The Monetary Approach to Balance of Payments Determination: An Empirical Test*

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The view that the balance of payments is essentially a monetary phenomenon—in other words, that the demand for and supply of money play a fundamental role in its determination—has recently gained considerable appeal in the literature.\(^1\) In the framework of the monetary approach, the balance of payments position of a country is considered to be a reflection of decisions on the part of its residents to accumulate or to run down their stock of money balances. It is this process of adjustment to the desired stock of money balances that results in balance of payments deficits and surpluses.\(^2\) If a country is small and there is perfect mobility of capital and goods (that is, at a given level of world interest rates and prices, a country can import or export goods and financial assets without affecting their prices), domestic prices and interest rates are determined exogenously.\(^3\) In this case any excess demand for money balances that emerges must be satisfied either from domestic sources or from abroad. Since prices and interest rates cannot change, and if the domestic component of the money stock is constant, this excess demand will result in an increase in international reserves (i.e., there will be a balance of payments surplus). This increase in international reserves may come about through an improvement in the trade balance, or the capital balance, or both. The monetary approach deals only with the ultimate effect and not with the channels through which this effect occurs.

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\(^2\) This adjustment should not be confused with the actual process by which this excess demand for money affects the balance of payments. The monetary approach does not go into this adjustment process explicitly. See Mussa (1974) for an extensive discussion of this particular version of the monetary approach.
\(^3\) This should not be taken to mean that the monetary approach applies only to small countries.
MONETARY APPROACH TO PAYMENTS DETERMINATION

This relationship between the excess demand for money balances and the balance of payments also has an interesting implication with regard to the effect of economic growth on the balance of payments. Since increases in the rate of growth of income affect the demand for real money balances in a positive fashion, the balance of payments and economic growth will always move together once the independent effects of the changes in the money supply originating from domestic sources have been taken into account. 4

Despite the considerable interest in this area, there have been relatively few published attempts to empirically test the implications of the theory in the form in which it has become popular. 5 It would thus be interesting to empirically examine the propositions of the monetary approach, and it is the purpose of this paper to test these propositions by way of a cross-sectional analysis of 39 developing countries. 6 Such a study, while not enabling an evaluation of the balance of payments of any one individual country, does have the advantage of allowing generalizations to be made across countries. If all countries in the sample were identical in all respects, then naturally the cross-sectional results would also be applicable to any of the individual countries in the sample. As this is not an assumption that could be satisfied even by defining the group of countries as "developing," the conclusions reached should therefore be interpreted as applicable only to an "average" developing country. This in itself can be considered a useful result even though the problems of aggregation and pooling inherent in any cross-sectional study still exist. Our reason for using such data stems from a key assumption of the version of the monetary approach that we are interested in—that is, it deals essentially with the long-run behavior of the balance of payments when the adjustments to any exogenous shock have been fully worked out. Since the data used in this study are averages of nine annual observations, it was felt that the long-run character of the theory would be better approximated than if one were to use time-series data.

Section I of this paper briefly describes the basic theoretical model

4 See Mundell (1968) and Laffer (1971).

5 Somewhat different versions of the monetary approach have been examined and tested by Polak (1957), Polak and Boissonneault (1960), Rhomberg (1965), and Khan (1974). The Polak interpretation explicitly outlines the process by which the balance of payments is affected, and in the long run is consistent with the monetary approach described here.

6 The lack of published studies should not be taken to imply that the theory is lacking in operational or practical significance. The financial programming exercises of the International Monetary Fund (IMF), especially in Latin American countries, have been conducted in the spirit of the monetary approach. For a discussion of how the IMF establishes a financial program, see Robichek (1967 and 1971).
and derives certain testable hypotheses. Section II discusses the results of testing these propositions, and Section III considers the implications of the results. Appendix I describes the data, and Appendix II provides alternative estimates for the equations.

I. The Monetary Approach to Balance of Payments Theory

In the context of a closed economy, the distinguishing characteristic of the monetary approach, in contrast to the Keynesian, is the emphasis placed on the effects of changes in the money supply on economic activity. The nominal stock of money, or the monetary base, is regarded as an instrument of monetary policy, and interest focuses on the effects of changes in this instrument on output, domestic prices, and interest rates. If output is fixed, then naturally only prices and interest rates will be able to change. In an open economy operating under a regime of fixed exchange rates, the supply of money can no longer be regarded as an exogenous policy instrument, since changes in it can be brought about through balance of payments deficits and surpluses. Thus, it is the relationship between the domestic component of the money stock (or, the monetary base), prices, output, and interest rates and the balance of payments that the monetary approach is concerned with. In a general framework, an excess demand for goods and financial assets leads to a disequilibrium in the foreign exchange market and the balance of payments. The resulting excess supply of real money balances leads to changes in domestic prices, interest rates, and output. These in turn feed back into the markets for goods and financial assets.

In the version of the monetary approach that we are interested in studying, it is assumed that the country is small, that it has a fixed exchange rate, and that there is perfect international mobility of goods and financial assets. These assumptions mean that domestic prices and interest rates will be equal to their respective world values and will be determined exogenously; it is also assumed that output is determined exogenously. In such a set of circumstances, any disequilibrium that emerges in the markets for goods and financial assets or in the money market will be fully reflected in the balance of payments. For example, if there is an excess supply of money, there will be a proportional amount of loss of international reserves. It is by concentrating on the connection between the money market and the balance of payments, rather than working through

1 In terms of being able to affect world prices.
the goods or financial assets market, that distinguishes the monetary approach from other theories of the balance of payments.

In the real world, and especially in developing countries, the conditions of perfect capital mobility and free trade would generally not be satisfied.\(^8\) There may also be various lags in adjustment, and it is possible that domestic prices and interest rates may have to rise above their respective world levels before complete adjustment takes place. Because of this, the entire increase in the domestic money supply may not completely leak out in the balance of payments. In the long run, however, these imperfections would be overcome and the proportional relationship between changes in the domestic money supply and the change in international reserves would be established. Treating the monetary approach in this longer-run fashion also allows one to treat output as exogenous to monetary shocks.\(^9\)

Because of this concentration on the money market, testing the monetary approach to the balance of payments involves the specification of a demand for money function and the money supply process. The demand for real money balances is specified as a function of real income and the opportunity cost incurred in holding these money balances. In financially developed countries, the opportunity cost of holding real money balances can be represented by the yield on alternative financial assets, namely, the rate of interest. In developing countries, where the range of alternative financial assets may be limited, substitution also takes place between goods and money.\(^10\) As such it would be more appropriate to represent the opportunity-cost argument in the demand for money function by both the return on alternative financial assets, the rate of interest, and the implicit return on goods, the rate of inflation. The demand for money in real terms can be written according to the following expression:

\[
\frac{M^d}{P} = F(Y, r, \Pi) \tag{1}
\]

where

- \(M\) = demand for nominal money balances;
- \(P\) = domestic price level;
- \(Y\) = level of domestic real income;
- \(r\) = rate of interest;
- \(\Pi\) = rate of inflation.

\(^8\) Most countries do adhere to fixed exchange rates.

\(^9\) Determined in the long run by population growth, technical progress, etc.

\(^10\) This is also true in developed countries, although perhaps not to such a degree.

278
\[ r = \text{domestic interest rate;} \]
\[ \Pi = \text{rate of inflation, defined as } \frac{dP}{dt} \cdot \frac{1}{P}. \]

Transforming equation (1) into terms of rates of growth gives:
\[
\frac{M^d}{M} \cdot \frac{\dot{P}}{P} = \eta_Y \frac{\dot{Y}}{Y} + \eta_r \frac{\dot{r}}{r} + \eta_n \frac{\dot{\Pi}}{\Pi}
\]
(2)

The dot over a variable denotes a time derivative, \( \frac{d}{dt} \).

The parameters \( \eta_Y, \eta_r, \) and \( \eta_n \) are, respectively, the real income, interest rate, and inflation elasticities of real money balances and are expected to have the following signs:
\[ \eta_Y > 0; \eta_r < 0; \eta_n < 0 \]

As the rate of growth in income increases, more real money balances will be demanded, while similar increases in the rates of growth in the interest rate and inflation will lower demand.

Equation (2) can be specified in nominal terms by simply moving \( \frac{\dot{P}}{P} \) to the right-hand side:
\[
\frac{\dot{M}}{M} = \frac{\dot{P}}{P} + \eta_Y \frac{\dot{Y}}{Y} + \eta_r \frac{\dot{r}}{r} + \eta_n \frac{\dot{\Pi}}{\Pi}
\]
(2a)

The supply of money is defined as equaling the product of the stock of high-powered money and the money multiplier:
\[ M = mH \]
(3)
where \( m \) is the money multiplier and \( H \) is the volume of high-powered money.

By definition the stock of high-powered money (the liabilities of the monetary authorities) is equal to the stock of international reserves, \( R,^{11} \) and the domestic asset (net of liabilities) holdings of the monetary authorities, \( D \):
\[ H = R + D \]
(4)

\[ ^{11} \text{In developing countries a large proportion, if not all, of the international reserves of the country is held by the monetary authorities. We are thus able to ignore the international reserve holdings of the rest of the banking system.} \]
MONETARY APPROACH TO PAYMENTS DETERMINATION

Substituting equation (4) into equation (3) and converting into rates of growth we obtain:

\[
\frac{\dot{M}}{M} = \frac{\dot{m}}{m} + \frac{\dot{R}}{R} \cdot \frac{R}{R} + \frac{\dot{D}}{D} \cdot \frac{D}{D}
\]

(5)

or, in terms of the rates of growth in international reserves:

\[
\frac{\dot{R}}{R} = \frac{H}{R} \left[ \frac{\dot{M}}{M} - \frac{\dot{m}}{m} \right] - \frac{D}{R} \cdot \frac{\dot{D}}{D}
\]

(5a)

If we assume that \( M^d = M \), we can substitute equation (2a) into equation (5a) and obtain:

\[
\frac{\dot{R}}{R} = \frac{H}{R} \left[ \frac{\dot{P}}{P} + \frac{\eta_Y \dot{Y}}{Y} + \frac{\eta_r \dot{r}}{r} + \frac{\eta_n \dot{n}}{n} - \frac{\dot{m}}{m} \right] - \frac{D}{R} \cdot \frac{\dot{D}}{D}
\]

(6)

Equation (6) represents the key relationship in the monetary approach to the balance of payments. Under the assumed signs of the elasticities, an increase in the rate of growth in prices and real income will improve the balance of payments, while increases in the rates of growth in the interest rate, inflation, the money multiplier, and net domestic assets of the central bank will lead to reserve losses. In this model, the public and the rest of the banking system do not necessarily behave passively and take all the explanatory variables as given, since they are able to affect the rate of growth in the money multiplier.

In testing this approach to balance of payments determination, one can use basically two methods. One method would be to estimate a demand for money function of the form (2):

\[
\left( \frac{\dot{M}}{M} - \frac{\dot{P}}{P} \right) = \alpha_0 + \alpha_1 \frac{\dot{Y}}{Y} + \alpha_2 \frac{\dot{r}}{r} + \alpha_3 \frac{\dot{n}}{n} + u
\]

(7)

where the rate of growth in a variable is defined as \( \frac{\dot{X}}{X} = (X_t - X_{t-1})/X_{t-1} \).

The error term \( u \) is assumed to be random, and the coefficients \( \alpha_1, \alpha_2, \) and \( \alpha_3 \) correspond to the elasticities \( \eta_Y, \eta_r, \) and \( \eta_n \), respectively.\(^{12}\)

If it cannot be assumed that the demand for money function is homogeneous of degree one in prices, the function can be estimated in nominal terms corresponding to equation (2a):

\[
\frac{\dot{M}}{M} = \beta_0 + \beta_1 \frac{\dot{P}}{P} + \beta_2 \frac{\dot{Y}}{Y} + \beta_3 \frac{\dot{r}}{r} + \beta_4 \frac{\dot{n}}{n} + v
\]

(7a)

where \( v \) is a random error term.

\(^{12}\) We have included a constant term in all the equations.
The estimates of equations (7) and (7a) can then be substituted into equation (5a):

\[ \frac{\dot{R}}{R} = \frac{H}{R} \left[ \hat{\alpha}_0 + \hat{\alpha}_1 \hat{Y} + \hat{\alpha}_2 \hat{r} + \hat{\alpha}_3 \frac{\dot{P}}{P} - \hat{m} \right] - \frac{D}{R} \cdot \frac{\dot{D}}{D} \]  

or,

\[ \frac{\dot{R}}{R} = \frac{H}{R} \left[ \hat{\beta}_0 + \hat{\beta}_1 \frac{\dot{P}}{P} + \hat{\beta}_2 \frac{\dot{Y}}{Y} + \hat{\beta}_3 \frac{\dot{r}}{r} + \hat{\beta}_4 \frac{\dot{P}}{P} - \hat{m} \right] - \frac{D}{R} \cdot \frac{\dot{D}}{D} \]  

In equation (8a) if \( \hat{\beta}_1 = 1 \), then the two equations will be identical.

Equations (8) and (8a) can be simulated for the rate of growth in international reserves, and the simulated values can be compared with the actual values to test the tracking ability of the model.

The other method of testing the theory implied by equation (6) would be to estimate the unrestricted reduced form directly.\(^{12}\)

\[ \frac{R}{H} \cdot \frac{R}{R} = \gamma_0 + \gamma_1 \frac{\dot{P}}{P} + \gamma_2 \frac{\dot{Y}}{Y} + \gamma_3 \frac{\dot{r}}{r} + \gamma_4 \frac{\dot{P}}{P} + \gamma_6 \frac{\dot{H}}{D} + \gamma_6 \frac{\dot{D}}{D} + \epsilon \]  

(9)

where the pattern of signs is expected to be as follows:

\( \gamma_1 = 1, \quad \gamma_2 > 0, \quad \gamma_3 < 0, \quad \gamma_4 < 0, \quad \gamma_5 = \gamma_6 = -1 \)

and \( \epsilon \) is a random error term.

Since \( \gamma_5 = \gamma_6 \), a second alternative could be to estimate:

\[ \frac{R}{H} \cdot \frac{R}{R} = \lambda_0 + \lambda_1 \frac{\dot{P}}{P} + \lambda_2 \frac{\dot{Y}}{Y} + \lambda_3 \frac{\dot{r}}{r} + \lambda_4 \frac{\dot{P}}{P} + \lambda_6 \frac{\dot{H}}{D} + \lambda_6 \frac{\dot{D}}{D} + \epsilon \]  

(9a)

where \( \lambda_6 = \gamma_6 = \gamma_6 \).

After estimating the parameters, equations (9) and (9a) can be solved, and the rate of growth in international reserves can be simulated.\(^{14}\)

Both types of tests are made in the paper. This procedure will allow an approximate test of the restrictions imposed with regard to the sizes of

\(^{12}\) Including a constant term and multiplying both sides by the ratio \( \frac{R}{H} \).

\(^{14}\) Multiplying the estimated equation through by \( \frac{H}{R} \).
MONETARY APPROACH TO PAYMENTS DETERMINATION

various coefficients. For example, equation (8) involves restricting the coefficient on the rate of growth in prices to be equal to unity and the coefficients on the rates of growth in the money multiplier and net domestic assets of the central bank to be minus unity. Equation (8a) removes the restriction on the rate of growth in prices and allows the coefficient to be estimated. Equation (9) represents the most general case, since no restrictions are imposed on the coefficients.

II. Results

This section discusses first the estimates obtained for equations (7), (7a), (9), and (9a). The simulation results are discussed later. Each of the four equations was estimated using cross-sectional data for 39 developing countries. Unfortunately, the interest rate variable had to be eliminated from the estimates, since such a series is not available for a large number of countries in the sample. Even in those countries where such a series is available, it is not very meaningful in that it tends to be constant over substantial time periods.

The first test was to estimate the demand for money function assuming homogeneity in prices. The results were as follows:

\[
\left( \frac{M - P}{M} \right) = -9.9207 + 2.8192 \frac{\dot{Y}}{Y} - 0.4566 \frac{\dot{\Pi}}{\Pi}
\]

\[R^2 = 0.4751 \quad SEE = 7.7753\]

The values in parentheses below the estimated coefficients are the t-values. \(R^2\) is the corrected coefficient of determination, and \(SEE\) is the estimated standard error of the regression.

It can be seen from equation (10) that both the income elasticity and the inflation elasticity have the correct signs and are significantly different from zero at the 1 per cent level. The size of the income elasticity of demand for money is relatively large. To some extent, 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. Insofar as savings increase more than proportionately with economic growth, the estimated income elasticity will exceed unity. The general fit of the equation is poor, but that is not unusual for cross-sectional data.

15 Appendix I provides a description of the data.

282

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Estimating the demand for money function in nominal terms yields:

\[
\frac{M_i}{M_i} = -3.8100 + 0.2611 \frac{\dot{P}}{P} + 2.3575 \frac{\dot{Y}}{Y} - 0.1142 \frac{\dot{\Pi}}{\Pi}
\]

(11)

\[R^2 = 0.3374 \quad SEE = 5.4479\]

Clearly the assumption of homogeneity in prices is rejected, since the coefficient of the rate of growth in prices is significantly less than unity. Whether a great deal of confidence can be established in this result is uncertain, as now the coefficient of the rate of growth in inflation is not significantly different from zero and this may be due to multicollinearity between inflation and the rate of growth in inflation. The fit of this equation, as measured by the \(R^2\), is poorer than that obtained for equation (11).

The estimates for equation (9) are as follows:

\[
\frac{R}{H} \cdot \frac{\dot{R}}{R} = -4.2476 + 0.2569 \frac{\dot{P}}{P} + 1.0276 \frac{\dot{Y}}{Y} - 0.1214 \frac{\dot{\Pi}}{\Pi}
\]

(2.74) (3.39) (3.67) (2.00)

(12)

\[R^2 = 0.6244 \quad SEE = 2.6921\]

All estimated coefficients in this equation 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 per cent 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 positive signs of the first two coefficients confirm two key monetary propositions, namely, that, \textit{ceteris paribus}, an increase in inflation or in the rate of growth in income will lead to an improvement in the balance of payments. This is at variance with the Keynesian view that an increase in these variables would result in an increase in imports and would necessarily worsen the balance of payments.\textsuperscript{16} The coefficient of the rate of growth in inflation is about the

\textsuperscript{16} This is a very simple representation of the Keynesian view and deals only with the trade balance. Recent models of the balance of payments, however, specify capital flows in terms of other economic variables. If capital flows move procyclically and the trade balance moves anticyclically, the balance of payments would move procyclically or anticyclically depending on the relative strengths of the trade and capital balance. See Aghevli (1975) and Williamson (1963).
same size as it was in the estimate of the nominal demand for money equation (12), except that it is now significantly different from zero at the 5 per cent level. The estimated coefficient of the rate of growth in domestic assets is significantly different from unity. This would imply that all increases in this variable would not leak out in the balance of payments. This is so perhaps because some of the assumptions behind the theory—for example, the exogenous nature of inflation—are not satisfied. To the extent that prices rise in response to an increase in net domestic assets, it would reduce the effect on the balance of payments. The fit of the equation is much better than was obtained in the demand for money equations, with more than 60 per cent of the variation of the dependent variable being captured by this specification.

In the final equation that was estimated, the coefficients of the rates of growth in domestic assets and the money multiplier were constrained to be equal. The results were as follows:

\[
\frac{R}{H} \cdot \frac{R}{R} = -4.3246 + 0.2351 \frac{P}{P} + 1.0437 \frac{\dot{Y}}{Y} - 0.1134 \frac{\Pi}{\Pi}
\]

\[
- 0.4045 \left[ \frac{m}{m} + \frac{D}{H} \cdot \frac{\dot{D}}{D} \right]
\]

\[
R^2 = 0.6226 \quad \text{SEE} = 2.6985
\]

It is obvious that there is no major difference between the unconstrained equation (12) and equation (13).\(^{17}\)

It could be argued that the results are biased owing to the inclusion of high-inflation countries, such as Argentina, Bolivia, Brazil, Chile, Colombia, and Uruguay in the sample, since the domestic rate of inflation is substantially different from the world rate of inflation. In our empirical tests we converted all the series used into U.S. dollars so that this would not

\(^{17}\) We also estimated equation (13a) with a further constraint that the coefficient of inflation was equal to unity (an assumption that strictly we are not able to make in the light of our previous results). The results were as follows:

\[
\frac{R}{H} \cdot \frac{R}{R} = -7.3308 + 1.1445 \frac{\dot{Y}}{Y} - 0.4951 \frac{\Pi}{\Pi} - 0.7866 \left[ \frac{m}{m} + \frac{D}{H} \cdot \frac{\dot{D}}{D} \right]
\]

\[
R^2 = 0.7369 \quad \text{SEE} = 5.4637
\]

Note that both the coefficients of \(\frac{\dot{Y}}{Y}\) and the rate of growth in domestic assets plus the money multiplier increase in size, compared with equation (13). It is interesting to observe that the \(R^2\) also improves.
be too much of a problem. Nevertheless, we did estimate the equations excluding the high-inflation countries, and the results are shown in Appendix II.

The estimates obtained in equations (10) and (11) were substituted into equations (8) and (8a) to determine the rate of growth in international reserves. The simulated values obtained, along with the actual values of the rate of growth in reserves, are shown in Chart I, A and B. Neither model appears to do very well in simulating reserves. The simple correlations between the actual and simulated values for the two cases were 0.7011 and 0.7659, respectively.

A similar simulation was performed using the estimates obtained from equations (12) and (13). The actual and simulated values are plotted in Chart I, C and D. Even visually it is obvious that these two models do far better than did the previous two, shown in Chart I, A and B. The correlations between the actual and simulated values were 0.8139 and 0.8069, respectively.

From both the equation estimates and the simulation results, it appears to be better to estimate the reduced form equation for the rate of growth in international reserves directly than to follow the two-step procedure of first estimating a demand for money equation (in real or nominal terms) and then substituting the estimates into the identity determining the growth in reserves.

III. Conclusion

The purpose of this paper has been to provide estimates for the monetary approach to the determination of the balance of payments. The exercise was performed on a cross-sectional basis using data for 39 developing countries. The results gave strong indication of the usefulness of this approach in explaining the rate of growth in international reserves of developing countries. Two types of tests of the theory were conducted, and both gave plausible results with most of the relevant explanatory variables exerting statistically significant influence on either the rate of growth in money balances (real or nominal), which represents a crucial relationship of the monetary approach, or the rate of growth in international reserves.

Apart from the ability of the monetary approach to explain the behavior of the balance of payments, the results also yielded some interesting policy implications. An increase in the domestic component of high-powered money will not all leak out in the balance of payments. In other words, there does not appear to be a one-to-one correspondence between these
CHART 1. SELECTED DEVELOPING COUNTRIES: RATE OF GROWTH IN INTERNATIONAL RESERVES

A. Simulated and Actual Values Obtained by Applying Equation (10)

B. Simulated and Actual Values Obtained by Applying Equation (11)
C. Simulated and Actual Values Obtained by Applying Equation (12)

D. Simulated and Actual Values Obtained by Applying Equation (13)
two variables. This is possibly so because our assumptions that prices and real income were exogenous are not strictly justified. If a change in domestic credit leads to a change in either of these variables, and therefore changes the public's demand for money, the effect on the balance of payments would be reduced. An increase of 10 per cent in domestic credit would result in a proportionate loss in international reserves only if all other relevant variables were constant. In the estimation, when a one-to-one restriction was imposed, it appeared that the explanatory power of the model was lower in comparison with the unrestricted case. In the context of policy, therefore, a much larger change in net domestic assets would be called for to achieve a given balance of payments target.

Another interesting result was the positive relationship between economic growth and the balance of payments. At first sight, this would tend to contradict the view that developing countries are constrained in their growth objectives by foreign exchange availability. However, this conclusion would be valid only if an initial increase in economic growth could be achieved independently of the balance of payments position. Since developing countries generally require foreign investment and imports of capital goods in order to increase real income, it would be unlikely that growth could be achieved without taking into account the balance of payments position.

The version of the monetary approach tested here involved certain very restrictive assumptions, namely, fixed exchange rates, full employment, infinite capital mobility, and free trade. These assumptions are obviously not satisfied in the group of countries studied here. It is, therefore, an indication of the robust nature of the theory that all the major propositions were still verified by the results. This provides further evidence of the validity of the monetary approach for long-run analysis of the balance of payments.

**APPENDICES**

I. Data Definitions and Sources

The data used in this study were obtained from two sources:


The definitions and sources of the variables are as follows:

- $R = \text{net international reserves (IFS)}$
- $M = \text{money plus quasi-money (IFS)}$
BIJAN B. AGHEVLI • MOHSIN S. KHAN

\[ P = \text{consumer price index, 1966} = 100 \ (IFS) \]
\[ Y = \text{gross national product in constant 1966 prices (Robinson)} \]
\[ D = \text{net domestic asset holdings of the central bank (IFS)} \]
\[ m = \text{money multiplier, defined as } \frac{M}{H} \ (IFS) \]
\[ H = \text{reserve money (IFS)} \]

All data are measured in U.S. dollars using the official exchange rate for conversion. The growth rates are calculated as average annual compound rates for the period 1957–66, using three-year averages for the end points. The variables, in level form, are all annual averages centered at midyear.

The countries in the sample were Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, the Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, Venezuela, Ethiopia, Kenya, Morocco, the Sudan, Tanzania, Tunisia, Uganda, Sri Lanka, India, Iran, Israel, Pakistan, Cyprus, Greece, Turkey, the Republic of China, Korea, the Philippines, Thailand, and Malaysia.

II. Alternative Equation Estimates

Since it is possible that the inclusion of high-inflation countries in the sample could distort the results obtained, we re-estimated the equations excluding Argentina, Bolivia, Brazil, Chile, Colombia, and Uruguay from the sample. The results for the reduced sample, shown below, are not very different from the results in the text and, although the effect of inflation on the rate of growth in international reserves is somewhat reduced, do not affect the conclusions of the paper.\(^1\) The equation numbers correspond to those in the text:

\[
\begin{align*}
\left( \frac{\dot{M}}{M} - \frac{\dot{P}}{P} \right) &= -2.321 + 1.661 \frac{\dot{Y}}{Y} + 0.108 \frac{\dot{n}}{n} \\
\bar{R}^2 &= 0.203 \quad \text{SEE} = 4.913
\end{align*}
\]

\[
\begin{align*}
\frac{\dot{M}}{M} &= 1.476 + 0.561 \frac{\dot{P}}{P} + 1.754 \frac{\dot{Y}}{Y} + 0.208 \frac{\dot{n}}{n} \\
\bar{R}^2 &= 0.317 \quad \text{SEE} = 4.898
\end{align*}
\]

\[
\begin{align*}
\frac{\dot{R}}{R} &= -0.710 + 0.201 \frac{\dot{P}}{P} + 0.522 \frac{\dot{Y}}{Y} - 0.193 \frac{\dot{n}}{n} - 0.169 \frac{\dot{m}}{m} \\
&\quad - 0.777 \frac{\dot{D}}{D} \\
\bar{R}^2 &= 0.857 \quad \text{SEE} = 1.632
\end{align*}
\]

\[
\begin{align*}
\frac{\dot{R}}{R} &= -2.575 + 0.306 \frac{\dot{P}}{P} + 0.748 \frac{\dot{Y}}{Y} - 0.234 \frac{\dot{n}}{n} - 0.564 \left[ \frac{\dot{m} + D}{H} \cdot \frac{\dot{D}}{D} \right] \\
\bar{R}^2 &= 0.725 \quad \text{SEE} = 2.268
\end{align*}
\]

\(^1\) Since all data used in the paper, including prices, are expressed in U.S. dollars, the rate of inflation in these countries is fairly constant over the period.
MONETARY APPROACH TO PAYMENTS DETERMINATION

\[
\frac{R}{H} \cdot \frac{\dot{R}}{\dot{P}} = -3.061 + 0.480 \frac{\dot{Y}}{Y} - 0.373 \frac{\dot{M}}{M} - 0.651 \left[ \frac{\dot{D}}{D} \right] \quad (13a')
\]

\[\hat{R}^2 = 0.718 \quad \text{SEE} = 2.692\]

REFERENCES


Robichon, E. W., "Financial Programming Exercises of the IMF in Latin America," address to a seminar of Professors of Economics (Brazil, September 20, 1967).
