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ADJUSTMENT: THREE
STUDIES

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“Implications for Latin America of the present state of the international monetary and financial system”.

THE DEMAND FOR IMPORTED GOODS*

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*Report prepared for the UNDP/CEPAL project entitled "Implications for Latin America of the present state of the international monetary and financial system" (RLA/77/021) by Mr. Valeriano García, a staff member of the Centre for Latin American Monetary Studies (CEMLA), who collaborated in the project from January to June 1978 under an agreement between CEPAL and CEMLA.

THE DEMAND FOR IMPORTED GOODS

Imports —one of the major components of national expenditure—represented 7.5% of the product of Latin America in 1960, as against 18% in 1974. Part of this increase, of course, was due to higher oil prices, but the rising trend had already begun in 1967. In addition, important structural changes took place in the composition of imports (see table 1). Imports of raw materials and intermediate products (excluding fuels) steadily increased in importance, rising from 31% of total imports in 1948 to almost 45% in 1974. In contrast, the proportion of imported consumer goods fell sharply (by almost 50%) during that period, while imports of capital goods remained at the same relative level.

The purpose of this study is to construct a model capable of identifying the economic variables with the greatest effect on the level of imports of goods, and to evaluate their empirical importance. For the purpose of explaining the structural changes in the composition of imports, it is felt that a study should also be made to isolate the effects of the different economic magnitudes on disaggregated expenditure on imported goods.

1. The theoretical approaches

In the traditional Keynesian approach, the money market has only an indirect effect on expenditure through the changes which it may cause in interest rates or in income. In the monetary approach, disequilibrium in the money market directly affects expenditure (including imports).

In both the Keynesian and the monetarist approaches, real income is considered a fundamental factor in the demand function. Take the following relationship:¹

$$QM = A + B YC + u \quad [1]$$

In both approaches B is expected to be positive, although its expected value is probably lower in the monetarist approach, which lays particular emphasis on the positive effects of income on the demand for money.

It is also important to include the effect of relative prices,² so that:

$$QM = A + B YC + C PM + u \quad [2]$$

¹The variables are defined in logarithms. QM is the quantum of imports, YC real income, u the random variable with constant variance and zero mean.

Table 1
LATIN AMERICA:^a COMPOSITION OF IMPORTS OF GOODS^b
(Percentages)

<i>Year</i>	<i>Consumer goods</i>	<i>Fuels</i>	<i>Raw materials and intermediate goods</i>	<i>Construction materials</i>	<i>Capital goods</i>	<i>Total</i>
1948	22.8	8.5	31.0	6.0	31.0	100.0
1949	21.6	7.9	33.0	6.7	30.4	100.0
1950	22.0	8.2	34.8	5.9	28.5	100.0
1951	19.2	9.2	36.7	5.4	29.0	100.0
1952	18.9	10.5	33.5	5.7	31.0	100.0
1953	19.6	11.0	31.7	6.0	31.2	100.0
1954	18.8	10.5	35.0	5.6	29.7	100.0
1955	18.5	10.9	35.4	5.6	29.2	100.0
1956	17.4	11.3	33.6	5.4	31.7	100.0
1957	16.5	10.6	31.7	5.4	35.5	100.0
1958	17.7	10.6	32.2	5.0	34.1	100.0
1959	19.3	10.1	33.5	5.0	31.5	100.0
1960	17.5	8.7	31.9	4.2	34.4	100.0
1961	17.9	7.6	36.1	3.9	33.7	100.0
1962	17.5	7.1	35.5	3.6	35.5	100.0
1963	15.0	7.0	40.5	3.4	33.3	100.0
1964	15.5	6.6	41.6	3.3	32.5	100.0
1965	15.5	6.4	42.4	3.2	32.0	100.0
1966	15.4	6.4	42.3	3.0	32.4	100.0
1967	15.7	6.3	41.0	2.8	33.8	100.0
1968	15.4	6.1	41.3	2.9	33.7	100.0
1969	14.9	5.9	41.3	3.1	34.2	100.0
1970	15.1	5.8	41.4	3.2	33.8	100.0
1971	14.3	6.9	41.4	3.2	33.5	100.0
1972	14.3	6.6	40.8	2.6	35.2	100.0
1973	14.3	8.5	41.3	2.3	33.2	100.0
1974	12.0	14.0	44.7	3.3	25.4	100.0

Source: CEPAL, *América Latina: Importaciones según uso o destino económico (CUODE) 1948-1974*, E/CEPAL/1043, 2 August 1977.

^aExcluding Barbados, Cuba, Guyana, Jamaica and Trinidad and Tobago; also Haiti and Paraguay from 1948 to 1959 inclusive.

^bOn the basis of current prices in millions of dollars, CIF.

In this equation, PM stands for the price of imports in local currency defined as the international price multiplied by the exchange rate, in relation to the domestic wholesale price level, and is designed to measure the substitution effect. This index has the defect that it is not a "true" relative price, since it does not include tariffs or domestic taxes; on the other hand, it has the virtue of being easy to calculate, for predictive purposes. Furthermore, it is assumed that the effect of tariffs and other restrictions is measured by another variable in the model (discussed below), thus avoiding problems of high correlation between independent variables.

Restrictions on international trade play an important role in balance-of-payments policy for many countries, and must therefore be included in any function designed to identify the determinants of the import function. One possibility for measuring the effect of these restrictions is to construct an index taking values between zero and one according to the subjective weight which the research attaches to them. Another is to assume a high negative correlation between reserves and the level of obstacles to imports. We have chosen the latter approach on the grounds that it is more objective and that its coefficient can be interpreted in quantitative terms by any researcher.

Thus:

$$QM = A + B YC + C PM + D R + u, \quad [3]$$

where R stands for the level of reserves in dollars.

The monetarist models stress monetary flow disequilibria.³ Take the following formulation:

$$SA = GDC - GMD$$

$$GMD = a GYC + b dGPe + GP$$

Where:

SA: monetary disequilibrium

GDC: rate of growth of domestic credit

GMD: rate of growth of the nominal demand for money

GYC: rate of growth of real income

dGPe: expected rise in inflation

GP: rate of inflation.

²"One of the most crucial variables in international trade theory and policy is the responsiveness of the volume of trade to price changes": Moredechai E. Kreinin, "Price Elasticities in International Trade", in *The Review of Economics and Statistics*, November 1967. Kreinin carries out regressions for the United States, at the quarterly level, of an index of the volume of imports, in the real gross national product, and the ratio of the import price index to the wholesale domestic price index, defining the variables logarithmically. Unfortunately, the fact that he uses a different disaggregation of imports and quarterly variables makes it impossible to compare his results with ours.

³V.F. García, *Endeudamiento externo y ajuste de balanza de pagos: El caso latinoamericano*, CEMLA, 1978.

The empirical model began with the simpler assumptions that $a = b = 1$, and that the expected rate of inflation is the same as the observed rate.

Thus the model can be completed as follows:⁴

$$QM = A + B YC + C PM + D R + E SA \quad [4]$$

The expected signs are as follows:

$$B > 0; C < 0; D > 0; E > 0.$$

2. Empirical results

Annual data for the period 1950-1974 were used to test equation [4] in the case of the following countries: Argentina, Brazil, Colombia, Chile, Guatemala, Honduras, Mexico, Peru, Venezuela.

The quantum level of imports was disaggregated in such way that equation [4] could also be estimated for: (a) durable consumer goods (CD); (b) consumer goods (C); (c) raw materials and intermediate goods (I); (d) capital goods (K). For all countries the data sources were the IFS and the CEPAL statistical bulletins.

The results for total imported goods are shown in the following table:

As may be seen from table 2, the variable which is always highly significant (except in the case of Venezuela) is real income. Elasticities range from 0.41 for Brazil to 1.36 for Honduras. Argentina, Brazil, Colombia, Mexico and Peru have less than unit income elasticity; in Chile, Guatemala and Honduras the demand for imports may be considered elastic with respect to real income.

The "relative price" variable⁵ is important in the cases of Brazil, Colombia, Guatemala and Mexico, and has the expected sign in seven of the nine countries considered (it is positive, although not significant, in the cases of Argentina and Chile). In the countries where the variable is very significant—Colombia, Honduras and Mexico—price elasticity is very close to unity, except in the case of Guatemala where it is still higher.

The price-elasticity found, in the cases where it was significant, may be very useful for predicting the effect of devaluations and changes in the international price of imports, *ceteris paribus*. In the case of Mexico, for example, the model for the total quantum of imports shows a coefficient of determination of 0.93, and the coefficients of all

⁴ All the variables, except SA, are defined in natural logarithms.

⁵ This covers the international price of the good and the exchange rate, related to the domestic price level.

Table 2

REGRESSION COEFFICIENTS FOR THE QUANTUM OF IMPORTS,
1950-1974, AT THE ANNUAL LEVEL

Country	Dependent variable	Independent variables				R ²	DW
		LY ^b	LPM ^c	LR ^d	SA ^e		
Argentina	LQM ^a	.58	.28	.01	.03	.68	1.51
Brazil	LQM	.41	-.51 ^g	.32	.03	.82	1.72
Colombia	LQM	.77	-.92	.12	.07	.72	2.07
Chile	LQM	1.11	.70	-.02	-.01	.88	1.82
Guatemala	LQM	1.18	-1.40	.43	.01	.92	1.97
Honduras	LQM	1.36	-.25	.16	.02	.96	1.62
Mexico	LQM	.43	-1.18	.25	.15	.93	1.33
Peru	LQM	.55 ^f	-.42	-.09	.07	.88	1.01
Venezuela	LQM	.35	-.12	.61	.05	.73	1.38

Source: *América Latina, Relación de precios del intercambio 1928-1978*, E/CEPAL/1040, 2 August 1977.

América Latina, Importaciones clasificadas según uso o destino económico, 1948-1974, E/CEPAL/1043, 2 August 1977.

International Financial Statistics, various numbers.

^aLogarithm of the quantum of imports.

^bLogarithm of real income.

^cLogarithm of the price of imports.

^dLogarithm of international reserves.

^eMonetary disequilibrium.

^fSignificant at 0.01.

^gSignificant at 0.05.

the explanatory variables are very significant; it may therefore be inferred with a good margin of confidence, and in line with the econometric results of this study, that a devaluation of 10%, for example, will reduce the quantum of imports by approximately 12% in one year.

The variable designed to measure the "level of restrictions" proves to be very important in Brazil, Colombia, Guatemala, Honduras, Mexico and Venezuela. Venezuela and Honduras are the countries with the highest elasticity in the total quantum of imports. In the disaggregated study, it may be seen that in both countries it is the capital goods sector which has been subject to restrictions related to the absolute level of reserves. We shall analyse in detail below the type of goods used by the countries under consideration to impose their restrictions, and the response of the sector.

The variable which represents the flow disequilibrium in the money market has not been included in traditional studies of the demand for imports, and a special analysis will be made of its results.

The econometric estimates for the quantum of imports of consumer durables are given in table 3.

The model has a very satisfactory explanatory value (in terms of the coefficient of determination) in the cases of Honduras, Guatemala, Mexico, Chile and Venezuela. In the case of Honduras the most important variable is real income, and elasticity is greater than unity. This variable, together with the level of international reserves, explains 33% of the changes in the level of imports of consumer durables for that country.

The model has high explanatory value (90%) for Guatemala and high significance for all the postulated variables. In particular, there is the high elasticity of relative prices, which would indicate that when planning the flow of imports of durable goods (and of imports in general) the economic authorities of Guatemala should place special emphasis on the prediction of relative prices and on the proper management of devaluations, since their economy appears to respond quite strongly to this stimulus. In the cases of Brazil, Mexico, Peru and Venezuela the relative prices variable again turns out to be very important, although in Peru the coefficient of determination (R^2) is rather low.

Only three of the nine countries studied (Brazil, Colombia and Guatemala) appear to have imposed restrictions connected with the

Table 3
REGRESSION COEFFICIENTS FOR THE QUANTUM OF IMPORTS
OF CONSUMER DURABLES, 1950-1974

Country	Dependent variable	Independent variables				R^2	DW
		LYC ^b	LPCD ^c	LR ^d	SA ^e		
Argentina	LQCD ^a	.98	.42	.09	.15	.26	1.50
Brazil	LQCD	.06	-1.30	.72	-.41	.68	1.18
Colombia	LQCD	.35	-.84	.65	-.02	.34	1.00
Chile	LOCD	1.80	.96	.38	-.14	.73	.73
Guatemala	LQCD	.84	-2.70	.56	.05	.90	1.66
Honduras	LQCD	1.39	-.93	.16	.01	.97	2.51
Mexico	LQCD	.15	-.91	.26	.21	.77	1.23
Peru	LQCD	-.21	-1.50	-.29	.10	.35	1.80
Venezuela	LQCD	.42	-.72	.07	.05	.73	1.37

^aLogarithm of the quantum of consumer durables.

^bLogarithm of real income.

^cLogarithm of the price of imports of consumer durables.

^dLogarithm of international reserves.

^eMonetary disequilibrium.

level of reserves in the consumer durables branch. As may be seen from the relevant tables, Brazil used this type of instrument for all imports and not merely consumer durables; but the highest level of elasticity (0.72) was found for the latter.

Table 4 shows the results of the model, in the case of imports of non-durable consumer goods.

Table 4
REGRESSION COEFFICIENTS FOR THE QUANTUM OF IMPORTS
OF NON-DURABLE CONSUMER GOODS, 1950-1974

Country	Dependent variable	Independent variables				R ²	DW
		LYC ^b	LPC ^c	LR ^d	SA ^e		
Argentina	LQC ^a	.49	.07	.01	-.07	.35	1.73
Brazil	LQC	.41	.35	.17	.11	.77	1.08
Colombia	LQC	-.47	-1.12	.82	.03	.57	1.58
Chile	LQC	1.14	-.36	-.11	.20	.84	1.78
Guatemala	LQC	.20	-1.70	.50	.06	.60	.94
Honduras	LQC	.51	1.2	.12	.06	.53	1.46
Mexico	LQC	.19	-1.0	.24	.07	.48	.44
Peru	LQC	-.10	-1.6	-.11	.04	.88	1.17
Venezuela	LQC	-.57	-.80	.24	.10	.50	.97

^aLogarithm of the quantum of non-durable consumers goods.

^bLogarithm of real income.

^cLogarithm of prices of non-durable consumer goods.

^dLogarithm of international reserves.

^eMonetary disequilibrium.

For Brazil, Chile and Peru, the estimates are satisfactory, in terms of the index of determination. In the case of Brazil, the most important variables are real income and the level of reserves, although the probable existence of serial correlation means that some caution must be observed in connexion with the particular value of the coefficients. In principle, this correlation only affects the variance of the estimators, but in a particular sample it would also affect the point estimate of the coefficient.

In the case of Chile, DW is satisfactory; there is high income elasticity (1.14); this variable is highly significant, and therefore should be taken into account in carrying out predictions. The money variable is also important, and will be studied below. The total explanation is good, in the order of 84%. In the case of Peru the most important variable is "relative prices", which is highly significant; however, the same reservations as in the case of Brazil should be made with regard to the particular value of the coefficient, since the DW test is not defini-

tive and therefore the "price elasticity" value recorded should be used with care in making predictions. Altogether, the model functions satisfactorily for the country, explaining approximately 90% of the variations in the quantum of imports of consumer goods in the sample period.

In the remaining countries the following is observed: in Colombia, the level of international reserves is the most important variable;⁶ the "relative prices" variable is also significant, and has greater than unit elasticity. In the cases of Guatemala and Mexico, this variable is again significant, but the presence of auto-correlation suggests that caution should be observed in this connexion.

Table 5 presents the results of the application of the model to imports of capital goods.

Bearing in mind that the demand functions for capital goods (as in the case of consumer durables) generally call for sophisticated stock-flow partial adjustment equations, the model set forth in this study appears to meet its objective satisfactorily, particularly in the cases of Honduras, Mexico, Venezuela, Guatemala and Brazil.

Table 5
REGRESSION COEFFICIENTS FOR THE QUANTUM OF IMPORTS
OF CAPITAL GOODS, 1950-1974

Country	Dependent variable	Independent variables				R ²	DW
		LYC ^b	LPK ^c	LR ^d	SA ^e		
Argentina	LQK ^a	.54	.32	.15	-.07	.43	.89
Brazil	LQK	.40	-.78	.37	-.02	.72	1.26
Chile	LQK	.50	.13	.03	-.03	.54	1.96
Colombia	LQK	1.00	-1.00	.03	.11	.65	1.40
Guatemala	LQK	1.79	-.67	.12	.05	.91	1.62
Honduras	LQK	1.22	-1.30	.88	.02	.78	1.70
Mexico	LQK	.22	-.42	.20	.12	.87	1.75
Peru	LQK	.67	.04	-.07	.06	.62	1.00
Venezuela	LQK	-1.30	.31	1.20	.04	.80	1.11

^aLogarithm of the quantum of imports of capital goods in the period.

^bLogarithm of real income.

^cLogarithm of the prices of imported capital goods.

^dLogarithm of international reserves.

^eMonetary disequilibrium.

⁶It will be seen below, when analyzing the effect of money, that the supply of money is also important as an explanatory variable in Colombia.

The real income variable is significant in eight of the nine countries considered. Its elasticity is in the order of 0.50 for Argentina, Brazil, Chile and Mexico, a little higher for Peru and Colombia, and substantially more in Guatemala and Honduras. For the latter two countries, these coefficients may be used with a high level of confidence bearing in mind the absence of serial correlation, the high degree of significance of the variable and the good results of the model in terms of the index of determination.

The "relative prices" variables has an elasticity higher than unity (in absolute values) in Guatemala, and is also very important in Colombia (unit elasticity) and in Brazil (elasticity of 0.78). In the remaining countries this variable does not appear to have a significant effect on imports of capital goods.

When the level of international reserves rises, Brazil, Guatemala, Mexico and Venezuela show a positive response in the quantum of imports of capital goods, probably because restrictions and taxes in the sector are reduced; elasticity is particularly high (1.20) in the case of Venezuela. It should be pointed out that this is the sole significant variable in that country for the sector.

Table 5 gives the results of the model for the quantum of imports of raw materials and intermediate goods (excluding fuels).

Table 6
REGRESSION COEFFICIENTS FOR THE QUANTUM OF IMPORTS
OF RAW MATERIALS AND INTERMEDIATE GOODS, 1950-1974

Country	Dependent variable	Independent variables				R ²	DW
		LYC ^b	LPI ^c	LR ^d	SA ^e		
Argentina	LQI ^a	1.05	.18	.06	-.02	.78	1.73
Brazil	LQI	.62	.12	.26	.19	.90	1.62
Colombia	LQI	1.00	-.43	.001	.02	.89	2.87
Chile	LQI	1.92	-.11	-.07	-.02	.91	1.90
Guatemala	LQI	1.61	-.12	.08	.23	.96	1.37
Honduras	LQI	1.90	-1.0	.15	.03	.95	1.64
Mexico	LQI	.46	-.93	.26	.11	.99	2.24
Peru	LQI	1.58	-.34	-.20	.04	.96	1.64
Venezuela	LQI	.67	.04	-.07	.06	.62	1.00

^aLogarithm of the quantum of raw materials and intermediate goods.

^bLogarithm of real income.

^cLogarithm of the prices of raw materials and intermediate goods.

^dLogarithm of international reserves.

^eMonetary disequilibrium.

Table 7
REGRESSION COEFFICIENTS FOR THE QUANTUM OF IMPORTS,
1950-1974, AT THE ANNUAL LEVEL

Country	Dependent variable	Independent variables						R ²	DW
		LYC ^b	LPM ^c	LR ^d	GDC ^e	GMD ^f			
Argentina	LQM ^a	.50	.26	-.04	.41	.01	.72	1.40	
Brazil	LQM	.43	-.52	.31	.03	-.05	.82	1.73	
Colombia	LQM	.70	-.74	.15	1.00	-.04	.75	2.16	
Chile	LQM	1.02	.08	.01	.01	.02	.89	1.79	
Guatemala	LQM	1.11	-1.23	.46	.50	-.02	.93	1.15	
Honduras	LQM	1.31	-1.10	.21	.40	-.01	.97	2.14	
Mexico	LQM	.44	-1.19	.25	.13	-.14	.92	1.33	
Peru	LQM	.77	-.42	-.09	.07	-.06	.88	1.01	
Venezuela	LQM	-.34	-.14	.65	.30	-.04	.80	1.67	

^aLogarithm of the quantum of imports.

^bLogarithm of real income.

^cLogarithm of the price of imports.

^dLogarithm of international reserves.

^eRate of growth of domestic credit (supply in terms of flow).

^fRate of growth of the nominal demand for money.

Table 8

COUNTRIES AND IMPORT CHANNELS FOR WHICH THE FLOW
SUPPLY OF MONEY (S) AND/OR FLOW DEMAND FOR
MONEY (D) ARE IMPORTANT VARIABLES

<i>Country</i>	<i>Consumer durables</i>	<i>Non- durable consumer goods</i>	<i>Capital goods</i>	<i>Raw materials and inter- mediate goods</i>
Argentina	-	-	-	S
Brazil	-	-	-	S-D
Colombia	-	S	D	-
Chile	-	S-D	-	-
Guatemala	-	-	-	-
Honduras	-	-	-	D
Mexico	-	-	-	S-D
Peru	-	S	-	D
Venezuela	S-D	-	S	-

It may be seen from this table that the model presents an excellent fit in almost all the countries. The most important variable is real income, as was to be expected, since the demand for intermediate goods is a derived demand and therefore heavily dependent on income in each country. The "relative prices" variable has the expected sign in six of the nine countries under consideration, although its value is only significant in two of them. In addition, the level of reserves and money market variables are important in Brazil and Mexico.

Turning now to the effect of the monetary flow disequilibrium, for the total of imports of goods this variable is significant in the case of Colombia, Mexico, Peru and Venezuela. In order to deal with its effect in greater depth, the variable was broken down into flow supply and flow demand. The results are given in the following table.

The growth rate of nominal credit has the expected sign in all the countries studied, and is significant in six out of the nine. This variable is used to represent the *ex ante* flow supply of money. The variable representing changes in the nominal demand for money has the expected sign in all the countries save two, but is significant only in the case of Mexico. It is worth mentioning here that the improvement of the assumptions on which the variable was constructed will probably make this coefficient significant too.

However, although it may be possible to measure this money variable more accurately, the present study sheds light on the channels through which, in part, the disequilibrium in the money market is adjusted. This may be seen in table 8, where a horizontal line indicates

that there was no significant money variable, S means that flow supply was significant and T means that flow demand was significant (both at the level of at least 0.025).

In eight of the nine countries considered, the money market is an important variable working through some of the import channels. In particular, there is a concentration in the raw materials and intermediate goods sector, as against the consumer durables and capital goods sector. This is highly plausible and no doubt due to the better government controls over these kinds of goods, and to the discontinuity characteristic of expenditure in those sectors.

It was pointed out at the start of this study that a salient feature is the structural change which has occurred in the composition of imported goods, with a increasing relative importance of intermediate goods and raw materials at the expense of final consumer goods. This may be explained by the differing responses to the monetary stimulus, since in general there were inflationary pressures in Latin America during the period under consideration, and also by the very different estimates of income elasticity. These are summarized in the following table.

It is clear from table 9 that as the Latin American countries develop, the proportion of intermediate goods imported in relation to final consumer goods will increase.

The following may be said in summary. The proposed model turns out to be highly satisfactory in the explanation of imported goods in nine Latin American countries over a period of 25 years. Real

Table 9
INCOME ELASTICITIES FOR IMPORTED GOODS, 1950-1974

<i>Country</i>	<i>Income-elasticity for consumer goods</i>	<i>Income-elasticity for raw materials and intermediate goods^a</i>
Argentina	.49	1.05
Brazil	.41	.62
Colombia	-.47 ^c	1.00
Chile	1.14	1.92
Guatemala	.20 ^o	1.61
Honduras	.51	1.90
Mexico	.19 ^o	.46
Peru	-.10 ^o	1.58
Venezuela	-.57 ^o	1.10

^aExcluding fuels.

^bThe sing 0 means that the coefficient is not significantly different from zero.

income plays a preponderant role at almost all levels. Income, and the rising trend in income over the period in the countries studied, is likewise the reason why there is a drastic change in the composition of imported goods, particularly between intermediate and final consumer goods.

The variable used in the place of "restrictions" turned out to be very useful. This means that the level of international reserves may be used with a good margin of confidence as a relevant variable for the explanation of the quantity of goods imported, in the expectation that within a year the latter will respond positively to the former.

The "relative price" variable, as constructed for this study, proved to be extremely useful. It will be recalled that this variable covers the international price of the good and the rate of exchange in relation to the domestic price level. This variable was written in commas since it was not constructed as the domestic price of imported goods. However, it takes into account the direct effect of a devaluation, *ceteris paribus*, hence its usefulness from the standpoint of balance-of-payments policy.

The variables designed to measure the direct effect of the money market on expenditure on imported goods proved to be very important. It was found that, as far as imports are concerned, the market adjusts more frequently through the raw materials than through the intermediate goods account, which may also have helped to explain some of the relative change in that category of goods within total imports of goods; many of the countries studied showed over time a trend towards an excess flow supply of money.

**BALANCE-OF-PAYMENTS ADJUSTMENT, CREDIT
POLICY AND CONTROL OF THE
EXTERNAL DEBT***

Valeriano García

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1. Background

The purpose of this study¹ is to identify the lags in the adjustment of the balance of payments and its accounts in response to monetary disequilibria. This question is extremely important from the standpoint of monetary, credit and balance-of-payments policy; it is closely linked with the control of money and the future course of external borrowing in line with different policy options, as well as with the prediction of changes in international reserves.

In certain, very general, conditions, the central banks in Latin America can attain the desired stock of international reserves through changes in the amount of credit injected by them into the system, which directly affect the balance of payments. The first question which then arises is: how big must the monetary disequilibrium be in order to attain the desired change in international reserves? A second, equally crucial, question is: does this monetary disequilibrium affect all the balance-of-payments accounts equally? And finally, a third question of fundamental importance for debt control policy is: how long does a disequilibrium deliberately created by the monetary authority take to achieve the desired objective in the balance of payments, and which of the accounts will react fastest?

The methodological framework for this study is the modern monetary approach to the balance of payments. Broadly speaking, this approach deals with the trade and capital balances together. However, it is likely that the different variables which generate the disequilibrium in the money market—the crux of this approach—do not affect the different balance-of-payments accounts to the same degree and with the same velocity. This problem is wholly empirical for the time being and given the present stage of economics as a science. The balance of payments will adjust the money market through its different accounts, and no *a priori* assumption can be made about which adjustment mechanism will be the fastest and most efficient; but it is essential for the monetary authorities to know what these channels are and how they function in practice.

A greater or smaller time-lag in adjustment is an element which determines the ability or inability of monetary authorities to control the stock of money. While the monetary approach concludes irrefutably that, under conditions of fixed exchange rates, the central bank does not control the stock of money in the long term, for a more

¹The author thanks J.S. Lizondo for his important and constructive suggestions, and also V.J. Flías for his useful comments on an earlier version. Naturally, the author is responsible for any errors and for the opinions expressed.

efficient formulation and control of monetary and credit policies it is crucial to know whether that period is one quarter or three to four years.

The monetary authorities are basically interested in the endogenous or non-controllable component of changes in the stock of money, which is not independent of time units; in one month it will probably be close to zero and in the long term close to unity.

Many studies have been made of the dynamics of domestic inflation stressing monetary disequilibria and attempting to estimate the time-lags in adjustment.² More recently, studies have begun to be made of the dynamics of monetary adjustment through the balance of payments and on the way in which monetary disequilibrium affects the different balance-of-payments accounts.³ Mario Blejer studied the empirical case of Mexico in the period 1950-1973, without attempting to distinguish between the various balance-of-payments accounts; for the balance of payments as a whole, he came to the conclusion that monetary adjustment in that country would take about three years through the external sector. Antonio Gómez Oliver, who made an important contribution by studying the forms in which monetary disequilibrium affects the levels of domestic prices and the different balance-of-payments accounts in an open economy with a fixed exchange rate, also studied the empirical case of Mexico.⁴ According to his findings, monetary disequilibria significantly affect the real value of imports and the net capital flows, but have little on the real value of exports, which appears generally to be independent from domestic expenditure; and with regard to the effect of monetary disequilibrium on the current account, he came to the conclusion that the corresponding coefficient was approximately equal to 50% of the disequilibrium within a year. Gómez Oliver's study dealt specifically with the case of Mexico and did not undertake an explicit explanation of the lags in adjustment through the different accounts.

The studies which we have mentioned both stress the importance of non-tradable goods in explaining the discrepancies between internal

²A. Harberger, "The Dynamics of Inflation in Chile", in C. Christ, *Measurement in Economics*, Stanford University Press, 1963; A.C. Diz, "Money and Prices in Argentina", in D. Meiselman, *Varieties of Monetary Experience*, The University of Chicago Press, 1970; R.C. Vogel, "The Dynamics of Inflation in Latin America, 1950-1969", *The American Economic Review*, Vol. LXIV, No 1, March 1974.

³M. Blejer, *Dinero, Precios y la Balanza de Pagos: La Experiencia de México, 1950-1973*, CEMLA, Mexico, 1977.

⁴A. Gómez Oliver, *The Adjustment of the Money Market, the Price Level and the Balance of Payments in Mexico*, doctoral thesis, University of Chicago, 1977.

and international inflation in an economy with a fixed exchange rate; both deal with the case of Mexico, and both come to the conclusion that monetary disequilibrium is a key variable in the explanation of the balance of payments and its accounts (except exports in Gómez Oliver's study); and the studies on Mexico also suggest that the lag in adjustment through the external sector is approximately three years.

The majority of the empirical studies using the monetary approach to the balance of payments assume that adjustment is carried out within the period of observation, since they start from the condition of equality of stock supply of and demand for money, and then assume an *ex ante*, excess supply (demand) of money which is what generates the deficits (surpluses) in the balance of payments, until at the end of the period leakage through the external sector leads to the assumed equality between the actual and the desired stock of money.

This study does not assume the length of the adjustment period *a priori*, but on the contrary attempts to identify it empirically without any restrictive prior assumption.

2. Evolution of ideas about the monetary aspects of the balance of payments, and theoretical framework of the study

Since the pioneering work of David Hume until the present-day contributions of Mundell and Johnson, there have been various theories about the determination of the trade balance. There is no real break, however, and it may be argued that Hume, Mundel and Johnson form a different line of approach from the partial elasticities approach of the Marshallian type, which subsequently incorporated "multipliers" under Keynes' influence. It seems probable that Alexander's expenditure approach may serve as a bridge between the two theories, because it has (incomplete) elements from both. Alexander stresses the expenditure-income relationship as a fundamental factor affecting the balance of payments, but fails to rationalize this discrepancy as an expression of a disequilibrium in money-market stocks. This is where the contribution by Mundell and Johnson comes into its own. Alexander's expenditure or "absorption" approach still emphasizes money flows and devaluation analyses, without recognizing the latter's transitory effects, which are stressed in the monetary approach to the balance of payments. According to the latter, what is important is not the trade balance in itself but rather the balance of payments. In an open economy with a fixed exchange rate, the balance of payments is a mechanism for adjusting disequilibria between the quantities of domestic and foreign money held and desired; thus movements of the balance of payments in these circumstances only reflect the decision of the holders of assets to return to an equilibrium, and a permanent state of disequilibrium may be

maintained by means of continual injections of money through domestic credit; in this situation of excess flow supply (demand) of money, a devaluation or increased tariffs or controls would represent a one-shot increase in the price level which might correct an excess stock supply of money (generated, for example, by a decline in income or a rise in inflationary expectations), but never an excess flow supply (demand) of money.

In the case put forward by Hume, domestic prices had to rise so that, as a result of the ensuing change in the relative price of international goods, given the fixed exchange rate, corrective forces would be generated. The rise in domestic prices above the international level is not a necessary condition, according to a modern approach of underlying monetary disequilibrium, but rather depends on the size and openness of the economy. In the extreme case of small, open economies with fixed exchange rates, the excess (shortfall) of money is adjusted directly through foreign trade, without any need for a rise in the domestic price level which would bring into play changes in relative prices. If the economy is large and not very open, with a high proportion of non-tradable goods, the rate of inflation may rise temporarily above the international rate, but this will gradually be corrected, since there will be a substitution of the non-tradable goods, and in addition the excess demand will tend to decline as domestic money is substituted by international currency. The short-term effects of the monetary disequilibrium (for example, a permanent rise in the growth rate of domestic credit at a constant rate higher than the growth rate for the demand for money) will have a stronger effect on the domestic price level than on the balance of payments, the lower the elasticity/monetary disequilibrium of the relative prices of domestic and international goods and the proportion of the former in relation to the latter. In other words, so long as there is an excess supply of money, the domestic rate of inflation will be higher than the world rate. When the adjustment has been carried out, and the excess flow supply has ceased to exist, the growth rate of the prices of domestic goods will be the same as that of internationally tradable goods, and equal to world inflation. During the initial stage of the transition the rate of inflation of domestic prices will rise faster than that of international prices, but subsequently the process will be inverted so that at the end of the transition the level of the former will have risen to the same extent as that of the latter and thus there will be no change in relative prices.

The "monetary" approach focuses on money-market stocks. The essence of the approach may be seen as a system of general equilibrium which simplifies the system with three types of goods: money, bonds and merchandise. For the system to be in equilibrium the sum of excess demand must amount to zero. If the economy is closed, equilibrium is attained through changes in the price of money in relation to goods

(inverse of the price level), or through changes in the interest rate (change in the price of bonds). If the economy is open, there is a third possibility of adjustment: changes in the nominal stock of money through non-compensated purchases and sales (deficit or surplus) in the international market. Since these flows affect the stock of money—they are precisely its means of adjustment, in this case—the system will be in equilibrium when net flows of purchases and sales of goods and bonds amount to zero, i.e., when the balance of payments is in equilibrium.

The crux of this approach lies in the demand-for-money function. The real stock of money is equivalent to the nominal stock divided by the general price level. If the demand for money is stable, there will be an "optimum" quantity of real money with which the community will be satisfied; any change in the numerator (nominal stock) or denominator (price level) will mean that holders of money will be in disequilibrium in relation to the desired stock, and will move towards the desired stock through changes in the flows of purchases and sales. This is where the "symptoms" of the disequilibrium become manifest: disequilibrium in the money market will give rise to a discrepancy between spending and income, but only temporarily since it will last only so long as the money market is becoming adjusted.

The consequences of this disequilibrium will differ according to the assumptions made about the particular economy and its foreign exchange system. In the case of wholly floating exchange rates, the entire disequilibrium will be adjusted through the divisor of the nominal stock of money, and the exchange rate will be an endogenous variable which can also be explained by the monetary disequilibrium. At the other extreme, in the case of a small country (international prices are a given) with a fixed exchange rate (exogenous) and open to international trade, the money market will be adjusted through the nominal stock of money, which will therefore become an endogenous quantity over which the monetary authorities will have little control; any attempt to counteract the effects of a disequilibrium will be fruitless, unless the lags in adjustment through the external sector are so great that, from the standpoint of monetary policy, they mean that the public does not significantly affect or offset the action of the central bank, at least in the period considered pertinent.

Some important consequences can be deduced from the above. Firstly, balance-of-payments deficits or surpluses ought to be transitory, since they reflect a problem of maladjustment. It is therefore essential to estimate the duration of the adjustment period. Secondly, in the case of a country open to trade, any attempt to counter the disequilibrium will be self-defeating if the adjustment in the monetary market through the external sector occurs rapidly; if it takes place

slowly, it will be self-defeating in the long-term, which may be irrelevant for the purposes of short-term monetary policy. Thirdly, there are a number of intermediate situations between the systems of completely endogenous and completely exogenous exchange rates, in which case the question of the effect of a devaluation arises. A fourth fundamental point is that if the main cause of disequilibrium is excess creation of internal credit by the monetary system, a devaluation will have a transitory effect, because it will not attack the basic cause of the disequilibrium and will only achieve a greater velocity of adjustment of actual monetary balances to desired levels, through its effect on the domestic price level and, ultimately, the denominator of the nominal stock of money.

The same may be said about the analysis of tariffs. It is well known that when Latin American countries begin to experience balance-of-payments problems they start increasing restrictions on international trade. From the standpoint of the approach studied here, this can only have a passing effect on the balance of payments, and it cannot be ensured that its effect will be as desired, since while it will cause a rise in the domestic price level (thus leading to equilibrium) it will also cause a decline in income or the growth rate of income, thus having a contrary effect to the one desired, since the demand for money is a positive function of income.⁵

3. The empirical model

In the empirical model used below, the symbols are defined as follows:

M	=	nominal stock of money
P	=	general price level
BK	=	capital balance
BC	=	trade balance
m	=	real stock of money M/P
g	=	proportional rate of exchange
BCA	=	current account deficit or surplus
K	=	net capital movement
y	=	real domestic income
*	=	desired quantity
log	=	natural logarithm

⁵Milton Friedman, *The demand for money: some theoretical and empirical results*, *Journal of Political Economy*, Vol. 67, August 1959, pp. 327-351.

- e = expected quantity
 CD = domestic credit
 d = absolute increment
 Y = nominal income
 BP = balance of payments

Take the following model:

$$m_t - m_{t-1} = a (m_t^* - m_{t-1}) + s \left(\frac{dM_t}{P} - \frac{dM_t^*}{P} \right) \quad [1]$$

The absolute change observed in the real stock of money is explained as a function of a proportion, which we call a , of the difference between the stock desired and that actually held; it is a volitional adjustment equation. The higher coefficient a , the greater the adjustment involved. The second term which explains the change observed in the real monetary balances is given by the "buffer", which measures the flow disequilibrium between the change in the nominal stock of money (supply) and the change in the desired nominal stock of money, as normalized by the price level. It should be noted that a and s will vary inversely, i.e., when $a = 1$, $s = 0$ and when $a = 0$, $s = 1$.

Furthermore, and for short periods:

$$m_t - m_{t-1} = \frac{dM}{P} - \frac{M}{P} gP \quad [2]$$

In other words, the observed change in the real stock of money is composed on the one hand of changes in the nominal stock divided by the price level, and on the other by the rate of inflation weighted by the existing real stock.

$$\frac{dM}{P} - \frac{M}{P} gP = \frac{BCC}{P} + \frac{K}{P} + \frac{dCD}{P} - \frac{M}{P} gP \quad [3]$$

Replacing in (1)

$$\frac{BCC}{P} + \frac{K}{P} + \frac{dCD}{P} - \frac{M}{P} gP = a (m_t^* - m_{t-1}) + s \left(\frac{dM_t}{P} - \frac{dM_t^*}{P} \right) \quad [4]$$

If we wish to apply this model to the balance of payments as a whole, the result is:

$$\frac{BP}{P} = \frac{BCC}{P} + \frac{K}{P}$$

$$\frac{BP}{P} + \frac{dCD}{P} - \frac{M}{P} gP = a(m_t^* - m_{t-1}) + s\left(\frac{dM_t}{P} - \frac{dM_t^*}{P}\right)$$

$$\frac{BP}{P} = a(m_t^* - m_{t-1}) + s\left(\frac{dM_t}{P} - \frac{dM_t^*}{P}\right) + \left(\frac{M}{P} gP - \frac{dCD}{P}\right) \quad [5]$$

Assuming that $\frac{K}{P}$ is the most exogenous component, the model can also easily be adapted to estimate the current account balance. In this case,

$$\frac{BCC}{P} = a(m_t^* - m_{t-1}) + s\left(\frac{dM_t}{P} - \frac{dM_t^*}{P}\right) + \left(\frac{M}{P} gP - \frac{dCD}{P}\right) - \frac{K}{P} \quad [6]$$

The next step consists in replacing the theoretical values of m_t^* and dM_t^* by empirical approximations.

The solution we have adopted is in principle the simplest one. We assume that the three year average of observed data approaches the desired level of the real stock of money; we believe that three years is a sufficiently long period to bear out this assertion. As concerns the change in the desired nominal stock of money, this was approximated by the change in nominal income, a procedure which assumes unit elasticity of demand for money in relation to real income in the short term, and which ignores changes in velocity of circulation due to changes in inflationary expectations, but which is carried out in an exploratory manner, applying Occam's razor.

In formulas:

$$m_t^* = 1/3 \sum_{i=0}^2 m_{t-1} + i$$

$$dM_t^* = dY_t$$

if: $dma = m_t^* - m_{t-1}$

$$N = \frac{M}{P} gP - \frac{dCD}{P}$$

$$ASAR = \frac{dM_t - dY_t}{P}$$

then:

$$\frac{BP}{P} = C + a \text{ dma} + s \text{ ASAR} + bN \quad [7]$$

and:

$$\frac{BCC}{P} = C + a \text{ dma} + s \text{ ASAR} + bN - c \frac{K}{P} \quad [8]$$

The expected coefficients are:

$$0 < a, s, b \leq 1, c = 1$$

The econometric estimation of coefficient a gives us an idea of the lag in adjusting the money stock disequilibrium through the external sector. The expected coefficient of s is positive, since the variable interpreted as the "buffer" in the face of unexpected changes in the desired money flow, which in the short term remains in portfolio and therefore does not affect the domestic price level nor the flow of money which leaks to the exterior in accordance with its coefficient. N is the variable which measures, in this case, the excess flow demand (supply) of money and therefore its coefficient b will give an idea of how long the money flow disequilibrium will last. We assume that N measures the *ex ante* pressure of excess flow supply or demand because *ex post* the coefficient must be unity. There may be stock equilibrium and flow disequilibrium, or vice versa, and the lags in the adjustment of the two may be different; most studies stress flow disequilibria and ignore stock disequilibria; both may be important, however. Everything that affects the level of real income or inflationary expectations may affect the desired stock of money, while the flow demand for money will be affected fundamentally by the rate of change of income and the change in inflationary expectations. In this study, as a first approximation, it is considered that the flow demand for money is fundamentally determined by the inflationary tax, or the nominal money flow which must be accumulated in order to maintain the level of the real stock of money.

4. Empirical application of the models and analysis of the results

The above models were applied for the period 1960-1976, using annual data relating to the trade, current account, capital account and payments balances, to the following countries: Argentina, Brazil, Colombia, Chile, Guatemala, Honduras, Mexico, Peru and Venezuela. Objection may be made to the alternating use of variables which are

sometimes dependent and elsewhere independent; their coefficient suffers in some cases from bias since the variable is correlated with the random term of the equation to be estimated (simultaneous bias). But in fact we are interested not in estimating the value of this coefficient, but in ensuring that the variable in question is controlled or constant from the statistical standpoint, in order to estimate correctly the adjustment coefficients which will therefore—in our model—not suffer from bias.

The results for the adjustment coefficients for stocks and flows appear in table 1. The equations of the model always showed the expected signs in their lag coefficients, which were in general highly significant. The coefficient of the "buffer" variable is always positive, which supports our interpretation of the variable, but in most cases not significant, which was also to be expected since the period under consideration was one year.

Table 1

COEFFICIENTS OF LAGS IN THE ADJUSTMENT OF MONETARY STOCK AND FLOW DISEQUILIBRIA THROUGH THE TRADE BALANCE (BC), CURRENT ACCOUNT BALANCE (BCC), CAPITAL BALANCE (BK), AND BALANCE OF PAYMENT (BP)

	<i>BC</i>	<i>BCC</i>	<i>BK</i>	<i>BP</i>
Argentina	0.31 ^a (.15 ^b)	0.32 ^a (.15 ^b)	0.26 ^b (.15 ^b)	0.23 ^a (.13 ^b)
Brazil	0.46 ^a (.46 ^a)	0.42 ^a (.61 ^a)	0.63 ^a (.82 ^a)	0.36 ^a (.24 ^a)
Chile	0.83 ^a (.70 ^a)	0.51 ^b (.45 ^a)	1.1 ^a (.91 ^a)	1.1 ^a (.91 ^a)
Colombia	0.24 ^b (.25 ^b)	0.36 ^b (.23 ^b)	0.75 ^a (.97 ^a)	0.63 ^a (1.0 ^a)
Guatemala	0.54 ^a (.81 ^b)	0.45 ^a (.90 ^a)	0.71 ^a (1.0 ^a)	0.59 ^a (1.0 ^a)
Honduras	0.38 ^a (.91 ^a)	0.38 ^a (.95 ^a)	0.36 ^a (1.1 ^a)	0.28 ^a (1.0 ^a)
Mexico	0.21 ^a (.40 ^a)	0.29 ^a (.41 ^a)	0.67 ^a (.50 ^a)	0.50 ^a (.44 ^a)
Peru	0.63 ^a (.81 ^a)	0.49 ^a (.59 ^a)	0.66 ^a (.60 ^a)	0.33 ^a (.47 ^b)
Venezuela	1.1 ^a (1.1 ^a)	1.3 ^a (1.0 ^a)	1.3 ^a (1.0 ^a)	1.3 ^a (1.1 ^a)

Note: The flow disequilibrium coefficient is given in brackets.

^aSignificant to 0.01.

^bSignificant to 0.025.

Table 2 gives the estimates for the different countries in decreasing order according to velocity of adjustment. As may be seen, the coefficient of adjustment of stocks is relatively small and entails an appreciable lag. In all the countries considered, except Venezuela, Chile and Guatemala, the total adjustment for this type of disequilibrium takes two to three years, and even longer in the case of Argentina. In

Table 2

STOCK DISEQUILIBRIA:
COEFFICIENTS OF ADJUSTMENT IN THE CAPITAL AND PAYMENTS
BALANCES, RANKED IN DECREASING ORDER

<i>Country</i>	<i>BK</i>	<i>Country</i>	<i>BP</i>
Venezuela	1.3	Venezuela	1.3
Chile	1.1	Chile	1.1
Colombia	0.75	Colombia	0.63
Guatemala	0.71	Guatemala	0.59
Mexico	0.67	Mexico	0.36
Peru	0.66	Brazil	0.36
Brazil	0.63	Peru	0.33
Honduras	0.36	Honduras	0.28
Argentina	0.26	Argentina	0.23

Source: Application of the model set forth in this study.

Venezuela and Chile the entire adjustment occurs within a year. As concerns flow disequilibria, the countries "slower" to adjust through the balance of payments as a whole are Argentina, Brazil, Mexico and Peru, whose coefficients range from 0.13 for Argentina to 0.47 for Peru. The fastest are Venezuela, Honduras, Guatemala, Colombia and Chile (see table 3).

Table 3

FLOW DISEQUILIBRIA:
COEFFICIENTS OF ADJUSTMENT IN THE CAPITAL AND PAYMENTS
BALANCES, RANKED IN DECREASING ORDER

<i>Country</i>	<i>BK</i>	<i>Country</i>	<i>BP</i>
Venezuela	1.1	Venezuela	1.1
Honduras	1.1	Honduras	1.1
Guatemala	1.0	Guatemala	1.0
Colombia	0.97	Colombia	1.0
Chile	0.91	Chile	0.91
Brazil	0.82	Peru	0.47
Peru	0.60	Mexico	0.44
Mexico	0.50	Brazil	0.24
Argentina	0.15	Argentina	0.13

Source: Application of the model set forth in this study.

With regard to the balance-of-payments accounts, it is the capital account which reacts fastest in all countries except Venezuela, where the accounts all adjust equally rapidly. In Venezuela the adjustment coefficient is roughly equal to one, for both stock and flow disequilibria, for all the accounts into which the balance of payments has been broken down, and also for the balance of payments as a whole.

The results show that Argentina, Brazil, Peru and Mexico have a relatively slow adjustment through the balance of payments as a whole. This means greater autonomy for the central banks in the management of their monetary policy, and at the same time lends greater weight to the "relative prices" effects indicated by Hume in the adjustment mechanism of the balance of payments. This appears to be the case for the so-called "large and medium-size" countries.

The adjustment coefficients for these countries may have a slightly different explanation or interpretation, although it leads to the same conclusions with regard to the power and autonomy of the monetary authorities: given the level of monetary disequilibrium, between 20 and 50% will be leaked through the external sector, in the course of the year whereas the rest will be adjusted through domestic prices or will be maintained as a "buffer". In addition, this conclusion suggests that if these countries wish to maintain a fixed exchange rate they may very rapidly, incur domestic inflation at a higher rate than international inflation, so that on this score they should be very careful not to have to face subsequently the classic choice between deflation or devaluation.

Everything seems to suggest for these countries that while in the long term the tenets of the monetary approach to the balance of payments are borne out, the lags may be sufficiently large to leave the monetary authorities a great margin of independence in the management of the stock of money and the policies designed to counteract disequilibria.

The "small" countries like Guatemala and Honduras and "intermediate" countries, like Venezuela, Colombia and Chile, show a very rapid adjustment to monetary flow disequilibria; thus their degree of autonomy is much less than in the case of the previous countries as concerns the management of the stock of money, and their attempts to counteract internal sector movements may be vain, and in any case will take the form of stabilization measures.

In sum, it may be said that the empirical results on the one hand bear out the theoretical conclusions of the monetary approach to the balance of payments, since disequilibrium in the money market explains very satisfactorily the external sector accounts. For some countries, these results call into question the assertion that the monetary authorities have very little control over the nominal stock of money; the conclusion suggests that while they do not have complete

control, they do have a great deal, even in the medium term. For other countries, which are smaller and probably more open to international trade, the empirical results clearly establish that the stock of money is an endogenous variable determined by demand conditions, within the period of one year, and that therefore the monetary authorities, rather than attempting to control it, should place the emphasis on domestic credit and its growth rate in relation to the demand for money and its growth.

THE MONETARY APPROACH TO THE EXCHANGE RATE*

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“To me it is crystal clear that reducing Bank Notes would bring down the price of gold ingots and improve the external exchange.”

David Ricardo, 1811.¹

“What, then has determined and will determine the values of the franc? First, the quantity, present and prospective, of the francs in circulation. Second, the amount of purchasing power which it suits the public to hold in that shape.”

J.M. Keynes, 1924²

The present paper³ contains a description and analysis of the principal determinants of the exchange rate, considered from a monetary viewpoint. Accordingly, the approach adopted highlights the importance of monetary variables in determining the exchange rate.

Under this approach, the exchange rate is determined by the relative purchasing power of two currencies. It should be pointed out that this is an approach parallel to the monetary approach to the balance of payments, since both emphasize the importance of monetary imbalances. In this way, excess supply of or demand for money will be reflected in the overall balance of payments when the exchange rate is fixed; in the exchange rate itself when this freely varies; or in both, in such cases as that of “dirty floating”. Even though this approach is not

¹In “Reply to Mr. Bosanquet’s Practical Observations on the Report of the Bullion Committee”, 1811.

²J.M. Keynes, *A Tract on Monetary Reform*, Collected Writings, vol. IV (London, Macmillan, 1971), p. xviii.

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a new one, since it was used by such economists as David Ricardo and Gustav Cassel, it has enjoyed a revival in the present decade after a long and chequered history.

This study is composed of two parts. The first part outlines a model which includes the basic propositions of a monetary approach to the exchange rate, and then explains its economic policy implications. The second part consists of an empirical application of the approach to some Latin American countries, of a comparison of the results with those of previous studies, and of a short recapitulation of the paper's conclusions.

Since this paper will cover countries with high levels of inflation, and periods of one year, the model used assumes equilibrium both in flows and in stocks in the money market. For countries with lower levels of inflation it would probably be necessary to modify the model to include possible maladjustments in the money market. In addition, it should be pointed out that this paper excludes the possible effects on the relative prices of tradable and non-tradable goods in inflationary situations, on the assumption that, in economies experiencing high inflation, relative prices will normally tend to achieve equilibrium rapidly. In the case of more moderate inflation, the model should also be adapted in this regard.⁴

It should be pointed out that development of the model leads to a level of disaggregation which is not entirely necessary. This is especially true in the case of the relationship between nominal and real interest rates and the concept of the parity interest rate. Neither has to be true in the short run, and especially in disequilibrium situations. This point might have been dealt with in a different way; however, it has been set out in this way in order to show the underlying long-term circumstances.⁵

⁴ See, for example, R. Dornbusch, "The Theory of Flexible Exchange Rate Regimes and Macroeconomic Policy", *Scandinavian Journal of Economics*, vol. 8, No 2 (May 1978), and M. Blejer, *Dinero, precios y la balanza de pagos: la experiencia de México, 1950-1973* (CEMLA, Mexico, 1977).

⁵ It is estimated that replacing the inflation rate (which was used in the empirical proofs of this study) by the nominal interest rate (which would have to be used if the ratios referred to [equations (4) and (5) of the model] were not considered), would not affect the empirical results of this paper, since in a situation of high inflation the nominal interest rate is almost entirely determined by inflation. In reading the model, especially the sections referred to, it is necessary to bear in mind that there are disaggregations which are not necessary, and which because of their long-term nature do not invalidate the conclusions. It should be mentioned that, for Latin America, it is difficult to obtain series of meaningful nominal interest rates, since for a long time these rates have been fixed.

Concerning the empirical section, it may be claimed that the data provided —both those developed in this paper and those of other authors summarized here— tend to support the monetary approach to the exchange rate and the specific model of that approach set out in section II. Thus in all cases the model shows very high predictive power, and in almost all the estimates it was found that changes in money produce proportional changes in the exchange rate; this is known as the homogeneity postulate, and constitutes an essential part of the model.

Finally, it should be mentioned that the approach adopted does not preclude the validity of other approaches for special cases. Thus it is perfectly possible, if necessary, to incorporate short-term characteristics of other approaches. Nevertheless, it holds that any model which does not include money is incorrectly designed, since it does not take into account one of the principal determinants of the exchange rate.

A. THE MODEL⁶

The model described below is presented in general equilibrium terms and formulated in terms of stocks of financial assets. It is a general-equilibrium model because it takes into account both the real and monetary sectors of the economy. On the other hand, the financial asset markets have been described in terms of stocks.

In general, all models based on the monetary approach to the exchange rate analyse the behaviour of demand for and supply of stocks of these financial assets, and on this basis determine the behaviour of the exchange rate. This contrasts with the currently traditional approaches for the determination of the exchange rate, which only analyse variables that are flows, such as imports, exports, and capital movements.⁷

Formulating a model for the determination of the exchange rate in terms of stocks has at least three advantages. Firstly, it can clearly be seen that flows are nothing more than adjustments designed to achieve the desired stocks, and that the fact that flows are in equilibrium does not necessarily mean that there is equilibrium in the stocks. Secondly, it can be seen that a small imbalance in demand for or supply of stocks can cause major flows, since stocks are usually very large compared with flows. Thirdly, it is simple to reduce the models from stocks to flows. For example, in the event that there are costs of adjustment in

⁶The model outlined here follows very closely those described by R. Dornbusch, *op. cit.*, and J. Bilson, "The Monetary Approach to the Exchange Rate: Some Empirical Evidence", *IMF Staff Papers* vol. 25, No 1 (March 1978).

⁷This distinction is similar to that between the theory of interest determination based on liquidity preference and the theory of flows of loanable funds.

the stocks such that, within the period defined, it is not possible to achieve total equilibrium in the stocks, the model can be presented with flow adjustments, but incorporating all the advantages cited for models presented in terms of stocks. It should be pointed out that the inclusion of flow adjustments in a stock model is an empirical problem which basically depends on the cost of adjustment and the length of the defined period.

The model presented below is made up of seven equations which contain the principal propositions of the monetary approach to the exchange rate. Each of them is described and analysed below.

1. The quantity theory of money

$$P = \frac{M}{m^d} ; P^* = \frac{M^*}{(m^d)^*} \quad [1]$$

In this equation \underline{M} is the nominal stock of money which, in this case, with a freely variable exchange rate, may be assumed to be determined by the Central Bank. \underline{P} is the price level and \underline{m}^d the demand for real monetary balances. Asterisks are used to distinguish variables corresponding to the other country or to the rest of the world.

This first equation, which may also be expressed as $m^d = \frac{M}{P}$, represents monetary equilibrium. It states that the price level in each country is adjusted in order to bring the real value of the nominal stock of money into line with that of real demand, thus balancing the market of real monetary balances. The equation also implies that, given the real demand for money, the price level will be determined and will vary in the same proportion as the money supply, at least in the long run.⁹ All the above constitutes the nub of the quantity theory of money.¹⁰

⁸In this case, it is assumed that any variation in the quantity of money will be immediately reflected in a change in prices. This assumption (instantaneous adjustment) is appropriate since we have dealt with inflation-prone countries. In the case of more stable countries, equation [1] must be modified by applying some kind of adjustment model. In the empirical section, the usefulness of the adjustment models for inflation-prone countries was put to the test, but the results showed clearly that such models are of little importance (see the empirical section of this paper).

⁹This is the "principle of equiproportionality", which is one of the basic propositions of the quantity theory of money. This relationship is even clearer when it is expressed in terms of rates of change: $\log P = \log M - \log m^d$, and on the assumption that m^d is constant (that is, that $d \log m^d = 0$) we have: $d \log P = d \log M$, in other words, proportional changes in \underline{M} will be reflected in equal proportional changes in \underline{P} .

2. Demand for money

$$m^d = ky^\alpha \cdot e^{-\beta i}; (m^d)^* = k^*y^{*\alpha} \cdot e^{-\beta^*i^*} \quad [2]$$

In this equation k is a constant, y represents the real income which is assumed to be exogenously determined, i is the nominal interest rate, and α and β are, respectively, income elasticity and interest rate semi-elasticity of money demand. An asterisk (*) will be used to distinguish the variables, and an apostrophe (') to distinguish the parameters corresponding to the other country, or to the rest of the world.

This second equation represents the money demand function and indicates that demand for real monetary balances on the part of the public is a stable function which depends on only two variables: real income and the nominal interest rate.¹¹ The first variable is an indica-

¹⁰To obtain the traditional form of the quantity equation it is sufficient to replace m^d by its form stated in [2] and make $ke^{-i\beta}$ equal to the inverse of the velocity of circulation:

$$P = \frac{M}{m^d}, \text{ therefore } m^d \cdot P = M. \text{ However,} \quad [1]$$

$$m^d = ky^\alpha \cdot e^{-i\beta} \quad [2]$$

Combining [1] and [2] we have:

$$ky^\alpha \cdot e^{-i\beta} \cdot P = M$$

If $ke^{-i\beta}$ is made equal to $\frac{1}{V}$ and $\alpha = 1$, then according to the assumptions of the quantity theory:

$$y \cdot P \cdot \frac{1}{V} = M \text{ and, re-arranging the terms:}$$

$$P \cdot y = M \cdot V, \text{ which is the traditional form of the quantity equation.}$$

It should be pointed out that the velocity represents, in this case, demand for money for such purposes as speculation ($e^{-i\beta}$), precaution and so on; k also includes the technical and structural conditions of the transaction process.

¹¹It should be pointed out that the fact that real income does not depend on money is another of the basic principles of the quantity theory, the "principle of neutrality". This principle, which must hold at least in the long term, is implicit in this formulation of demand for money and may be derived clearly from the traditional form of the quantity equation. Furthermore, it should not be forgotten that this exogeneity presupposes the existence of downward flexibility in prices, which might be a very strong assumption. Nevertheless, since we usually work with inflationary (and not deflationary) situations, the above assumption does not in fact appear to be a limitation on the model.

tor of the real volume of transactions, and thus represents demand for money for this purpose. On the other hand, the interest rate measures the opportunity cost of holding money. We see that parameter β corresponds to the interest rate semi-elasticity of money demand, and accordingly measures the response of demand to changes in the nominal interest rate. β is negative, indicating that the wish to maintain real balances varies inversely with the cost of maintaining them. Finally, it should be mentioned that it will be assumed that for both countries income elasticity is 1 ($\alpha = \alpha' = 1$) and that the interest rate semi-elasticity (β) is the same in all the countries ($\beta = \beta'$). Neither assumption affects the general application of the model, while both make it possible to eliminate considerations which are not necessary for the explanation provided by the model.¹²

3. The purchasing power parity theorem .

$$P = XP^* \quad [3]$$

In this equation X is the exchange rate, P is the price level in the country and P^* the level of prices in the other country or remaining countries. P^* (or its rate of change) is fixed (and independent) vis-à-vis the actions of the country analysed.¹³

As the equation indicates, price levels in both countries are identical when they are expressed in terms of a common currency at the equilibrium exchange rate. This means that the exchange rate equalizes these price levels, and therefore the purchasing power of the two currencies, when expressed in a common currency. This condition —of purchasing power parity— is necessary if the currency markets are to be in balance in the two countries, and if both stocks of money are to be willingly held by the public. If there was no purchasing power parity, there would be greater demand on the part of the public for the currency with more purchasing power, and less demand for the other. The excess demand for the former and excess supply of the latter will cause the exchange rate to adjust until the purchasing power falls into line and both stocks of money are willingly held. One way of repre-

¹²Nevertheless, these restrictions will not be applied to the model in the empirical section.

¹³In this case, when speaking of prices, the reference is to relative price levels between different countries. In this way, the individual behaviour of prices is of no importance, since the wish is to the general purchasing power of each currency. For an interesting analysis of this point, see J. Frenkel, "A Monetary Approach to the Exchange Rate: Doctrinal Aspects and Empirical Evidence", *Scandinavian Journal of Economics*, vol. 78, No 2 (1976).

senting the parity purchasing power is to express the exchange rate as $X = \frac{P}{P^*}$, which corresponds exactly to its monetarist interpretation.

It is well known that in each country, the value of money is inversely related to the level of prices. Therefore, the relative value of two currencies will be equal to the relative value of their price level ($X = \frac{P}{P^*}$). Application of the operator \underline{g} ¹⁴ gives: $g_X = g_P - g_{P^*}$, which amounts to saying that, in equilibrium, the rate of change in the exchange rate will be the same as the difference between the rates of change in price levels in the countries concerned.

4. Relationship between real interest rate (or real rate of return on capital) and nominal interest rate¹⁵

In this equation, \underline{i} is the nominal interest rate and $\underline{\rho}$ the real interest rate (or rate of return on capital), \underline{g}_P the rate of inflation, and subscript \underline{e} a way of expressing the expected value of any variable.

This equation defines the nominal interest rate as the sum of the real interest rate (or rate of return on capital) and the expected inflation rate. This gives the Fisher ratio,¹⁶ according to which the nominal interest rate should be equal to the real interest rate plus expected inflation, this being valid within each country.

5. The concept of the parity interest rate

$$\rho = \rho^* = \rho_w^{17} \quad [5]$$

In this equation, $\underline{\rho}$ is the real rate of interest (or rate of return on capital), while subscript \underline{w} indicates the world economy as a whole.

¹⁴ \underline{g} = "rate of change" operator. It is equivalent to the concept $\log Z_t - \log Z_{t-1}$ where \underline{Z} is any variable.

¹⁵Equations [4] [5] are not necessary for developing the model, as was pointed out in foot-note 5 above.

$$\underline{i} = \underline{\rho} + \underline{g}_{P_e}; \quad \underline{i}^* = \underline{\rho}^* + \underline{g}_{P_e^*} \quad [4]$$

¹⁶After the economist Irving Fischer.

¹⁷Equation [5] might equally read:

$$\underline{\rho} + \underline{a} = \underline{\rho}^* + \underline{a}^* = \underline{\rho}_w$$

In other words, a constant \underline{a} , different for each country, might be added, to represent the concept of risk differentials in the various countries due, for example, to political factors, other random factors, and so on. Note that $\underline{a} < 0$, since it represents a payment for capital risk.

This equation expresses the parity interest rate concept, according to which the real yield of assets tends to be the same in all countries, at least in marginal terms, irrespective of the currencies in which it is expressed. Since we are assuming that capital is internationally mobile, in other words that foreigners can buy bonds in a given country while nationals of that country can buy foreign bonds, the real yield must be the same everywhere in order for the stocks of such assets to be willingly held.¹⁸ As a result, the equation states that the real interest rate (marginal and net of risk) of all countries is the same, and that it is the same as the world rate. (if there are no restrictions on the movement of capital between countries).

Equations [4] and [5] taken together imply that the differences between the nominal interest rates of countries reflect the differences between those countries' expected inflation rates. For example, if the market expects that United States inflation will be 20% and Chilean inflation 15%, then the nominal interest rate in the United States will be 5% higher than in Chile.

6. Monetary hypothesis of the formation of inflationary expectations

$$g_{p_e} = f(g_{M_e}); g_{p_e}^* = f'(g_{M_e}^*) \quad [6]$$

In this equation, $\underline{g_{p_e}}$ is the expected future inflation rate, and $\underline{g_{M_e}}$ the expected rate of growth in the money stock.

Equation [6] states that a monetarist hypothesis concerning inflationary expectations must be based on the market's expectations concerning future rates of monetary growth. This means, of course, that the market must anticipate or project future rates of monetary growth with the aim of forecasting future inflation rates. This equation is monetarist since it focuses these expectations on the expected rate of growth in money, consequently its frame of reference is the quantity theory of money.¹⁹

¹⁸The reasoning is completely analogous to that of the theory of purchasing power parities, but is now applied to the capital account instead of the current account of the balance of payments.

¹⁹Using the quantity equation, it is possible to define future inflation on the basis of expected growth in money: $M^e \cdot V^e = P^e \cdot y^e$ (the suffix e means expected value). In terms of rates of change we have:

$$g_{M_e} + g_{V_e} = g_{P_e} + g_{y_e}, \text{ then } g_{P_e} = g_{M_e} + g_{V_e} - g_{y_e}.$$

If, maintaining the previous monetarist assumptions, we suppose that g_{V_e}

7. Projection of the future rate of monetary growth

$$g_{M_e} = h(g_M, I); g_{M_e}^* = h'(g_M^*, I^*) \quad [7]$$

In this equation $\underline{g_{M_e}}$ is the expected rate of monetary growth, \underline{I} the information on the basis of which expectations are formed and $\underline{g_M}$ the present rate of growth in the money stock.

The equation explains how future growth in money is anticipated. It assumes that the public forms its expectations rationally, using all the information available in order to predict the future growth of money, and perhaps revising its predictions as new information appears, such as, for example, recent economic policy announcements, imminent changes in economic policy, data concerning the present and past behaviour of monetary variables or information concerning the response of the authorities to different changes in the economy.

The equation does not aim to explain exactly how predictions concerning the future growth of money arise from this type of information. It simply assumes that the predictions are made in some form, and that their accuracy increases in line with that of the information existing in the market.²⁰

It should be noted that incorporating equation [7] in equation [6] brings us to the *hypothesis of efficient markets*. This states that expectations concerning the exchange rate *reflect all the information available* on the subject, with these expectations being automatically adjusted to incorporate any new information which may appear.

8. Causal relation between the variables

Taken together, the above relationships comprise the monetarist view of exchange rate determination. These relationships imply two channels of influence on the exchange rate, one direct and one indirect, linking money with prices and with the exchange rate.

and g_{y_e} are independent of growth in money, and that they increase at a constant rate, the difference between them may be represented by a constant b , which may be positive or negative. Then we would have $g_{p_e} = g_{M_e} + b$, which represents a monetarist approach to future inflation.

²⁰ For further explanation of this mechanism of formation of expectations, see the excellent article by T. Sargent and N. Wallace, "Rational Expectations and the Dynamics of Hyperinflation", *International Economic Review*, LXII (September 1972).

The first channel implies that the present stock of money directly affects prices and the exchange rate by means of the monetary equilibrium and purchasing power parity equations. Therefore,

$$M^s \longrightarrow P \longrightarrow X$$

The second, indirect channel assumes that anticipated growth in money has an influence on prices and the exchange rate through expectations, and that this in turn affects the nominal interest rate and, consequently, demand for money. Specifically, the model postulates the following causal chain:

The present (gM_t) and past (gM_{t-i} for $i = 1 \dots n$) rates of growth in money have an important influence on predictions concerning the future growth in money (gM_e); these predictions determine the expected inflation rate (gP_e), and given the real interest rate (ρ), inflationary expectations determine the nominal rate of interest (i). This variable, together with real income (y), determines the real quantity of money sought (m^d); the latter and the nominal money stock (M) determine the price level (P), which in turn, together with the level of foreign prices (P^*), determines the rate of exchange (X). Then

$$\begin{array}{l} gM_t, gM_{t-i} \longrightarrow gM_e \longrightarrow gP_e, \text{ given } \rho \longrightarrow i, \\ \quad (i = 1 \dots n) \\ \text{given } y, \longrightarrow m^d y M \longrightarrow P, \text{ given } P^* \longrightarrow X. \end{array}$$

In this model, connexions run from present and anticipated money to prices and the exchange rate. All variables which affect the exchange rate do so through monetarist channels, in other words, those of demand for or supply of money. In this regard, demand for and supply of money are the immediate determinants of the exchange rate. However, the final determinants are the less immediate determinants of demand, such as income, nominal interest rate (which in turn is determined by the real interest rate and all exogenous information) and money supply.

9. Solution of the model

“A second objection that is raised is that floating exchange rates would be highly unstable and that unstable rates would add to the uncertainty and difficulty of conducting foreign trade. However, floating rates need not be highly unstable. . .

“If floating rates are . . . unstable, it

will be because the internal monetary policies of the countries or some other aspects of their economy are highly unstable."²¹

The relationships between the final determinants of the exchange rate and this variable can clearly be seen when the system is solved, leaving the exchange rate aside as an unknown. The resulting expression in reduced terms is:

$$X = \begin{bmatrix} k^* \\ / \\ k \end{bmatrix} \begin{bmatrix} M \\ / \\ M^* \end{bmatrix} \begin{bmatrix} y^* \\ / \\ y \end{bmatrix} e^{-\beta(i^* - i)} \quad [8]$$

²¹Milton Friedman, *Dollars and Deficits* (Englewood Cliffs, N.J., Prentice-Hall, 1968), p. 231. The most important part of the quotation is underlined.

²²Equation [8] was obtained from equation [3]:

$$P = XP^* \quad [3]$$

But from [1] we know that

$$P = \frac{M}{m^d}, \quad P^* = \frac{M^*}{m^{d*}}$$

Replacing [1] in [3] we have

$$\frac{M}{m^d} = X \frac{M^*}{m^{d*}}$$

From [2] we know that

$$m^d = k y \alpha e^{-\beta i} \quad m^{d*} = k^* y^* \alpha' e^{-\beta' i^*}$$

but as it has been assumed that $\alpha = \alpha' = 1$, and that $\beta = \beta'$, finally we have

$$m^d = k y e^{-\beta i} \quad m^{d*} = k^* y^* e^{-\beta i^*}$$

Substituting these in the above, the equation reads

$$\frac{M}{k y e^{-\beta i}} = X \frac{M^*}{k^* y^* e^{-\beta i^*}}$$

and solving for the dependent variable X we have

$$X = \begin{bmatrix} k^* \\ / \\ k \end{bmatrix} \begin{bmatrix} M \\ / \\ M^* \end{bmatrix} \begin{bmatrix} y^* \\ / \\ y \end{bmatrix} e^{-\beta(i^* - i)}, \quad \text{which is equation [8].}$$

or, since the nominal rate of interest is the sum of the real rate plus the expected rate of inflation (g_{pe}):

$$\begin{aligned}
 X &= \begin{bmatrix} k^* / k \\ M / M^* \end{bmatrix} \begin{bmatrix} y^* / y \end{bmatrix} e^{-\beta(\rho + g_{pe}^*(m_e^*, I) - \rho - g_{pe}(m_e, I))} \quad [9] \\
 &= \begin{bmatrix} k^* / k \\ M / M^* \end{bmatrix} \begin{bmatrix} y^* / y \end{bmatrix} e^{-\beta(g_{pe}^* - g_{pe})}
 \end{aligned}$$

Equations [8] and [9] include the final determinants of the exchange rate. Four groups may be distinguished in these equations: constants, the relative supply of money, relative real income and relative nominal interest rates, which in equation [9] are broken down into the real interest rate and inflation expectations. The first group covers "other" (relative) effects on demand for money; the second, "pure" monetary influences on the exchange rate; the third, real influences; and the fourth, the role of expectations. As regards the second group of determinants, the equation implies that, if all other conditions are equal, the country with the higher growth rate in its money supply will experience depreciation of its currency in foreign markets. The third group of determinants states that, again if all other conditions are constant, the country with more rapid growth in real income, and accordingly, in real demand for money will find itself in the opposite situation.²³ The reason is clear: with a given nominal stock of money, the rise in demand for money due to an increase in income will require a fall in the price level in order to balance the money market. Since this fall in prices is greater in the economy which grows faster, and since by definition the exchange rate is the relationship between the two price levels, the currency of the country with more rapid growth will increase in value in foreign markets.²⁴ It should

²³ It should be pointed out that this assertion is correct because it has been assumed that $N_y = 1$ (income elasticity equal to 1). Otherwise it would be necessary to say that "the country with the greater growth in income because of its income elasticity of demand for money will find that the value of its currency increases".

²⁴ This conclusion assumes that in the change in income, there are enough tradable goods in order to "buy" the increase in imports. If this assumption is analysed empirically, it will be seen to be not at all restrictive in the short term. Over longer periods, the conclusion is always true.

be noted that the monetarist conclusion that increases in real income tend to raise the exchange rate contradicts the traditional view of the balance of payments, whereby a rise in income increases demand for imports in the country concerned,²⁵ and accordingly leads to a devaluation of the exchange rate. Finally, as regards the third group of determinants, equations [8] and [9] state that, given ρ , the country with relatively higher inflationary expectations will suffer a decline in its exchange rate. This is due to the fact that the public will wish to keep a smaller quantity of the currency whose value is expected to fall most, therefore leading to a drop in its demand; assuming that the supply of the currency is constant, the exchange rate will fall. At the same time, contracts will tend to be drawn up in the currency which is expected to depreciate less; that is to say, the stronger currency will be preferred as an international unit of account and as a means of international payment, thus further reducing demand for the other currency and strengthening its depreciation and the fall in the exchange rate. In short, the fact that there are expectations of depreciation of a currency will reduce both demand for assets and transactions demand and, as a result, will lead to an actual depreciation of the currency. It should be pointed out that these expectations are not independent of recent or present measures and announcements of monetary policy, but are strongly influenced by them. In this way, according to the model, a long history of monetary expansion will lead to expectations of further monetary expansion and, accordingly, will contribute to weakening the currency on the foreign exchange market. On the other hand, a history of monetary stability will create a favourable climate for the currency, and will therefore contribute to its strength. The above arguments show the importance that the approach attaches to the role of expectations in the determination of the exchange rate. Equation [9] specifies that the difference in inflationary expectations in various countries is the reason why exchange rates sometimes deviate from the levels suggested by the relative levels of money supply and income. According to this equation, the exchange rate will be adjusted to the levels suggested by the fundamental conditions (such as real income and the stock of

²⁵In general, this view has been proposed by the Keynesian models of income determination. In Latin America this approach has been supported principally by the Economic Commission for Latin America (CEPAL). In this regard, C. Massad has pointed out to me that the CEPAL approach was formulated on the basis of conditions prevailing in the 1940s, when there were serious difficulties in purchasing goods abroad, which meant there was a very high proportion of non-tradable goods. Today, the conditions prevailing in Latin America in this regard are substantially different, so that this assumption does not reflect real conditions and the inferences derived from it should therefore be revised.

money) only when inflationary or other expectations are the same in both countries.²⁶

Equation [9] is interesting since it is also capable of explaining another present characteristic of floating rates: a degree of instability in exchange rates. The equation identifies two main sources of movements in exchange rates. The first lies in movements in the relative levels of money supply due to changing monetary policies which differ between countries. For example, fluctuations in the exchange rate can occur because two countries embark on anti-cyclical monetary policies at different moments. The second source of instability in the exchange rate identified by equation [9] lies in the changes in expectations caused by the emergence of new information. This new information prompts the market to revise its opinion concerning the future cost of and return on keeping the various currencies. The exchange rate, reflecting these changes in expectations, will change until the existing stocks of money are once again willingly held.²⁷ Any new information which changes the market's expectations concerning the future values of currencies will lead to sudden changes in the exchange rate.²⁸ It should be mentioned that, on such occasions, *substantial changes in the purchasing power parity* suggested by the basic underlying conditions may occur. This was a contribution made by X. Zolotas, the first to state it explicitly.

A third possible source of instability in the exchange rate are changes in relative income. However, this factor is not so important in the monetarist analysis, since this analysis assumes that such changes are small compared with the changes in the stocks of money and in inflationary expectations. However, in a period of relative monetary stability, this may be an important factor, specially in developing countries with only one export.²⁹

²⁶In this special case, the future rates of return on the currencies are identical, so that this argument disappears from the equation and the exchange rate remains dependent on its fundamental determinants. In other words,

$$X = \begin{bmatrix} k^* \\ / \\ k \end{bmatrix} \begin{bmatrix} M \\ / \\ M^* \end{bmatrix} \begin{bmatrix} y^* \\ / \\ y \end{bmatrix} \quad [10]$$

²⁷It should be pointed out that an exchange rate is no different from the price of a share. In the same way that the price of a share at any moment reflects all the available information concerning the future profitability of the firm, so does the exchange rate. Thus, exchange rates include all the known information affecting the future values of two currencies.

²⁸Just as new information concerning the profitability of a company causes major changes in the value of its shares.

²⁹As in the case of changes in the price of the sole export product.

10. Economic policy implications of the model

“The ultimate objective is a world in which exchange rates, while *free* to vary, are in fact highly stable. *Instability of exchange rates is a symptom of instability in the underlying economic structure.*”

Milton Friedman, 1953³⁰

The model presented specifies that the key elements in determining the exchange rate are money stocks. Specifically, the model postulates that these stocks are exogenously controlled by the Central Banks, and that the public's inflationary expectations (and, accordingly, expectations concerning the future purchasing power of the various currencies) are strongly influenced by present (and past) monetary policies and by announcements made by the Central Bank.

This model has various implications.³¹ The first is that, given the growth rate of the stock of foreign money, the most effective way of halting and reversing the decline in the exchange rate is a permanent (and declared) reduction in the rate of growth of domestic money. Like any new information, the announcement itself will have an immediate effect on the rate of exchange by way of price expectations. In order for this effect to be maintained, the authorities must ensure that growth in the money supply actually coincides with the declared rates, since the public forms its expectations concerning the future, at least in part, on the basis of present experience. Assuming that this takes place, and that stable money growth is henceforth pursued, the exchange rate will become strengthened continuously and consistently through the money and expectations components in accordance with equation [9].

The second implication is that variations will occur in the exchange rate when two countries' monetary policies are divergent. This may be shown by reference to equation [8].

In the context of the model it is impossible for one country to stabilize its exchange rate by adhering to a monetary rule if the other country is following a different rule, or if both, while following the same rule, do so in an unco-ordinated manner. In other words, stability

³⁰M. Friedman, “The Case for Flexible Exchange Rates”, in *Essays in Positive Economics* (Chicago, University of Chicago Press), 1953, p. 158.

³¹It is worth recalling that these implications reflect the particular assumptions of the model, and that some of these assumptions may be debatable in the short term. This is particularly true with regard to purchasing power parity, the parity interest rate and the exogeneity of income.

in exchange rates is impossible when the countries apply mutually incompatible monetary policies. A third implication of the model, therefore, is that co-ordination and harmonization of monetary policies is the key to securing stability in the exchange rate. For example, if both countries agree to a given rate of monetary expansion equal to the growth rate in income, both countries will have the same set of information, the same money-income ratio³² and the same rates of interest, as a result of which the freely floating exchange rate will be so stable that it will be equivalent to a fixed rate.

An important conclusion can be drawn from the above. It is known that stability in exchange rates is a prerequisite for the efficient functioning of the international monetary system. This is because money is a mechanism designed to economize on scarce resources in the generation and transmission of economic information. This characteristic disappears when exchange rates fluctuate erratically.³³ It may therefore be said that the international economic system will not operate with maximum efficiency while exchange rates continue to vary sharply. Merely from the viewpoint of efficiency, exchange rate stability is a desirable objective. What is important, as the above analysis suggests, is that the key to ensuring exchange rate stability is not related so much to the way in which the market is organized (with fixed or flexible systems), but rather to the existence of means of co-ordinating countries' monetary policies, as was explained above. Thus, co-ordination of policies is necessary to ensure that exchange rates are relatively stable within a system of floating exchange rates.³⁴ It is important to point out that some type of co-ordination is always necessary, even in a system of fixed rates, since otherwise one of the countries could increase its stock of money out of proportion, and this

³²Rewriting equation [8] gives:

$$x = \left[\frac{k^*}{k} \right] \left[\frac{M}{y} \right] / \left[\frac{M^*}{y^*} \right] e^{-\beta(i^* - i)} \quad [11]$$

in which the expression between round brackets is the money-income ratio.

³³In such circumstances, economic agents must make projections concerning changes in the value of the currencies, assuming the risks involved in such changes or else contracting some insurance to avoid them. At all events, real resources (effort, time and knowledge) are diverted from production activity in order to make projections and to create the insuring institutions which assume the risks of such activities. This would be unnecessary if exchange rates were stable.

³⁴Such co-ordination between countries should take the form of a uniform rule for money growth, since this is the only possible practical way of doing it.

would finally lead to the break-up of the system and a change in the exchange rate.

Finally, it should be pointed out that, with a freely variable exchange rate, each country can have an independent monetary policy which enables it to have whatever rates of inflation and exchange rate depreciation it desires. In other words, from another viewpoint, with a floating exchange rate the country can insulate itself from the inflation generated in the rest of the world. It should be pointed out that flexible exchange rates do not insulate an economy from real changes in the rest of the world. Thus a drop in the growth rate of money in the remaining countries would not affect domestic prices in the country concerned, and it might be claimed that this country would stand aside from the monetary policy of the rest of the world. However, the maintenance of a flexible exchange rate can not insulate the country from the real changes originating in other economies. Thus a drop in the income of other countries which reduces demand for goods from the country in question, and therefore reduces its relative prices, would make the country's income fall, whatever its exchange system.

To sum up, rather than the fixed or floating exchange rate system, co-ordination of monetary policies is the *sine qua non* for exchange rate stability. For a small country such as Chile, "co-ordination" has a very special meaning. In view of the limited bargaining power of small countries, "co-ordination" means making money grow at the average rate at which it grows in other countries, particularly those with which the country has trade relations. In other words, small countries follow large ones, and a sufficient condition for keeping their exchange rates stable (and accordingly for not having to face deflationary situations) is the application of policies which generate inflation similar to that of "the rest of the world". Generally, no attention is paid to the problem that any country which decides to maintain a fixed exchange rate system must also gauge the level of inflation (or stability) which it is accepting. This is due to the fact that the country will not always be able to establish its trade links with another country whose domestic monetary policy (which may be excessively contractionary or expansionary in relative terms) enables it to maintain the level of inflation regarded as ideal from the domestic viewpoint.

As a result, it may be said that a country always has to choose either to keep a stable exchange rate (accepting the inflation which is desired by the country with which it fixes its parity) or to have a domestically desirable level of inflation, but with a variable exchange rate and with the costs already referred to. If the country succeeds in maintaining substantial trade relations with another country that wishes to have inflation similar to its own, then there is really no dilemma, since it is possible to have at the same time a stable (fixed) exchange rate and the desired level of inflation.

B. EMPIRICAL PROOF

1. Estimates for some Latin American countries

Below appear the estimates which correspond to the model developed above for four Latin American countries with high inflation. Specifically, the estimated form [8'] is the logarithm of equation [8], and in it appear the different terms with their expected signs.

$$\ln X = \ln [K^*/K] + \ln [M/M^*] - \ln [Y^*/Y] - (\xi_{pe}^* - \xi_{pe}) \quad [8']$$

Since the countries for which it was wished to make estimates (Argentina, Brazil, Chile and Uruguay) value their currencies in terms of the United States dollar, and since a substantial part of their trade is with the United States, the exchange rate was determined *vis-à-vis* the United States dollar.³⁵ Table 1 gives the results of the estimates.

A brief description of the most important aspects of table 1 appears below. The explicative power of the model for these countries with high inflation proved to be very good. Thus R^2 varied between 0.99 and 0.94, which indicates that for small inflation-prone countries the model produces very good predictions.

The Durbin-Watson proof for its part, indicates the presence of first-order auto-correlation in the case of Argentina, permits no assertions regarding Brazil and Chile because of the small number of observations, and indicates that there is no first-order auto-correlation in the case of Uruguay.

Regarding the explicative variables, the relative stocks of money appear with the correct sign and are very significant in all cases. In three of the four cases (Argentina, Chile and Uruguay) the money coefficient is not, in statistical terms, significantly different from 1, which is a property that is expected under this approach. In other words, the changes in a country's stock of money are reflected in proportional changes in the exchange rate, if all other factors are constant. Only in significant cases does the income coefficient appear with the expected sign. In the four cases the sign of expectations is the expected one, although in most of them it is not significant.

To sum up, the estimates in table 1 indicate that the exchange rate between two countries can be explained on the basis of the model set out above, with money as the essential basis of the explanation. The lack of a greater number of observations and the correlation of one or other of the variables (for example, money and income grow at the same rate) would appear to be the explanation for some coefficients

³⁵Therefore country* is always the United States.

Table 1

RESULT OF THE ESTIMATES PRODUCED BY THE MODEL FOR ARGENTINA, BRAZIL, CHILE AND URUGUAY

$\ln X$		$\ln (M/M^*)$	$\ln (y^*/y)$	$\ln (s_{p_e}^* - s_{p_e})$	R^2	$D-W$
Argentina	coef.	1.1	-1.72	0.0004		
- United States	t.	(8.1)	(0.7)	(0.12)	0.94	0.5
(1950-1974)	s.d. ^a	0.13	2.5	0.003		
Brazil	coef.	0.34	-0.65	0.009		
- United States	t.	(1.2)	(0.9)	(3.4)	0.99	1.7
(1963-1974)	s.d. ^a	0.3	(0.7)	0.003		
Chile	coef.	0.982	4.04	0.0010		
- United States	t.	(18.3)	(2.13)	(1.0)	0.99	1.3
(1958-1975)	s.d. ^a	0.5	1.9	0.001		
Uruguay	coef.	0.980	2.17	0.002		
- United States	t.	(10.5)	(1.5)	(0.8)	0.99	2.2
(1960-1974)	s.d. ^a	0.09	1.4	0.002		

Source: *International Financial Statistics*, various issues.

^aStandard deviation.

with a sign different from the expected one. Finally, the results might suggest, for some cases, the presence of multicollinearity between the explicative variables.

2. Other empirical proofs

A short summary is given below of three recent studies on empirical proofs of the monetary approach to the exchange rate. These tend in general to confirm the predictions of the approach as set out above. It should be pointed out that the summary is very short and that the terminology is brought into line, where possible, with that used in the present paper in order to increase understanding and aid comparison.

(a) *J. Frenkel*

J. Frenkel³⁶ estimated the approach for the German hyperinflationary period (1920-1923), using monthly data. Following a multi-stage development he arrived at the following specification:

$$\ln X = a + b \ln M + c \ln g_p + u$$

Here $g_p = (1 + g_p^e)$, where g_p^e is the approximate value for the expected difference between the international and national inflation rates.³⁷

The above equation implies, among other results, that the elasticity of the exchange rate with respect to the difference g_p^e is positive.³⁸ Inclusion of the "expectations" variable is designed to lessen the magnifying effect of money on the dependent variable (X).³⁹ It is important to point out that this model highlights expectations, as well as the quantity of money, as one of the principal determinants of the exchange rate. The results obtained in the estimate and outlined below are consistent with the predictions of the monetary approach to the exchange rate:

³⁶J. Frenkel, *op. cit.*

³⁷ $g_p^e = E(g_p - g_p^*)$, where g_p is the national inflation rate and g_p^* is the international inflation rate.

³⁸It is similar in magnitude, in absolute terms, to the income elasticity of demand for money.

³⁹In other words, a given change in the quantity of money will be reflected in a similar change in the exchange rate.

Table 2

RESULTS OF THE ESTIMATES PRODUCED BY THE MODEL, ACCORDING TO KARPLUS

$\ln X$		cte	$\ln(M/M^*)$	$\ln y^*$	$\ln y$	$\ln i^*$	$\ln i$	R^2	$D-W$	$s.e.^a$
Germany	coef.	-17	2.52	3.55	-0.77	-0.18	-0.03			
- United States	t.	(3.4)	(2.1)	(3.0)	(0.7)	(1.1)	(0.1)	0.69	1.62	0.033
	s.d.	5.0	1.2	1.2	1.07	0.16	0.23			
France	coef.	-10	1.05	4.00	-2.4	-0.2	0.28			
- United States	t.	(1.7)	(1.7)	(4.3)	(2.7)	(0.2)	(1.6)	0.84	1.82	0.030
	s.d.	6.0	0.63	0.92	0.90	0.10	0.18			
Italy	coef.	-8.8	0.31	1.74	0.85	c.				
- United States	t.	(2.4)	(1.0)	(3.8)	(1.3)			0.75	1.11	0.027
	s.d.	3.7	0.46	0.63						
Norway	coef.	3.2	1.54	1.22	-1.47					
- United States	t.	(0.8)	(3.2)	(2.5)	(5.4)			0.71	1.22	0.026
	s.d.	0.48	0.49	0.27						

Source: R. Karplus "The Monetary Approach to Foreign Exchange Rates: The Current Experience", Term paper, Graduate School of Business, University of Chicago, November 1975.

^aStandard error of the regression.

^bStandard deviation of the estimate of the coefficient concerned.

^cThe data are missing in the original.

$$\ln X = -5.135 + 0.975 \ln M + 0.595 \ln g_p \quad R^2 \quad D-W \quad \text{s.e.}$$

$$\text{s.e.}^{40} \quad (0.731) \quad (0.050) \quad (0.073) \quad 0.994 \quad 1.91 \quad 0.241$$

(b) *R. Karplus*

R. Karplus,⁴¹ using monthly data for the period 1973-1975, estimated the equation:

$$\ln X = a \ln (M/M^*) + b \ln y + c \ln y^* + d \ln i + e \ln i^* + u$$

where,

M = the quantity of money in the country

y = the country's real income

i = the nominal interest rate in the country.

The variables with an asterisk (*) are those relating to the United States.

The results of this estimate, which are set out in table 2, generally coincide with the predictions of the monetary approach. However, as may be observed, statistical problems exist in some cases.

(c) *J. Bilson*

J. Bilson⁴² specified the equation to be estimated in the same form as that used in the present study. Thus, he defined his equation as:

$$X = \left(\frac{k^*}{k}\right) \left(\frac{M}{M^*}\right) \left(\frac{y}{y^*}\right) e^{(i-i^*)}$$

in which the asterisks (*) refer to the relevant variables for England and the items without asterisks to the relevant variables for Germany. Bilson then derives the final equation to be estimated:

$$\ln X = a + bt + c \ln M + d \ln M^* + c \ln y + f \ln y^* + g (i-i^*) + h \ln X_{t-1}$$

In order to arrive at this equation, $\frac{k}{k^*}$ was defined as equal to

⁴⁰The Student statistics do not appear in the original.

⁴¹R. Karplus, "The Monetary Approach to Foreign Exchange Rates: The Current Experience", Term paper, Graduate School of Business, University of Chicago, November 1975.

⁴²John F.O. Bilson, "The Monetary Approach to the Exchange Rate - Some Empirical Evidence", *International Monetary Fund Staff Papers*, October 1977.

$k^{\circ} + \lambda t$, where k° is a constant and λ represents relative growth in demand for money over time. This variable allows for some exogenous movement in relative demand for money for the two countries. In addition, Bilson assumes that the effective exchange rate (X) will adjust towards the equilibrium rate in accordance with

$$\ln X - \ln X_{t-1} = V (\ln X - \ln X_{t-1})$$

where V = the partial adjustment coefficient
 X = the equilibrium exchange rate.

After various corrections, Bilson succeeded in obtaining optimum coefficients for the explicative variables. Thus, for example, the elasticities of the exchange rate with respect to the two moneys (M and M^*) are extremely close to unity, as is shown by the coefficients from the estimate effected by him. The results obtained are:

$$\ln X_t = -1.3280 - 0.0049t + 1.0026 \ln M_t - 0.9846 \ln M_t^* + t^{43}$$

(3.247)	(6.259)	(6.258)
+ 1.0183 $\ln y_t^* - 0.9009 \ln y_t + 1.3853 (i - i^*)^{44}$		
(3.623)	(3.341)	(2.792)
<u>R²</u>	<u>D W</u>	<u>s.e.</u>
0.98	1.97	0.0276

Like Frenkel, Bilson states that the homogeneity postulate is valid, that is, that a change in the quantity of money will be reflected in a similar change in the exchange rate.

3. Summary of the conclusions of the empirical proofs of the model

It may be concluded, both from the estimates made in the present paper and from those of other authors summarized here, that the monetary approach makes it possible to provide an extensive explanation of changes in exchange rates. This explanation becomes practically complete in the case of economies with a high degree of inflation. All the studies presented are based on the homogeneity postulate —i.e., that changes in the quantity of money produce proportional changes in the exchange rate. As a result, it may be stated that the empirical evidence presented tends to confirm the usefulness of the approach.

⁴³ Student statistics, which are approximations derived from a first-order Taylor's series expansion of the long-run elasticities. The standard errors do not appear in the original.

⁴⁴ Obtained from a restricted regression with mixed sample and prior information.

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