of the "reserve flow equation" and "exchange market pressure equation" of the monetary approach to balance of payments which discuss the central bank reaction function see appendix 10. For a comprehensive list of references in the context of the "capital flow equation" of the monetary approach to balance of payments which discuss the central bank reaction function see appendix 11. For a comprehensive list of references in the context of the "reserve flow equation" of the monetary approach to balance of payments which discuss the causality tests of the type Granger (1969), Geweke (1978), Haugh (1976), Hausman (1978), or Sims (1972) see appendix 12.

The results of two stage least squares estimates of the parameters, using quarterly data for the period 1950-II to 1968-IV, are reported in Table 4. The results indicate that the specification of the central bank reaction function is inadequate, in that the government financing fails to be significant. This is likely to be the result of short-run instability of the central bank's policy response due to the existence of many alternative targets. Experiments with yearly data did produce a significantly positive b_2 which was consistent with the long-run need for deficit financing through the central bank.

Table 4: Genberg's Model: Two-Stage Least Squares Estimates of the Parameters

Money*	a_0	a_1	a_2	a_3	a_4 (P)	a_4 (T)	a_4 (C)	a_5	a_6	b_0	b_1	b_2
M1	0.43	-1.31	-0.27	1.12	-0.14	0.20		0.01	-0.04	0.012	-0.57	0.02
	(0.26)	(1.03)	(0.49)	(0.74)	(0.37)	(0.48)		(0.03)	(0.02)	(0.004)	(0.25)	(0.06)
M1	0.39	-1.23	-0.23	1.06			-0.04	0.01	-0.04	0.011	-0.53	0.02
	(0.17)	(0.63)	(0.30)	(0.45)			(0.25)	(0.03)	(0.02)	(0.004)	(0.27)	(0.06)
M2	-0.01	1.39	-0.87	0.90	-0.58	0.24		0.00	0.01	0.016	0.94	0.03
	(0.10)	(0.28)	(0.66)	(0.33)	(0.41)	(0.47)		(0.02)	(0.02)	(0.003)	(0.21)	(0.05)
M2	0.03	-1.11	-0.53	0.81			-0.02	0.00	0.00	0.015	-0.88	-0.02
	(0.05)	(0.37)	(0.31)	(0.21)			(0.23)	(0.02)	(0.01)	(0.003)	(0.21)	(0.05)

* "Money" refers to the definition of money used in the regression.

P = Permanent income T = Transitory income C = Current income

The numbers in parenthesis indicate standard errors.

As far as the reserve flow equation is concerned, the estimates of the coefficients of g_D, g_m, and g_P are not significantly different from their expected values of -1 (for the first two) and +1. The income and interest rate coefficients are not significant at 95 percent confidence level. Genberg (1976) concludes that it does not appear that the sterilization hypothesis offers a very plausible alternative to the explanation of reserve flows.

In general, a considerable literature has arisen from empirical investigations of sterilization. While these studies indicate that at least some degree of sterilization has been or could be undertaken in the short run by the countries surveyed, they also suggest a wide range of experience, even among industrialized nations. Besides indicating wide variations in experience among countries, all studies conducted so far have been subject to serious problems of simultaneity, revealing the need for much more work to develop better empirical tests of the general applicability of the monetary approach and its policy implications. See Whitman (1975).

b. *Exchange Rate*: To account for the excluded variable of foreign exchange rates, one can use the "exchange market pressure" formulation of

the monetary approach developed by Lance Girton and Don Roper (1977). In their formulation of the monetary approach the dependent variable is the sum of: (i) the change in reserves as a percentage of the base, and, (ii) the percentage rate of appreciation of the domestic currency. This allows disequilibrium among national money markets to be resolved by reserve flows, changes in the exchange rate, or some combination of the two. For a comprehensive list of references which have followed this approach see appendix 13.

In a two-country model, where one of them is the reserve currency country, the authors derive the following equation for the non-reserve currency country:

$$[(DR/H) + D(1/r)/(1/r)] = a.(DD/H) + b.[DH(v)/H(v)] + c.(DY/Y) + d.[DY(v)/Y(v)]$$

where r is the foreign exchange rate, H is the monetary base, and variables preceding (v) pertain to the reserve currency country. As shown in Table 5, for the composite dependent variable over the 1952-74 period annual estimates for Canada vis-à-vis the United States yield good fits. The United Sates is considered the reserve currency country.

Table 5: Girton-Roper Model

Money*	Constant	a	b	c	d	R-squared	D-W
M2	-0.04	-0.96	1.14	2.80	-2.84	0.92	1.80
	(1.08)	(12.74)	(4.86)	(3.01)	(3.59)		
M1	-0.03	-0.96	1.74	2.54	-2.51	0.95	2.11
	(1.38)	(16.03)	(8.37)	(3.97)	(4.83)		
H	-0.03	-0.97	1.61	2.63	-2.62	0.96	2.29
	(1.43)	(18.53)	9.09	4.46	5.35		

* "Money" refers to the definition of money used in the regression.

The numbers in parethesis are t-statistics.

In this section, typical empirical work on the monetary approach to the balance of payments based on long-run analysis were reviewed and some problems involved with ways to reduce them were discussed. In the next section, the same methodology will be followed for existing empirical work on the monetary approach to the balance of payments based on a short-run approach.

CONCLUSION

This paper provided a review of the seminal long-run empirical research on the monetary approach to the balance of payments with a comprehensive reference guide to the literature. The paper reviewed the three major alternative theories of balance of payments adjustments. These theories were the elasticities and absorption approaches (associated with Keynesian theory), and the monetary approach. In the elasticities and absorption approaches the focus of attention was on the trade balance with unemployed resources. The elasticities approach emphasized the role of the relative prices (or exchange rate) in balance of payments adjustments by considering imports and exports as being dependent on relative prices (through the exchange rate). The absorption approach emphasized the role of income (or expenditure) in balance of payments adjustments by considering the change in expenditure relative to income resulting from a change in exports and/or imports. In the monetary approach, on the other hand, the focus of attention was on the balance of payments (or the money account) with full employment. The monetary approach emphasized the role of the demand for and supply of money in the economy. The paper focused on the monetary approach to balance of payments and reviewed the seminal long-run empirical work on the monetary approach to balance of payments. Throughout, the paper provided a comprehensive set of references corresponding to each point discussed. Together, these references would exhaust the existing long-run research on the monetary approach to balance of payments.

APPENDIX 1

This is a comprehensive list of references which have estimated or discussed either the "reserve flow equation" or the "exchange market pressure equation."

Aghevli and Khan (1977), Akhtar (1986), Akhtar, Putnam, and Wilford (1979), Arize, Grivoyannis, Kallianiotis, and Melindretos (2000), Asheghian (1985), Bean (1976), Beladi, Biswas, and Tribedy (1986), Bhatia (1982), Bilquees (1989), Blejer (1979), Bourne (1989), Boyer (1979), Brissimis and Leventakis (1984), Burdekin and Burkett (1990), Burkett, Ramirez, and Wohar (1987), Burkett and Richards (1993), Civcir and Parikh (1992), Cobham (1983), Connolly (1985), Connolly and Da Silveira (1979), Connolly and Taylor (1976, 1979), Coppin (1994), Costa Fernandes (1990), Courchene and Singh (1976), Cox (1978), Cox and Wilford (1976), Farhadian and Dunn, Jr. (1986), Feige and Johannes (1981), Fontana (1998), Frenkel, Gylfason, and Helliwell (1980), Genberg (1976), Girton and Roper (1977), Grubel and Ryan (1979), Guitian (1976), Gupta (1984), Hacche and Townend (1981), Hodgson and Schneck (1981), Ibrahim and Williams (1978), Jager (1978), Jayaraman (1993), Jimoh (1990), Johannes (1981), Joyce and Kamas (1985), Kamas (1986), Kemp and Wilford (1979), Kenneally and Finn (1985), Kenneally and Nhan (1986), Khan (1973, 1990), Killick and Mwega (1993), Kim (1985), Laney (1979), Lee and Wohar (1991), Leiderman (1980), Leon (1988), Looney (1991), Luan and Miller (1979), Mah (1991), Martinez (1999), McCloskey and Zecher (1976), McNown and Wallace (1977), Miller (1978), Modeste (1981), Pentecost, Van Mooydonk, and Van Poeck (2001), Phaup and Kusinitz (1977), Putnam and Wilford (1986), Rasulo and Wilford (1980), Roper and Turnovsky (1980), Sargen (1975, 1977), Sheehey (1980), Sohrab-Uddin (1985), Sommariva and Tullio (1988), Spanos and Taylor (1984), Taylor, M.P. (1987a, 1987b), Thornton (1995), Tullio (1979, 1981), Watson (1988, 1990), Weymark (1995), Wilford (1977), Wilford and Wilford (1977, 1978), Wilford and Zecher (1979), Wohar and Burkett (1989), Wohar and Lee (1992), and Zecher (1974).

APPENDIX 2

This is a comprehensive list of references which have estimated the "capital flow equation."

Argy and Kouri (1974), Artus (1976), Brunner (1973), Darby (1980), De Grauwe (1975), Fratiani (1976), Herring and Marston (1977), Hodjera (1976), Kouri (1975), Kouri and Porter (1972, 1974), Kulkarni (1985), Laskar (1981, 1982), Luan and Miller (1979), Martinez (1999), Murray (1978), Neuman (1978), Obstfeld (1980, 1982), Porter (1972, 1974), and Stockman (1979).

APPENDIX 3

This is a comprehensive list of references which have either estimated the "reserve flow equation" or estimated the demand for money and substituted it in the "reserve flow equation."

Aghevli and Khan (1977), Akhtar (1986), Akhtar, Putnam, and Wilford (1979), Arize, Grivoyannis, Kallianiotis, and Melindretos (2000), Asheghian (1985), Bean (1976), Beladi, Biswas, and Tribedy (1986), Bhatia (1982), Bilquees (1989), Blejer (1979), Boyer (1979), Civcir and Parikh (1992), Cobham (1983), Connolly and Taylor (1976, 1979), Coppin (1994), Courchene and Singh (1976), Cox (1978), Cox and Wilford (1976), Fontana (1998), Frenkel, Gylfason, and Helliwell (1980), Genberg (1976), Grubel and Ryan (1979), Guitian (1976), Gupta (1984), Ibrahim and Williams (1978), Jager (1978), Jayaraman (1993), Jimoh (1990), Johannes (1981), Joyce and Kamas (1985), Kamas (1986), Kemp and Wilford (1979), Kenneally and Finn (1985), Khan (1973, 1990), Killick and Mwega (1993), Leiderman (1980), Leon (1988), Looney (1991), Luan and Miller (1979), McCloskey and Zecher (1976), McNown and Wallace (1977), Miller (1978), Phaup and Kusinitz (1977), Putnam and Wilford (1986), Rasulo and Wilford (1980), Roper and Turnovsky (1980), Sheehey (1980), Sohrab-Uddin (1985), Sommariva and Tullio (1988), Spanos and Taylor (1984), Taylor, M.P. (1987a, 1987b), Tullio (1979, 1981), Watson (1988, 1990), Wilford (1977), Wilford and Wilford (1977, 1978), Wilford and Zecher (1979), Wohar and Burkett (1989), and Zecher (1974).

APPENDIX 4

This is a comprehensive list of references which have estimated either the "reserve flow equation" or the "exchange market pressure equation" and/or theoretically have discussed signs and values of the coefficients in the context of the monetary approach to balance of payments.

Aghevli and Khan (1977), Akhtar, Putnam, and Wilford (1979), Arize, Grivoyannis, Kallianiotis, and Melindretos (2000), Bean (1976), Beladi, Biswas, and Tribedy (1986), Bhatia (1982), Connolly and Taylor (1976, 1979), Dornbusch (1971), Fontana (1998), Frenkel, Gylfason, and Helliwell (1980), Genberg (1976), Hacche and Townend (1981), Jager (1978), Kamas (1986), Kemp and Wilford (1979), Kenneally and Finn (1985), Komiya (1969), Lee and Wohar (1991), Leon (1988), Looney (1991), McNown and Wallace (1977), Miller (1978), Modeste (1981), Purviz (1972), Putnam and Wilford (1986), Reid (1973), Spanos and Taylor (1984), Taylor, M.P. (1987b), Tullio (1979, 1981), Wein (1974), Wilford (1977), Wilford and Wilford (1977, 1978), Wilford and Zecher (1979), Wohar and Lee (1992), and Zecher (1974).

APPENDIX 5

This is a comprehensive list of references which have estimated either the "reserve flow equation" or the "exchange market pressure equation" and have not only discussed signs and values of the coefficients in the context of the monetary approach to balance of payments but also contrasted them with those as expected by the Keynesian approach.

Aghevli and Khan (1977), Akhtar, Putnam, and Wilford (1979), Bean (1976), Beladi, Biswas, and Tribedy (1986), Bhatia (1982), Dornbusch (1971), Frenkel, Gylfason, and Helliwell (1980), Kamas (1986), Kenneally and Finn (1985), Lee and Wohar (1991), Looney (1991), McNown and Wallace (1977), Miller (1978), Purviz (1972), Putnam and Wilford (1986), Reid (1973), Taylor, M.P. (1987b), Tullio (1979), Wein (1974), Wilford (1977), Wilford and Wilford (1977, 1978), Wilford and Zecher (1979), and Wohar and Lee (1992).

APPENDIX 6

This is a comprehensive list of references which have estimated either the "reserve flow equation" or the "exchange market pressure equation" and have not only discussed signs and values of the coefficients in the context of the monetary approach to balance of payments and contrasted them with those as expected by the Keynesian approach but also explicitly decided in favor of one theory or the other.

Kenneally and Finn (1985), Lee and Wohar (1991), Putnam and Wilford (1986), Taylor, M.P. (1987b), Tullio (1979), Wilford (1977), Wilford and Wilford (1977, 1978), Wilford and Zecher (1979), and Wohar and Lee (1992).

APPENDIX 7

This is a comprehensive list of references which have estimated the demand for money and substituted it in the "reserve flow equation."

Aghevli and Khan (1977), Genberg (1976), Jimoh (1990), Kenneally and Finn (1985), Khan (1990), McCloskey and Zecher (1976), and Watson (1988).

APPENDIX 8

This is a comprehensive list of references in the context of the "reserve flow equation" and "exchange market pressure equation" of the monetary approach to balance of payments which discuss sterilization.

Akhtar (1986), Arize, Grivoyannis, Kallianiotis, and Melindretos (2000), Bean (1976), Blejer (1979), Boyer (1979), Burkett and Richards (1993), Cobham (1983), Connolly and Taylor (1979), Feige and Johannes (1981), Fontana (1998), Genberg (1976), Gupta (1984), Hacche and Townend (1981), Jager (1978), Johannes (1981), Joyce and Kamas (1985), Kamas (1986), Kenneally and Finn (1985), Killick and Mwega (1993), Kim (1985), Laney (1979), Lee and Wohar (1991), Leiderman (1980), Leon (1988), Luan and Miller (1979), Phaup and Kusinitz (1977), Shorab-Uddin (1985), Taylor, M.P. (1987a), Tullio (1979, 1981), Watson (1988, 1990), and Wohar and Burkett (1989).

APPENDIX 9

This is a comprehensive list of references in the context of the "capital flow equation" of the monetary approach to balance of payments which discuss sterilization.

Argy and Kouri (1974), Artus (1976), Darby (1980), Dombrecht (1978), Herring and Marston (1977), Hodjera (1976), Kouri (1975), Kouri and Porter (1974), Laskar (1981, 1982), Luan and Miller (1979), Martinez (1999), Murray (1978), Obstfeld (1982), Porter (1972), and Stockman (1979).

APPENDIX 10

This is a comprehensive list of references in the context of the "reserve flow equation" and "exchange market pressure equation" of the monetary approach to balance of payments which discuss the central bank reaction function.

Cobham (1983), Connolly and Taylor (1979), Genberg (1976), Jager (1978), Kamas (1986), Kenneally and Finn (1985), Laney (1979), Lee and Wohar (1991), Leon (1988), Luan and Miller (1979), Shorab-Uddin (1985), Tullio (1981), and Watson (1988).

APPENDIX 11

This is a comprehensive list of references in the context of the "capital flow equation" of the monetary approach to balance of payments which discuss the central bank reaction function.

Argy and Kouri (1974), Artus (1976), Darby (1980), Herring and Marston (1977), Hodjera (1976), Laskar (1981, 1982), Martinez (1999), Murray (1978), and Stockman (1979).

APPENDIX 12

This is a comprehensive list of references in the context of the "reserve flow equation" of the monetary approach to balance of payments which discuss the causality tests of the type Granger (1969), Geweke (1978), Haugh (1976), Hausman (1978), or Sims (1972).

Blejer (1979), Burkett and Richards (1993), Feige and Johannes (1981), Fontana (1998), Gupta (1984), Johannes (1981), Joyce and Kamas (1985), Kamas (1986), Killick and Mwega (1993), Lee and Wohar (1991), Leiderman (1980), Martinez (1999), Phaup and Kusinitz (1977), Taylor, M.P. (1987a, 1987b), Wohar and Burkett (1989), and Wohar and Lee (1992).

APPENDIX 13

This is a comprehensive list of references which have estimated the "exchange market pressure equation."

Bourne (1989), Brissimis and Leventakis (1984), Burdekin and Burkett (1990), Burkett, Ramirez, and Wohar (1987), Burkett and Richards (1993), Connolly (1985), Connolly and Da Silveira (1979), Costa Fernandes (1990), Farhadian and Dunn, Jr. (1986), Feige and Johannes (1981), Girton and Roper (1977), Hacche and Townend (1981), Hodgson and Schneck (1981), Jimoh (1990), Kenneally and Finn (1985), Kenneally and Nhan (1986), Kim (1985), Laney (1979), Lee and Wohar (1991), Mah (1991), Martinez (1999), Modeste (1981), Pentecost, Van Mooydonk, and Van Poeck (2001), Sargen (1975, 1977), Thornton (1995), Weymark (1995), and Wohar and Lee (1992).

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