The Developing Economies, XXX-1 (March 1992)

MONETARY DEPENDENCY IN THE SOUTHERN CONE: THE CASE OF PARAGUAY

DONALD G. RICHARDS

I. INTRODUCTION AND BACKGROUND

THE purpose of this paper is to derive and empirically test a simple macro model of monetary dependency for a small, open country. A number of recent articles have focused attention on the issue of monetary dependency in the Third World [2] [10] [6]. The present work differs in the particular theoretical specification of the dependency model but shares a basic interest in the determination of the country's monetary base a function of its balance of payments.

The small, open economy of Paraguay has been comparatively neglected in development studies, especially by economists. This neglect is unfortunate as Paraguay has had a unique developmental experience as compared to other South American countries. The Paraguayan average annual growth rate during the decade of the 1970s was among the highest in the world.[1] Moreover, its rate of inflation was low relative to its neighbors'. Both events can be considered extraordinary accomplishments given the massive external shocks experienced during the 1970s. I contend, however, that the rapid growth that occurred in Paraguay was itself externally generated. Specifically, Paraguayan growth was driven by large balance-of-payments surpluses and these surpluses were themselves a reflection of the country's subordinate position to the region's dominant economic power—Brazil. To test this hypothesis, I specify a model that places central emphasis on the relationship between Paraguay's monetary base, its balance of payments, and its economic relationship with Brazil. Before turning to the model, some background information on the changing structure of the Paraguayan economy over the period 1960–86 is provided.

While Paraguay's economy continues to be primarily an agriculturally oriented one, the relative contribution of agriculture has declined steadily and significantly over the (approximately) twenty-five-year period under study. This, of course, is not a surprising transformation for a developing economy. Yet the typical historical path of countries that have made the transition from less developed to developed

The author would like to thank Stephen Miller and several referees of this journal for helpful comments on earlier versions of this paper. They bear no responsibility for any remaining errors.

[1] According to the United Nations Economic Commission for Latin America and the Caribbean, the average annual rate of growth for the country was 8.2 per cent. Between 1977 and 1981 that rate was 10.3 per cent [16].

status has been to replace primary, agricultural activity with secondary, manufacturing-industrial activity. This has not occurred for Paraguay. Between 1962–65 and 1981–85, the percentage share of GDP accounted for by industrial output increased by less than 2 per cent. Virtually every other sector of the economy experienced more rapid growth than the industrial sector. In particular, construction activity increased substantially beginning in the mid-1970s. Not coincidentally, this takeoff in construction occurred with the beginning of the huge hydroelectric project at Itaipú. The other sector of the economy that experienced especially significant growth between 1962 and 1985 was commercial services. Again, beginning in the mid-1970s the banking sector in Paraguay experienced a remarkable period of growth and expansion because of the tremendous capital inflows associated with the Itaipú project. The promulgation of Law 417 in 1973, which liberalized the financial sector, also stimulated development in this sector.

Although agricultural activity does not play as prominent a role in the overall economy in the 1980s as it did in the 1960s, this sector did experience considerable growth over the two-decade period. In particular, Paraguay's less densely populated Eastern border with Brazil came under an intense development effort spurred by a conscious effort to establish agricultural colonies.[2] Aided by this development, and by high commodity prices during the 1970s, Paraguayan production and export of cotton and soybeans boomed and became the focus of commercial agriculture in the country.

The structural evolution of Paraguay's economy over the period 1960–85 as briefly outlined here was accompanied, particularly in the latter half of the period, by increasing integration with the Brazilian economy. The construction of the dam at Itaipú was a binational project undertaken with Brazil which provided the majority of the financial and other resources for its completion. While most of the energy generated by the binational entity will be consumed by the Southwestern region of Brazil around São Paulo, it is undeniably true that its construction had a profound sectoral and macroeconomic effect on Paraguay.[3] Since 1974 the total cost of construction and installation of the dam's energy-generating turbines has exceeded U.S.$8 billion—a figure several times larger than Paraguay's gross domestic product.

The inflow of capital associated with the dam's construction was a significant factor in the extraordinary expansion of liquidity in the economy beginning in the mid-1970s. The surplus in Paraguay's capital account balance went from U.S.$38 million to U.S.$94 million between 1973 and 1974 and from U.S.$117 million to U.S.$647 million between 1974 and 1980. The Paraguayan money supply growth also experienced rapid acceleration starting in the mid-1970s as indicated in Table I.

The structure of Paraguayan exports shows a significant change not only in its commodity composition—cotton and soy becoming more important—but also in terms of its country of destination, Brazil replacing Argentina.

A similar story holds for Paraguayan imports. That is, Brazil has displaced Argentina, the United States, and the European Community as the number one

[2] For further discussion of this issue, see [1].

[3] See [3] for a detailed treatment of the terms of the contract.

TABLE I

PARAGUAYAN MONETARY GROWTH, 1970–80

Year	M1	M2
1970–71	.108	.141
1971–72	.188	.219
1972–73	.304	.240
1973–74	.247	.211
1974–75	.178	.211
1975–76	.191	.185
1976–77	.429	.383
1977–78	.532	.401
1978–79	.339	.230
1979–80	.219	.271

Source: Growth rates are calculated on the basis of data from [12, p. 114].

foreign provider of goods and services. The official statistics in fact undoubtedly underestimate the magnitude of Brazil's dominance of Paraguay's foreign trade insofar as they do not include the large illegal, contraband trade.

Finally, Brazil has also displaced the United States, Europe, and the multilateral institutions (e.g., Inter-American Development Bank, World Bank) as the largest provider of capital to Paraguay. This is true both for direct private investment as well as for bank loans and development loans.[4]

II. THE MODEL

This section specifies a simple theoretical model that relates the rate of growth of real output of a small, open economy to its monetary base via its balance-of-payments position. Assuming the absence of a functioning bond market, Walras's Law suggests that general macroeconomic equilibrium is assured given monetary equilibrium. Money market equilibrium requires that the demand for real balances be equal to the real money supply. Symbolically this is expressed as

$$\frac{M^D}{P}=\frac{M^S}{P}, \tag{1}$$

where M^D and M^S are the nominal demand and supply of money respectively, and P is the price level.

Let real money demand be expressed as L^D so that equation (1) becomes

$$L^D=\frac{M^S}{P}. \tag{2}$$

Taking log-derivatives of equation (2) gives

$$\hat{L}^D=\hat{M}^S-\hat{P}, \tag{3}$$

[4] See [13].

where a circumflex ($\hat{}$) over a variable indicates a rate of growth.

The domestic monetary base (B) has two major components—Central Bank Credit (CBC) and International Reserves (IR). Thus, ignoring other minor factors,

$$B = CBC + IR. \tag{4}$$

The relationship between the monetary base and the domestic money supply is

$$M^S = \mu B, \tag{5}$$

where μ is the money multiplier. The rate of monetary growth is then

$$\hat{M}^S = \hat{\mu} + \hat{B}. \tag{6}$$

The rate of growth of the monetary base can be expressed as the weighted sum of its components so that

$$\hat{B} = \lambda C\hat{B}C + (1-\lambda)\hat{IR}, \tag{7}$$

where $\lambda = CBC/B$.

Substituting equation (7) into equation (6) and the result into equation (3) gives

$$\hat{L}^D = \hat{\mu} + \lambda C\hat{B}C + (1-\lambda)\hat{IR} - \hat{P}. \tag{8}$$

The demand for real balances can be expressed as a function of income and the real domestic interest rate,

$$L^D = L^D(Y, i). \tag{9}$$

Totally differentiating equation (9) and rearranging terms results in the following expression,

$$\hat{L}^D = \eta_Y \hat{Y} + \eta_i \hat{i}, \tag{10}$$

where $\hat{Y}$ is the rate of growth of income, $\hat{i}$ is the proportionate rate of change in the real interest rate, and η_Y, η_i are the income and interest elasticities of demand for real balances, respectively.

Substituting equation (10) into equation (8) and rearranging terms results in

$$\hat{Y} = \frac{1}{\eta_Y}[\hat{\mu} + \lambda C\hat{B}C + (1-\lambda)\hat{IR} - \eta_i \hat{i} - \hat{P}]. \tag{11}$$

The growth in international reserves occurs as a result of financing balance-of-payments imbalances through the monetary account. Thus, the time rate of change in international reserves is

$$\dot{IR} = B_n, \tag{12}$$

or

$$\hat{IR} = B_n/IR, \tag{13}$$

where the dot over IR refers to the time derivative and B_n is the monetary account of the balance of payments. The monetary account is given by

$$B_n = T_n + K_n, \tag{14}$$

where T_n is the trade balance and K_n is the capital account balance.

The trade balance is defined as the difference between exports (EX) and imports (IM), i.e.,

$$T_n = EX - IM. \tag{15}$$

Equations (11), (13), (14), and (15) give us a reduced-form equation that expresses the growth rate of national income as

$$\hat{Y} = \frac{1}{\eta_Y}[\hat{\mu} + \lambda C\hat{B}C + (1-\lambda)\frac{(EX - IM + K_n)}{IR} - \eta_i\hat{i} - \hat{P}]. \tag{16}$$

Exports are expressed as a behavioral function of trading partner incomes and the terms of trade as follows:

$$EX = EX(Y_{US}, Y_B, Y_A, R), \tag{17}$$

where Y_{US}, Y_B, and Y_A are the incomes of Paraguay's three largest trading partners —the United States, Brazil, and Argentina—and R is the terms of trade expressed as the ratio of indices measuring the unit value of exports and the unit value of imports, respectively. We assume that export demand responds positively both to increases in income and the terms of trade.

An import function can be specified as a function of domestic income and the terms of trade as follows:

$$IM = IM(Y, R), \tag{18}$$

where Y is domestic national income. Imports respond positively to domestic income and negatively to the terms of trade.

Equations (16), (17), and (18) constitute the structural equations of the model.

Summarizing the argument to this point, real economic growth in a small open economy is driven in part by the expansion of its financial sector. Financial growth depends both on the development of domestic credit institutions as well as on the accumulation of foreign reserves. The latter, in turn, are a function of balance-of-payments surpluses that arise from trade-balance surpluses and net inflows of capital from abroad.

In Paraguay, these important international economic relationships have been increasingly dominated by Brazil. Paraguayan exports of agricultural goods to Brazil have become the most important activity for the country. Similarly, Paraguay's imports have increasingly over the period under study come to be composed of Brazilian manufactured goods. Moreover, the construction of the Itaipú dam during the 1970s led to a virtual explosion in the financial sector of Paraguay.

III. ESTIMATION PROCEDURES AND RESULTS

An estimable version of the model given by equations (16), (17), and (18) can be written as follows:

$$\hat{Q}=\beta_0+\beta_1 C\hat{BC}+\beta_2 EX+\beta_3 IM+\beta_4 K_n-\beta_5\hat{P}+\psi, \tag{19.1}$$

$$EX=\alpha_0+\alpha_1 Y_B+\alpha_2 Y_{US}+\alpha_3 Y_A+\alpha_4 R+\varepsilon, \tag{19.2}$$

$$IM=\delta_0+\delta_1 Y+\delta_2 R+e, \tag{19.3}$$

where βs, αs, and δs are parameters to be estimated and ψ, ε, and e are homoscedastic error terms. For simplicity's sake it is assumed that the money multiplier is constant, i.e., $\hat{\mu}=0$. The lack of reliable data on interest rates in the financially repressed economy of Paraguay does not allow for the inclusion of this variable in the estimable version of the model. Equations (19.1), (19.2), and (19.3) are estimated by ordinary least squares.[5] The data used are annual covering the period 1962–86.[6] Estimation results are given in the following Table II.

The results in Table II provide support for the hypothesis of a strong link between Paraguay's rate of economic growth and its external economic relationships. Specifically, the rate of growth of gross domestic product is shown to have a positive relationship to the balance of trade, i.e., exports (*EX*) minus imports (*IM*). Exports in turn are shown to be strongly and positively related to the level of Brazilian income in equation (19.2). The results for equation (19.3) show that national income is positively related to the level of imports and is significant at the 0.05 level.[7] The positive and statistically significant estimate for β_4 also supports the hypothesis that Paraguayan growth in the time period under study has been in part fueled by external capital flows.[8]

The results in Table II do not suggest that economic growth in Paraguay has been accompanied by a similar expansion in the rate of domestic central bank credit. This "non-result" is itself interesting and is perhaps explicable in terms of the following two theoretical explanations.

The first is that Paraguayan monetary dependency is consistent with the monetary approach to the balance of payments (*MBOP*).[9] In this approach, a balance-of-payments surplus, by increasing the "external" component of the monetary base, causes domestic agents who have stable money demands to reduce their holdings of domestically denominated assets such that monetary equilibrium is preserved. Hence, a contraction in the domestic component of the monetary base occurs to "offset" the expansion in the external component. Thus, "monetary dependency" can be interpreted as the loss of domestic monetary control suffered by the small, open economy.

Second, the domestic monetary authority may attempt to sterilize the effects of international reserve accumulation on the monetary base as an anti-inflationary

[5] Substantially the same qualitative results are achieved when the set of equations (19.1), (19.2), and (19.3) are estimated jointly by two-stage least squares.

[6] See the Appendix for the data sources.

[7] A one-period lagged value of the dependent variable is included on the right-hand side in the estimation of equation (19.3) in order to capture the effects of lags in the adjustment process.

[8] Unfortunately the available series on capital inflows do not allow me to disaggregate by country of origin. Rodriguez Silvero [13], however, provides evidence that Brazil has assumed a dominant position as a provider of these resources since around 1970.

[9] See [8] [9].

TABLE II

REGRESSION RESULTS FOR THE STRUCTURAL MODEL

Equation (19.1)

Variable	Estimate	Standard Error	*T*-Ratio
INTERCEPT	3.133254	1.318711	2.3760*
CBC	0.089487	0.153796	0.5819
EX	0.000053	0.000012	2.6820*
IM	−0.000040	0.000009	−4.1725**
K_n	0.000031	0.000012	2.6154*
P	−0.072664	0.059749	−1.2162
$F(6, 23) = 5.88$**,	$R^2 = 0.6338$,	*D.W.* = 2.4956.	

Equation (19.2)

Variable	Estimate	Standard Error	*T*-Ratio
INTERCEPT	−19,706.4	106,732.6	−0.1846
Y_B	4.878795	1.370166	3.5607**
Y_A	−6.947729	4.452517	−1.5604
Y_{US}	24.62956	62.730796	0.6998
R	273.1918	841.684831	0.3246
$F(5, 21) = 47.04$**,	$R^2 = 0.9216$,	*D.W.* = 1.5466.	

Equation (19.3)

Variable	Estimate	Standard Error	*T*-Ratio
INTERCEPT	−1,240,103	563,652.2	−2.2001*
Y	1,215,471	58,947.8	2.0620*
$IM_{(t-1)}$	0.50736	0.263118	1.9283
R	−876.185	1,285.366	−0.6817
$F(4, 21) = 118.79$**,	$R^2 = 0.9545$,	*D.W.* = 1.3246.	

Notes: 1. R^2 is the coefficient of multiple determination and *D.W.* is the Durbin-Watson statistic for first-order auto-correlation.

2. The inclusion of $IM_{(t-1)}$ in the estimation of equation (19.3) improves the fit of the model.

** Indicates statistical significance at the 0.01 level.

* Indicates statistical significance at the 0.05 level.

policy. There is prima facie evidence to support this interpretation. Paraguay has managed (at least up until recent years) to maintain comparatively stable prices and a fixed exchange rate. This is in contrast to its neighbors whose rates of inflation and exchange rate fluctuations have been quite pronounced. Thus, "monetary dependence" is interpreted as the need to undertake specific actions to insulate the domestic economy from an externally generated macroeconomic problem. A sterilization policy also "forces" the domestic economy into a position of chronic payments imbalances.

IV. CAUSALITY AND MONETARY BASE

A number of recent studies (e.g., [10] [2] [6]) have examined the issue of monetary dependence in less developed countries. These studies have, by and large, focused attention on changes in domestic credit in the face of balance-of-payments deficits. For the interesting case of Paraguay, however, the balance-of-payments disequilibrium has, in the period under study, shown large surpluses more often than large deficits. Causality testing would be useful then both as a test of *MBOP* as well as to check for the possibility of a sterilization policy pursued by the central bank. In this case domestic credit is *contracted* in response to excessive accumulations of international reserves by large payments surpluses.

To investigate the causality question I shall specify a bivariate autoregressive model using time series data for central bank credit (*CBC*) and international reserves (*RES*) and use Granger's test to determine the existence of a "causal" relationship between the two variables.

Granger's test involves estimating the following regression model:

$$RES_t = \sum_{j=1}^{n} \beta_j RES_{t-j} + \sum_{j=1}^{m} \alpha_j CBC_{t-j} + e_t, \tag{20}$$

and test the hypothesis that $\alpha_i = 0$, $j = 1, \ldots, m$. Rejecting the null hypothesis suggests that *CBC* "causes" *RES* (i.e., *CBC*→*RES*). Similarly, a regression of the following type is estimated:

$$CBC_t = \sum_{j=1}^{m} \alpha_j CBC_{t-j} + \sum_{j=1}^{n} \beta_j RES_{t-j} + e'_t, \tag{21}$$

and test the hypothesis that $\beta_j = 0$, $j = 1, \ldots, n$. Rejecting this null hypothesis suggests that *RES* causes *CBC* (i.e., *RES*→*CBC*). Rejecting each of the above hypotheses implies mutually, interacting causation.

Two problems are typically addressed in estimating vector autoregression models: (1) stationarity of the data and (2) the appropriate lag specification of the model. With respect to stationarity data series, it is assumed that the error terms in equations (20) and (21) are vectors of white-noise innovation terms with zero mean and constant covariance. To ensure that this is the case, the quarterly *CBC* and *RES* data are transformed by both regular first differences as well as first seasonal differences. Stationarity is then confirmed by regressions of the transformed data on seasonal dummies and a linear trend term. None of the associated t-tests provide evidence that seasonal or linear trend remains in the data.

The second issue of lag specification is addressed with the help of a procedure recommended by Hsiao [7] and recently applied in a paper by Saunders [14]. Hsiao's procedure involves computing the final prediction error (*FPE*) for the univariate autoregression model involving either *RES* or *CBC* over a range of alternative lag specifications. That specification is selected which minimizes the *FPE* which is computed as $(SEE)^2(T + K)/(T - K)$, where *SEE* is the standard error of the regression, T is the number of observations, and K is the number of

TABLE III
GRANGER TEST RESULTS

$CBC \rightarrow RES$
$RES_t = \beta_0 + \sum_{j=1}^{3} \beta_j RES_{t-j} + \alpha CBC_{t-1} + e_t.$ (22)
Test of H_0: $\alpha = 0$, $F(1, 72) = 4.6265^{**}$.
$RES \rightarrow CBC$
$CBC_t = \sum_{j=1}^{2} \beta_j RES_{t-1} + \sum_{j=1}^{7} \alpha_j CBC_{t-j} + e'_t.$ (23)
Test of H_0: $\beta_j = 0$, $F(2, 63) = 19.8697^{**}$.

** Indicates statistical significance at the 0.01 level.

parameters. The motivation of using *FPE* as a selection criterion is that it trades off the biasness introduced into the model by too few parameters against the increased variance of a larger number of parameters.[10]

Having determined the appropriate order lag for the dependent variable, lagged values for the independent variable are sequentially added to the model to determine which specification, again, minimizes the *FPE*. According to Hsiao, if the value of *FPE* is decreased when lagged values of the independent variable are added, then this constitutes evidence of a causal relationship. The same procedure is then undertaken again reversing the roles of the two variables to determine the existence of reverse causality. In the present work, however, I have chosen to test for causality by examining the *F*-test for statistical significance and using Hsiao's procedure to determine the lag order for the model.

The data used in the estimations of equations (20) and (21) are quarterly measures of central bank credit and international reserves for the period 1965–85 taken from the *International Financial Statistics*. The Hsaio procedure referred to above suggests that the optimal specification of equation (20), i.e., that which minimizes the *FPE*, includes three lagged values of *RES* and one lagged value of *CBC*. The same procedure applied to equation (21) suggests that the right-hand-side variables include seven lagged values of the dependent variable and two lagged values of *RES*. The results of the Granger causality tests are summarized in Table III.

The above results give evidence of a bidirectional causal relationship between Paraguay's holdings of international reserve assets and the volume of domestic central bank credit. As such we cannot reject the strong hypothesis of the *MBOP* of a causal relationship between central bank credit and the availability of reserve assets. Neither can we reject the possibility that an inflow of international reserves is offset by sterilization operations by the Paraguayan central bank.

A difficulty limiting the usefulness of Granger's test is its inability to give us a measure of the sign or the size of the relationship between variables. A possibility

[10] See [7, p. 554].

TABLE IV
DYNAMIC MULTIPLIER RESULTS

Relationship	*LRM*	Standard Errors	*T*-Ratio
CBC→RES	1.8877	0.51071	3.6963**
RES→CBC	−1.0815	0.36198	−2.9878**

** Indicates statistical significance at the 0.01 level.

of investigating these other interesting aspects of the question is provided with the help of the calculation of dynamic multipliers.[11] A dynamic multiplier measures the impact of a one-unit change in an exogenous variable on an endogenous variable. In the context of our vector autoregression model, the exogenous impulse originates as a random shock in the error term (due, perhaps, to a change in one of the variables outlined in the structural model described in Section II). The exogenous change then will have delayed, intermediate (cumulative), and long-run impacts on both of the (endogenous) variables in the model. I shall limit myself to presenting the long-run dynamic multiplier results for each of the causal sequences considered above, i.e., "*RES* causes *CBC*" and "*CBC* causes *RES*." These results are presented in Table IV.

The long-run multipliers (*LRM*s) presented in Table IV measure the long-run impact on the expected value of *CBC* (*RES*) of a random shock to *RES* (*CBC*). The results indicate that the causal relationship running from changes in central bank credit to changes in international reserve holdings is positive with a long-run multiplier of approximately 1.89. Hence, the strong hypothesis of the *MBOP* is not supported in this case. On the other hand, a negative causal relationship running from changes in international reserve flows to changes in central bank credit is confirmed. Interestingly enough, the *LRM* in this case is very close to negative one (−1.08) which is consistent with the assumptions of the *MBOP*. It still cannot be overlooked, however, that the "offsetting" behavior that is observed in the domestic component of Paraguay's monetary base may be the outcome of sterilization operations carried out by the country's monetary authorities. Further testing of the type proposed by Kamas [10] might be helpful in distinguishing between these cases but would carry us beyond the bounds of this paper.

V. CONCLUSION

Paraguay experienced an extraordinary decade of growth during the 1970s despite the external shocks that plagued the world economy and led to stagnation in many other Latin American countries. Despite this impressive record it may be argued that the stimulus for growth was itself largely external emanating primarily from Paraguay's largest neighbor—Brazil. The specific sectoral sources of this stimulus are found in the huge capital inflows associated with the construction of the binational hydroelectric project at Itaipú and the boom in cotton and soybean

[11] For a technical discussion of dynamic multipliers see [5] [4] [15].

exports to the Brazilian market. While externally generated growth is not necessarily to be lamented, it is frequently true that the results of such dependent growth include unbalanced sectoral development, large inequalities in the distribution of income and wealth, and balance-of-payments disequilibrium. These are the symptoms of a dependent economy whose consequences include the demise of the "Paraguayan miracle" during the early 1980s as the recession that plagued the entire Plata region, and Brazil in particular, was transmitted to Paraguay. The deceleration of Paraguayan growth is also partly associated with the completion of the main construction activity at Itaipú.

The purpose of the present paper has been to analyze the dependent character of the Paraguayan economy from a monetary perspective. The model specified here expresses Paraguayan growth as a function of its balance of payments in the spirit of the monetary approach to the balance of payments (*MBOP*). The estimation results clearly support the hypothesis that Paraguay's economic growth in the period 1962–85 is related to its balance of payments both in terms of current account and capital account expansion. Moreover, the results show a positive and statistically significant relationship between Brazilian income and Paraguayan exports. On the other hand, the empirical results offer no such evidence as regards similar relationships between Paraguayan growth and the income levels of the country's other two major trading partners—Argentina and the United States. From these results then I conclude that Brazil occupies a dominate position in Paraguay's external economic relations.

An interesting "non-result" that emerges from my monetary model is the lack of a statistically significant relationship between the rate of growth of output in Paraguay and the rate of expansion of domestic central bank credit. An interesting theoretical possibility is that the Paraguayan monetary authority contracted domestic credit in the face of burgeoning increases in foreign exchange reserves as a result of current and capital account surpluses. This would make sense given the desire of monetary policymakers to avoid the inflationary experience suffered by many countries in the Southern Cone (e.g., Argentina, Brazil, and Uruguay). To test the hypothesis of central bank sterilization the Granger causality test is applied to the relationship between international reserves and central bank credit. The results provide some support for the sterilization hypothesis and in fact suggest the existence of mutually, i.e., two-way, causality between the variables. A shortcoming of the Granger test is that while it may identify the existence of a relationship that may be interpreted as "causal," it is unable to suggest the sign of the relationship. To further investigate the relationship between international reserves and central bank credit, long-run multipliers are calculated to measure the effect of a unit (random) shock to one variable on the long-run value of the other. The results of these exercises confirm the mutual causation suggested by the Granger tests but provide the further information that the direction of causation is positive from central bank credit to international reserves and negative from international reserves to central bank credit. This last result is again suggestive of sterilization operations designed to protect Paraguay from excessive inflationary pressure.

REFERENCES

1. BAER, W., and BIRCH, M. H. "Expansion of the Economic Frontier: Paraguayan Growth in the 1970's," *World Development*, Vol. 12, No. 8 (August 1984).
2. BURKETT, P.; RAMIREZ, J.; and WOHAR, M. "The Determinants of International Reserves in the Small Open Economy: The Case of Honduras," *Journal of Macroeconomics*, Vol. 9, No. 3 (Summer 1987).
3. CANESE, R., and MAURO, L. A. *Itaipú: Dependencia o Desarollo* (Asunción: Editorial Aravera, 1985).
4. DHRYMES, P. J. "Restricted and Unrestricted Reduced Forms: Asymptotic Distribution and Relative Efficiency," *Econometrica*, Vol. 41, No. 1 (January 1973).
5. GOLDBERGER, A. S. *Impact Multipliers and the Dynamic Properties of the Klein-Goldberger Model* (Amsterdam: North-Holland Publishing Co., 1959).
6. GUPTA, S. "Causal Relationship between Domestic Credit and International Reserves: The Experience of Developing Countries," *Kredit and Kapital*, Vol. 18, No. 2 (1984).
7. HSIAO, C. "Autoregressive Modeling of Canadian Money and Income Data," *Journal of the American Statistical Association*, Vol. 74, No. 367 (September 1979).
8. JOHNSON, H. "The Monetary Approach to the Balance of Payments Theory," *Journal of Financial and Quantitative Analysis*, Vol. 7, No. 2 (March 1972).
9. ————. "The Monetary Approach to the Balance of Payments: A Nontechnical Guide," *Journal of International Economics*, Vol. 7, No. 3 (August 1977).
10. KAMAS, L. "External Disturbances and the Independence of Monetary Policy under the Crawling Peg in Columbia," *Journal of International Economics*, Vol. 19, No. 4 (November 1986).
11. ————. "The Balance of Payments Offset to Monetary Policy: Monetarists, Portfolio Balance, and Keynesian Estimates for Mexico and Venezuela," *Journal of Money, Credit and Banking*, Vol. 18, No. 4 (November 1986).
12. OTAZÚ GIMÉNEZ, O. D. *El Encaje Legal y la Tasa de Interés como Instrumento de la Política Monetaria: El Caso Paraguayo, 1962/1980* (Brasília: Centro de Pesquisa, Escola de Administração Fazendaría, 1983).
13. RODRIGUEZ SILVERO, R. *La Integración Económica del Paraguay en el Brasil* (Asunción: Editorial Historica, 1987).
14. SAUNDERS, P. J. "Causality of U.S. Prices and the Money Supply: Further Empirical Evidence," *American Journal of Agricultural Economics*, Vol. 70, No. 3 (August 1988).
15. SCHMIDT, P. "The Asymptotic Distribution of Dynamic Multipliers," *Econometrica*, Vol. 41, No. 1 (January 1973).
16. United Nations, Economic Commission for Latin America and the Carribbean. *Economic Survey of Latin America and the Caribbean, 1982*, Vol. 1 (Santiago, 1984).

APPENDIX

The following is a list of the data sources used in the empirical analysis along with the corresponding variables for which these sources provided partial or complete time series.

CBC, K_n: Banco Central del Paraguay, Departemento de Estudios Economicos, *Boletin Estadistico Mensual* (Asunción), various issues.

Q, EX, IM, R, Y: Banco Central del Paraguay, Departemento de Estudios Economicos, *Cuentas Nacionales* (Asunción), various issues.

P: International Monetary Fund, *International Financial Statistics* (Washington, D.C.), various issues.

Y_A, Y_B: University of California, Latin American Center, *Statistical Abstract of Latin America,* Vol. 26 (Los Angeles: University of California, Latin American Center Publications, 1988); United Nations, Economic Commission for Latin America and the Caribbean, *Statistical Yearbook for Latin America and the Caribbean* (Santiago), various issues.

Y_{US} (real GNP in 1982 dollars): U.S. Department of Commerce, *Survey of Current Business* (Washington, D.C.), various issues.