62

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FINANCIAL INDEX-LINKING, INTEREST-RATE LIBERALIZATION, AND THE BRAZILIAN DEMAND-FOR-MONEY FUNCTION

by

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FINANCIAL INDEX-LINKING, INTEREST-RATE LIBERALIZATION, AND THE BRAZILIAN DEMAND-FOR-MONEY FUNCTION

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A B S T R A C T

This essay describes the results of "maximum-likelihood piecewise" estimates of the quarterly Brazilian demand-for-money function for the period 1961-1979. (The "break points" are determined through the estimation procedure.) The results suggest strongly that the function shifted over the period. The changes in its parameter values are shown to be related to the changing conditions of Brazil's macroeconomy over the period, in particular, to the introduction of financial index-linking in the mid-1960's and to the liberalization of financial rates in the mid-1970's.

I. INTRODUCTION

The stability, or durability over time, of the demand-for-money function is a matter of considerable importance for the inflation-prone economies of South America. The responsiveness of the demand for money to anticipated inflation, as well as to financial rates and to the rate of real economic activity, may shift significantly in an economy whose monetary and financial systems are developing rapidly, particularly where these systems are adjusting to accumulating inflation experience. Increasing responsiveness of the demand for money to anticipated inflation and to other financial rates may require a monetary authority to run tighter policy in order to carry out any given stabilization objective.

This essay discusses apparent shifts in the parameters of the Brazilian demand-for-money function, using quarterly macroeconomic data for the period 1961-1979. Several characteristics of Brazil's economy make the shifts in its demand-for-money function especially interesting. Brazil is the largest South American economy, and perhaps the most closely studied "high-inflation" economy. Not only were Brazil's inflation rates quite high over the period in question, they were also quite variable: between December 1960 and December 1979 the average annual inflation rate was about 40%, while the standard deviation of the quarterly annualized rates of inflation was about 27 percentage points. Furthermore, since 1964 Brazil's financial and monetary systems have developed at unprecedented speed, in both size and sophistication. Innovating practices, institutions, and instruments appeared virtually every year. [See Ness (1974).]

There are good *a priori* reasons to believe that the introduction of index-linked financial assets in the mid-1960's and the liberalization of financial rates beginning in the mid-1970's affected Brazil's demand-for-money function. This writer and others have argued that the introduction of index-linked financial assets increased the sensitivity of Brazil's demand-for-money to inflationary expectations (and to inflationary uncertainty). [See Beckerman (1979), Moura da Silva (1979), Baer-Beckerman (1980).] The present analysis offers further evidence in support of this view. In addition, it stands to reason that the development of the financial system and liberalization of financial rates might increase the interest-rate sensitivity of the demand for money. Again, evidence is offered that this happened in Brazil in the mid-1970's.

The main statistical procedure used in the analysis is "maximum-likelihood piecewise estimation." This is a variation on the Goldfeld-Quandt technique for determining the maximum-likelihood "shift of regime" for a time series regression estimate (see Goldfeld and Quandt 1972, 1973). Some minimum number D of degrees of freedom and some number P of intervals is chosen for the time-series sample in question. That particular set of P consecutive regression lines through the sample, each with D or more degrees of freedom, is determined (by means of a FORTRAN program), so as to maximize an appropriate likelihood function. That is, the "break points" of the sample are determined by the estimation procedure, so as to minimize a weighted geometric average of the standard errors of the P regression lines, with the weighting according to the number of observations in each interval. The regression coefficients of the intervals may then be compared by informal and, to some extent, formal means. If the distribution of the stochastic error term can be assumed invariant over all of the intervals, the appropriate formal test for the equivalence of the regression coefficients is an F test, which would determine whether the sum of the sums of squared deviations from the P regression lines is significantly less than the sum of squared deviations from a single ordinary least-squares regression line.[1] A "high" value of the F statistic would suggest that the piecewise-estimation lines taken together differ significantly from the ordinary regression line. Under stronger statistical assumptions, F tests for the equivalence of individual regression coefficients may also be carried out.

Section 2 discusses the demand-for-money variables, specifications and full-sample estimates. Section 3 describes the piecewise estimates. Section 4 provides a capsule summary of Brazil's macroeconomic experience over the past two decades, and Section 5 interprets the estimation results in the light of that experience.

2. VARIABLES, SPECIFICATIONS AND FULL-SAMPLE ESTIMATES FOR THE BRAZILIAN DEMAND-FOR-MONEY FUNCTION

The subject of the analysis is the quarterly purchasing-power valuation of Brazil's "M-1" money supply, i.e., currency outside the banking system plus demand deposits at commercial banks. The dependent variable in all the estimating specifications considered, (log) "m" = "M/p", is the Brazilian M-1 deflated by the wholesale price index.[2] Four explanatory variables are included in the specifications discussed here:

(i) All of the specifications considered incorporate a measure of real national income, (log) "y". (Appendix B describes the construction of an annual real national-income series for Brazil from several mutually inconsistent partial series. The quarterly series was constructed on the basis of this series and a quarterly industrial-power-consumption series.)

(ii) The nominal rate of return, "n", on commercial exchange acceptances ("letras de cambio") is included in some of the specifications. These short-term assets have been a significant means of holding wealth in Brazil, and their rates of return have moved roughly in correlation with the rates on other nominal assets (such as government bills -- "letras do Tesouro Nacional", or "LTN", which were introduced in 1970). The precise variable used is (the log of) "one plus the quarterly equivalent" of the yield on 360-day exchange acceptances.[3] (This facilitates comparisons of its coefficient with the coefficient of the inflation variable discussed next.)

(iii) The (log of one plus the) current inflation rate, (log) "z" {= (log) [p(t)/p(t-1)]} is included in some of the specifications. The inclusion of this variable may be interpreted as following from the assumption that the Brazilian public determines its monetary behavior on the basis of inflationary expectations formed with perfect foresight. It is possible to validate the inclusion of this variable on assumptions somewhat less extreme than perfect foresight; nevertheless, the assumptions required are still strong. (See Appendix A, which suggests a "quasi-rational" inflationary expectation based on the demand-for-money function being estimated.) It is important to emphasize that "z" is included mainly as a proxy variable for the effect of anticipated inflation and inflationary uncertainty on the demand for money in period t. No claim is made here that inflationary expectations are in fact "rationally formed" by the Brazilian public, much less that they are formed with perfect foresight.[4]

(iv) Finally, the lagged value of the (log) real money supply is incorporated in some of the specifications. Inclusion of this variable amounts to assuming that there may be partial adjustment to monetary equilibrium.[5]

The inclusion of a lagged dependent variable in the specification may cause problems of bias and efficiency for ordinary-least-squares estimation, particularly if there is autocorrelation in the error term. Regression estimates were therefore made by means of an iterative generalized-least-squares procedure.[6]

In order to discuss possible estimating specifications, it is helpful to refer to the following "basic" specification [0]:

$$[0]: \log M = C0 + C1 \log y + C2 \log(1+n) + C3 \log p + C4 \log[p(-1)] + C5 \log[M(-1)].$$

Each of the eight specifications listed below is a version of this one, with a different set of linear restrictions imposed. In the listing below, each specification is given with the relationship of its coefficients to those of the basic specification, i.e., with the linear restrictions on [0] that yield the given specification:

[1] $\log m = A0 + A1 \log y;$
[$A0 = C0$, $A1 = C1$;
restrictions: $C2 = 0$, $C3 = 1$, $C4 = 0$, $C5 = 0$.]

[2] $\log m = A0 + A1 \log y + A2 \log z$
[$A0 = C0$, $A1 = C1$, $A2 = C3 - 1 = C4$;
restrictions: $C2 = 0$, $C3 + C4 = 1$, $C5 = 0$.]

[3] $\log m = A0 + A1 \log y + A2 \log(1+n)$
[$A0 = C0$, $A1 = C1$, $A2 = C2$;
restrictions: $C3 = 1$, $C4 = 0$, $C5 = 0$.]

[4] $\log m = A0 + A1 \log y + A2 \log z + A3 \log(1+n)$
[$A0 = C0$, $A1 = C1$, $A2 = C3 - 1 = C4$, $A3 = C2$;
restrictions: $C3 + C4 = 1$, $C5 = 0$.]

[5] $\log m = A0 + A1 \log y + A2 \log[m(-1)]$
[$A0 = C0$, $A1 = C1$, $A2 = C5 = -C4$;
restrictions: $C2 = 0$, $C3 = 1$, $C4 + C5 = 0$.]

[6] $\log m = A0 + A1 \log y + A2 \log z + A3 \log[m(-1)]$
[$A0 = C0$, $A1 = C1$, $A2 = C3 - 1$, $A3 = C5$;
restrictions: $C2 = 0$, $C3 + C4 + C5 = 1$.]

[7] $\log m = A0 + A1 \log y + A2 \log(1+n) + A3 \log[m(-1)]$
[$A0 = C0$, $A1 = C1$, $A2 = C2$, $A3 = C5 = -C4$;
restrictions: $C3 = 1$, $C4 + C5 = 0$.]

[8] $\log m = A0 + A1 \log y + A2 \log z + A3 \log(1+n) + A4 \log[m(-1)]$

[$A0 = C0$, $A1 = C1$, $A2 = C2$, $A3 = C3 - 1$, $A4 = C5$;
restrictions: $C3 + C4 + C5 = 1$.]

It is useful to estimate specification 0 and then test the sets of restrictions corresponding to the other eight specifications. This meets an objection frequently made to money-demand specifications such as these: the presence of variables based on the same price-level series on both sides of a specification virtually forces a least-squares estimate to indicate a close relationship; therefore such an estimate must be regarded as unreliable. (King 1971 and Pastore 1972 discuss this point.) Even specifications such as 1 and 3 are problematic because they prejudicially assume a unitary price-level elasticity for the nominal demand for money. Specification 0 imposes none of the objectionable restrictions on the coefficients. The F test of the restriction on specification 0 that gives each of the other specifications may therefore be taken as one indicator of the appropriateness of the particular specification.

The iterative-generalized-least-squares estimates of these specifications for the full sample period are given in Table 1. The data are all geometric averages of their monthly values in their respective quarters (see Appendix B). For specifications 1 - 8, the F test of the corresponding linear restriction imposed on specification 0 is given, with degrees of freedom in parentheses and marginal significance in brackets just below. From Table 1, the following observations <u>for the full sample period</u> seem warranted.

i- The inclusion of the lagged real money supply in specifications 5 through 8 significantly improves the quality of the estimates. This variable is clearly significant.

ii- The estimated real-income elasticity in all of the specifications appears to lie between zero and one.

iii- The inflation variable is statistically significant in every specification in which it appears (2, 4, 6 and 8), with a theoretically appropriate negative sign.

iv- The interest-rate coefficient is statistically significant in every specification in which it appears (3, 4, 7, 8) except [8], with a theoretically appropriate negative sign. [Cardoso found the interest rate statistically significant in her money-demand estimates for the sample period 1966:1 - 1979:4. See Cardoso (1981).]

v- The F tests of the linear restrictions on the basic specification associated with each one of specifications 1 - 8 indicate a zero-percent marginal significance for specifications 1 - 4, 5 and 7, but higher marginal significance -- 60.2 and 78.5 percent -- for specifications 6 and 8.

The full sample estimates are consistent with conventional monetary theory and experience, and they offer no surprises. On the whole the "best" specification for the full sample period appears to be specification 6. The (log) money-demand function implied by specification 6 for the whole sample has the formula

$$\log m = -1.26 + 0.193 \log y - 0.855 x,$$

where "x" represents the (log) expected inflation rate (plus one) over the coming quarter; and the speed of partial adjustment to equilibrium is 0.109.

3. "MAXIMUM-LIKELIHOOD PIECEWISE" ESTIMATES FOR SPECIFICATION 6.

Table 2 gives the maximum-likelihood piecewise estimates for specification 6 for five intervals and a minimum of six degrees of freedom.[7] In addition, Table 2 gives various F statistics for tests of the equality of the estimates over the five intervals. The estimates were obtained using the data adjusted by the full-sample iterative-generalized-least-squares estimate of the autocorrelation coefficient "rho"[=0.2014312]. It is necessary to assume that the autocorrelative structure remained unchanged over the five intervals, and to carry out the piecewise estimation on the basis of the data adjusted by "rho." The assumption of an unchanged autocorrelative structure over the whole sample period is unfortunate, but clearly preferable to assuming that there was no autocorrelation, as the use of unadjusted data would imply.

The coefficient estimates for the five intervals differ significantly from one other and from the full-sample estimates. Before discussing them, however, we present two arguments, (i) in defense of the choice of specification 6, and (ii) in defense of the choice of five as the number of intervals.

(i) Even if specification 6 is superior for the whole-sample regression, it might not be for the piecewise estimate. Space limitations make it impossible to provide piecewise estimates for more than one specification. The following argument, based on the estimates uncorrected for autocorrelation, is offered in defense of the use of specification 6 rather than specifications 7 or 8. (Unfortunately, an analogous argument cannot be carried out using the piecewise results based on data adjusted for autocorrelation, because the estimated autocorrelation coefficients are different for each specification.)

For the ordinary-least-squares piecewise estimates, the F statistic for the test of the significance of one additional explanatory variable is given by

$$F(P, N-PK) = \{ [R0 - R1] / P \} / \{ R1 / [N-PK] \},$$

where P is the number of partitions, N the total number of observations, K the number of explanatory variables (including the intercept) in the specification with the additional variable, and R1 and R0 the sums of sums of squares for the larger and smaller specifications respectively. The comparisons of the results of these specifications may be tabulated as follows:

Sums of sums of squares over five intervals:	Specifications compared	Additional variable	F test	
[1]: 0.1111				
[5]: 0.08234	5, 1	log[m(-1)]	3.912 (5, 61)	**
[6]: 0.04099	6, 5	log z	11.297 (5, 56)	**
[7]: 0.05740	7, 5	log(1+n)	4.867 (5, 56)	**
[8]: 0.03445	8, 6	log(1+n)	1.937 (5, 51)	

** significant at the one-percent level
* significant at the five-percent level

From this table, observe that while log z and log(1+n) are both significant at better than one percent when added to specification 5, a larger F value is associated with the addition of log z. On the other hand, the F value associated with the addition of log(1+n) to specification 6 is only 1.937, below the five-percent critical value (about 2.40). On this evidence, specification 6 would be the most appropriate choice of the specifications listed for piecewise estimation; we take it to be the most appropriate with data adjusted for autocorrelation.

(ii) The choice of five as the number of intervals is somewhat arbitrary, but the following argument may be made in its defense. A simple F test can be carried out to determine whether a piecewise estimate of P intervals explains a "less than significant" proportion of the unexplained variance around a piecewise estimate of P-1 intervals. Several applications of this test suggest that while lines of 2, 3, 4, and 5 intervals explain significant proportions of the remaining variance by comparison with lines of 1, 2, 3, and 4 intervals, respectively, a line of 6 intervals does not explain a significant proportion of the remaining variance by comparison with a line of 5 intervals:

Piecewise estimate of P intervals compared with piecewise estimate of P-1 intervals:	F statistic	Degrees of freedom	Marginal significance
P = 2 compared with P = 1:	4.102	4, 68	0.005
P = 3 compared with P = 2:	4.262	4, 64	0.004
P = 4 compared with P = 3:	5.094	4, 60	0.001
P = 5 compared with P = 4:	2.681	4, 56	0.041
P = 6 compared with P = 5:	0.379	4, 52	0.822

For all five intervals, the slope-coefficient estimates are significant at the five-percent level, with the following exceptions: the real-income coefficient for the first and final intervals, the expected-inflation coefficient for the fourth interval, and the lagged-money-supply coefficient for the final interval. (See Table 2.) In the discussion that follows, we take these coefficients to have been zero and the other coefficients to have been their point estimates. Furthermore, since the lagged-money-supply coefficient is taken to equal zero for the final interval, the coefficient estimates for that interval are taken to be the respective implied real-income elasticity and expected-inflation coefficient of the money-demand function. We consider the changes in these coefficients over the five intervals of the sample.

The real-income elasticity is statistically indistinguishable from zero in the first and final intervals, and is apparently negative (-0.395) in the second interval. In the second and third intervals its values are respectively 2.40 and 1.40. The implied expected-inflation coefficients are all less than zero, rising in absolute value through the first three intervals (from -0.875 to -2.42 and -5.64), then diminishing in absolute value through the fourth and fifth intervals (to -1.84 and -0.535). Finally, the implied speed of partial adjustment goes from 0.393 to a negative value in the second interval (-0.137, statistically indistinguishable from zero); it then takes on positive values in the next two intervals (0.711 and 0.539), and a value statistically indistinguishable from unity in the final interval.

The five-interval piecewise estimation of specification 8 (specification 6 plus the interest-rate variable), based on the data adjusted by an autocorrelation coefficient equal to 0.302531 (from Table 1), turns out to divide the sample period into almost the same intervals as the estimation of specification 6; the single difference is that the estimation of specification 8 locates the end of the second interval at 1968:3 rather than 1968:1 as in Table 2. For specification 8, the interest-rate coefficient estimate differs significantly from zero in only one interval:

INTERVAL 4: 1972:4 - 1976:2 [15 OBSERVATIONS] :

$$\log m = -7.71 + \underset{<3.88>}{1.06} \log y \underset{<-2.35>}{-7.85} \log (1 + n)$$

$$\underset{<-0.752>}{- 0.324} \log z + \underset{<1.54>}{0.253} \log [m(-1)]$$

Sum of squared residuals:	0.0087899	Durbin-Watson statistic:	2.991
Regression standard error:	0.0296478	Durbin h statistic:	-2.479

Implied real-income elasticity [A1/A4]:	4.20
Implied interest-rate coefficient [A2/A4] :	-31.1
Implied expected-inflation coefficient [A3/A4] :	-1.28
Implied speed of adjustment [1 - A4] :	0.747

It therefore appears that specification 6 is appropriate for all five intervals except for the fourth. For the fourth interval, the implied real-income elasticity of the demand for money is 4.20, and the implied interest-rate coefficient is -31.1 (a strikingly high absolute value). The implied expected-inflation coefficient is not significantly different from zero; the implied speed of adjustment is not significantly different from one. (Note, however, that the Durbin h statistic is high, indicating that for this interval there was high second-order autocorrelation.) Table 4 gives the "stylized" coefficient values that will be used in Section 5 to discuss the implications of the results in the context of Brazil's macroeconomic experience.

If the distribution of the stochastic error term could be assumed to be invariant over all of the intervals, then a simple F test could be used to determine whether the piecewise estimate significantly reduces the sum of squared distances from the data points by comparison with the ordinary-least-squares line. This F test could also be interpreted as a test of the hypothesis that the coefficients are stable. [See Note 1.] The F statistics for the tests of the equality over the five intervals of the over-all relation, of the equality over the five intervals of all the coefficients apart from the intercept coefficient, and of the equality over the five intervals of each coefficient separately are given following Table 2. These F statistics are all convincingly above the five-percent critical values for rejecting the hypothesis of equality. Unfortunately, they are not valid as formal tests of the equivalence of the coefficients, because the variance of the error term around the piecewise estimate cannot be taken to have been invariant over the five intervals: F tests of the equality of (i) the variances for each interval with (ii) the variance for the whole sample reject the hypothesis of equality for interval 3, and nearly do so for intervals 1 and 2. (See the last part of Table 2.) All the same, the informal and formal evidence for the view that the Brazilian demand-for-money function in specification 6 was unstable over the period 1961:1 - 1979:4 seems compelling.

4. RECENT BRAZILIAN MACROECONOMIC EXPERIENCE

The 1961-1979 sample interval may be divided retrospectively into four periods, during each of which the Brazilian macroeconomy behaved in markedly distinct ways. Here we briefly describe these intervals, to provide a background against which the estimation results may be evaluated. Table 3 provides some of the revelant annual data.

(i) 1961:1-1964:4. This was a period of steadily worsening economic and political crisis. Inflation accelerated, principally on account of a widening government-budget deficit. Real national income growth decelerated. In April 1964, following the failure of the Dantas-Furtado stabilization program and a deepening political crisis, the Brazilian Armed Forces took over the government. (The Armed Forces have dominated the Brazilian Government ever since.)

(ii) 1965:1-1968:2. The new regime carried out a program of economic reforms, including the institution of a true central bank, and the introduction of index-linked government obligations (in order to finance the continuing budget deficit with a minimum of money creation, and also in order to finance a new national housing-finance system). These were instituted in conjunction with a "gradualist" stabilization program, under which the inflation rate was gradually reduced through control of the budget deficit, tight wage policies, and the use of a monetary "program". Real national income continued to grow sluggishly, and there were two sharp stabilization recessions, in mid-1965 and early 1967. (See Simonsen 1970.)

(iii) 1968:3-1973:3. In August 1968 Brazil introduced a "crawling-peg" exchange rate. This, in combination with significant foreign-finance inflows (a liberalized central-bank policy on this matter went into effect in 1967), buoyant conditions in export markets, and vigorous state-enterprise investment brought about a period of high real-income growth, combined with declining inflation rates. This period is often described as Brazil's "miracle" era. (See Baer 1972.)

(iv) 1973:4-1979:4. The world oil-price rise of October 1973 had complicated consequences for the Brazilian economy. The diminished growth rates in Brazil's export markets, along with the oil-price rise itself (Brazil imports 80-90 percent of its oil requirements), severely strained the economy. During 1974 the Government took half-hearted, ineffective measures -- including liberalization of financial rates -- to adjust the economy to the changed circumstances. Although economic growth remained high through 1974, the rate of inflation also rose significantly. Increasing inflation rates, inflationary uncertainty, generalized economic uncertainty, and liquidity tightness, all in a context of financial liberalization, generated a series of crises in the financial system during 1975 and 1976. Real output grew in the late 1970's at rates markedly lower than the "miracle" rates, and inflation rates rose roughly to a 40% level. [See Beckerman (1979) and Cline (1981) for discussions of macroeconomic events at this time.] This period may be said to have concluded with the 30% "real" devaluation (the first apart from crawling-peg adjustments since August 1968), and other policy changes, of December 1979.

5. AN INTERPRETATION OF THE ESTIMATION RESULTS

This outline summary of recent Brazilian macroeconomic experience enables us to place the results of the piecewise estimation in context. Table 4 summarizes and "stylizes" the results and discussion of Section 3, providing the parameter estimates to be used in the discussion following.

The first interval, 1961:1 - 1965:1, may be taken to be representative of the monetary conditions prior to the economic reforms carried out by the Government following the March 1964 military *coup*. The real-income elasticity and interest-rate coefficients are statistically indistinguishable from zero, while the expected-inflation coefficient is relatively low. The low inflation and interest-rate coefficients may be presumed to reflect the fact that during these years there were relatively few financial assets -- much less index-linked assets -- available, apart from money. (There was considerable capital flight in those years.)

The second interval, 1965:2 - 1968:1, corresponds to the difficult stabilization period, with two stabilization recessions (mid-1965 and early 1967) and generally sluggish output growth. The significant negative value of the real-income coefficient may reflect these short, sharp recessions: as the economy went into recession, economic agents apparently continued to behave according to the real-income levels of preceding quarters; as the economy emerged from recession, economic agents apparently continued to behave as though the economy were still in recession. The sharply higher absolute value of the expected-inflation coefficient undoubtedly reflects the availability of index-linked financial assets. The zero value for the speed of adjustment implies that during this period economic agents tended to maintain their real-balance levels.

The third interval, 1968:2 - 1972:3, covers most of the "miracle" period, with its high rates of real-output growth and declining inflation rates. The real-income elasticity is apparently above one for this period. The absolute value of the expected-inflation coefficient is higher than that of the previous period, presumably reflecting the more widespread availability and acceptance of index-linked financial assets.

The fourth interval, 1972:4 - 1976:2, includes the period in which Brazil suffered resurgent inflation, the oil-price "shock", and severe financial-market turbulence and crises. This was also the period during which financial-market rates were liberalized. It stands to reason that the interest-rate coefficient takes on a significant value in this period, although its high value is somewhat surprising, and surely reflects adjustment to a new pattern of behavior. The real-income elasticity appears to have taken on a higher value in this period. The insignificant value of the expected-inflation coefficient may be the consequence of nominal asset's increased importance: open-market operations in (nominal) Treasury bills became important in this period. (The open market itself was the focus of the financial crises of late 1975 and early 1976.) The speed of adjustment appears to have become virtually one during this period.

The final, most recent interval, 1976:3 - 1979:4, is something of a puzzle. It covers a period of somewhat reduced (but still high) real-income growth rates. The real-income elasticity and the interest-rate coefficient apparently both fell to zero, and the expected-inflation coefficient diminished sharply. At the same time, the speed of partial adjustment became virtually unity, so that full adjustment to equilibrium appears to take place within the quarter. One point that is undoubtedly relevant can be seen in Table 3. After growing at high annual rates through the 1968-1973 "miracle" period, the real money supply grew at a much lower rate over 1974 and thereafter diminished. The velocity of circulation increased sharply after 1974, after having diminished through the "miracle" period. It is at least possible that index-linked financial assets, particularly savings accounts, have come increasingly to be held for transactions purposes, in spite of several regulations intended to discourage their being held for "volatile" transactions purposes. It appears also that Government bills -- "Letras do Tesouro Nacional" -- have come to function as a close liquidity substitute since the mid-1970's.

6. CONCLUSION

The piecewise estimates described here differ markedly from the conventional regression estimates. They therefore appear to support the conclusion that the Brazilian demand-for-money function, in the specification with real national income, the current inflation rate, and the one-period-lagged real money supply as explanatory variables, shifted over the decades of the 1960's and the 1970's. The basic money-demand parameters and the speed of partial adjustment appear to have varied considerably over the two decades. These changes can be broadly related to the changes in Brazil's macroeconomic conditions over the period. In particular, the introduction of index-linked financial assets in the 1960's and financial liberalization in the 1970's appear to have changed the bases on which the Brazilian public determined its willingness to hold real money balances.

NOTES

1. This F test may be interpreted in several ways. Intuitively, the F test seeks to determine whether the ordering in time of the observations makes a difference. Different time orderings would yield the same ordinary regression estimates but different piecewise estimates, hence different F statistics. Some readers may object that since the break points are selected so as to minimize the sum of squared distances to the P lines, the piecewise lines are selected so as to maximize the F statistic, and consequently the F test is invalid. This objection is based on a misunderstanding of the F test. The presumable population of the F test is <u>not</u> the set of F values arising from the different possible sets of lines through the given sample; rather, it is the set of F values that arise from minimizing the sum of sums of squares in different "drawings of samples" from the "population" of possible samples (or, alternatively, in different time orderings of the sample).

2. Nominal time deposits at Brazilian commercial banks are nearly insignificant in value, because of the widespread availability of index-linked passbook savings accounts at the Brazilian "Housing Finance System." The Brazilian "M-2" money supply corresponding to that of other nations therefore differs little from the Brazilian M-1.

3. Controls on commercial-bank rates and changing liquidity and real-credit conditions appear to have kept Brazilian "money-market" rates from adjusting exclusively in response to inflationary anticipations. The correlation coefficient of log (1+n) and the inflation variable for the 1961:1-1979:4 period was 0.583.

4. Since the degree of inflationary uncertainty is probably closely related to inflationary expectation, the variable "z" may be presumed to be a proxy for inflationary uncertainty as well. This writer has argued on theoretical grounds that inflationary uncertainty has an enhanced effect on the money-demand function when index-linked financial assets are available. See Beckerman (1980).

5. Using the well-known formulation, if the "desired"-demand-for-money function is given by

$$\log m^* = a0 + a1 \log y + a2 \log z + a3 \log(1+n),$$

and if the "partially adjusted" demand for money is given by

$$\log m = \log m(-1) + c \, [\, \log m^* - \log m(-1) \,],$$

then point estimates of a0, a1, a2, a3 and c can be obtained from

$$\log m = A0 + A1 \log y + A2 \log z + A3 \log(1+n) + A4 \log[\, m(-1) \,],$$

by setting $a0 = A0/A4$, $a1 = A1/A4$, $a2 = A2/A4$, $a3 = A3/A4$, and $c = (1-A4)$.

6. Broadly speaking, however, the basic qualitative and even quantitative results turn out to be virtually the same with ordinary-least-squares estimation.

7. The choice of a minimum of six degrees of freedom is somewhat arbitrary. With six degrees of freedom each interval must have a minimum of 10 quarters. Estimations with fewer degrees of freedom requires greatly increased computing time. It turns out, however, that the estimate of specification 6 with a minimum of two degrees of freedom yields the result given in Table 2.

T A B L E 1

Coefficient Estimates for the Full Sample Period

Period: 1961:1 - 1979:4 [76 observations]

Estimation technique: iterative generalized least squares

Specification number:	[0]	[1]	[2]	[3]	[4]
Dependent variable:	log m	log m	log m	log m	log m
A0:	-1.34	1.34	1.28	0.993	0.882
A1 [log y]:	0.245	0.317	0.332	0.364	0.375
	<2.60>	<2.53>	<2.79>	<3.09>	<3.31>
A2 [log z]:	--	--	-0.420	--	-0.363
			<-2.80>		<-2.44>
A3 [log (1+n)]:	-0.498	--	--	-2.51	-2.13
	<-0.786>			<-2.65>	<-2.29>
A4 [log (m(-1))]:	--	--	--	--	--
A5 [log p]:	0.271	--	--	--	--
	<1.70>				
A6 [log p(-1)]:	-0.0159	--	--	--	--
	<-0.102>				
A7 [log M(-1)]:	0.741	--	--	--	--
	<10.1>				
Estimate of serial correlation:	0.284626	0.988671	0.986198	0.981690	0.979958
Sum of squared residuals:	0.103738	0.172751	0.156272	0.158442	0.146663
Regression standard error:	0.038496	0.048316	0.046268	0.046588	0.045133
Durbin-Watson statistic:	2.067	1.581	1.504	1.768	1.657
Durbin h statistic:	-0.383	--	--	--	--
F test of restrictions: on specification 0:	--	73.15	12379.0	39.72	53.60
	--	(4,70)	(2,73)	(3,70)	(2,70)
	--	[0.00]	[0.00]	[0.00]	[0.00]

Cont.

(Cont.)

TABLE 1

Specification number:	[5]	[6]	[7]	[8]
Dependent variable:	log m	log m	log m	log m
A0:	0.611	-1.12	-4.28	-1.28
A1: [log y]:	0.109 <1.72>	0.172 <3.38>	0.408 <4.99>	0.247 <3.57>
A2: [log z]:	--	-0.762 <-6.40>	--	-0.709 <-4.98>
A3: [log (1+n)]:	--	--	-2.50 <-3.83>	0.613 <1.06>
A4: [log (m(-1))]:	0.879 <13.4>	0.891 <15.2>	0.565 <6.70>	0.727 <10.2>
Estimate of serial correlation:	0.246709	0.201431	0.477005	0.302531
Sum of squared residuals:	0.164666	0.105085	0.137608	0.103775
Regression standard error:	0.047494	0.038204	0.043718	0.038231
Durbin-Watson statistic:	2.043	3.067	2.086	2.079
Durbin h statistic:	-0.227	-0.159	-0.550	-0.439
F test of restrictions on specification 0:	13.70 (3,70) [0.00]	0.5210 (2,70) [0.602]	12.425 (2,70) [0.00]	0.6688 (1,70) [0.785]
Implied real-income elasticity [A1/A4]:	0.124	0.193	0.722	0.340
Implied expected-inflation coefficient [A2/A4]:	--	-0.855	--	-0.975
Implied interest-rate coefficient [A3/A4]:	--	--	-4.22	0.843
Implied speed of adjustment [1 - A4]:	0.121	0.109	0.435	0.273

T A B L E 2

Maximum-likelihood Piecewise Estimate of Specification 6,

With Five Intervals and a Minimum of Six Degrees of Freedom,

1961:1 - 1979: 4;

Adjusted for Autocorrelation with Coefficient of

Autocorrelation Equal to 0.20143

	Interval 1	Interval 2	Interval 3	Interval 4	Interval 5
Number of observations:	17	12	18	15	14
Initial quarter:	1961:1	1965:2	1968:2	1972:4	1976:3
Final quarter:	1965:1	1968:1	1972:3	1976:2	1979:4
Dependent variables:	log m	log m	log m	log m	log m
A0:	1.35	4.41	-3.02	-3.41	4.57
A1 [log y]:	0.0390	-0.449	0.591	0.553	0.162
	<0.224>	<-5.46>	<5.14>	<2.59>	<1.32>
A2 [log z]:	-0.532	-2.75	-1.63	-0.850	-0.535
	<-2.78>	<-11.1>	<-4.81>	<-1.84>	<-2.04>
A3 [log m(-1)]:	0.607	1.13	0.289	0.461	-0.195
	<3.10>	<14.1>	<2.32>	<2.67>	<-0.740>
Sum of squared residuals:	0.015387	0.002042	0.004520	0.013166	0.006588
Regression standard error:	0.034403	0.015976	0.017969	0.034596	0.025668
Durbin-Watson statistic:	1.766	2.765	2.376	2.555	2.334
Durbin h statistic:	0.816	-1.380	-0.9440	-1.448	-3.559
F test of restrictions on specification 0:	0.05265	0.5480	3.2988	2.9805	0.1309
	(2, 11)	(2, 6)	(2, 12)	(2, 9)	(2, 8)
	[0.939]	[0.608]	[0.071]	[0.101]	[0.875]
Implied real-income elasticity [A1/A3]:	0.0642	-0.395	2.04	1.20	(-0.832)
Implied expected-inflation coefficient [A2/A3]:	-0.875	-2.42	-5.64	-1.84	(2.75)
Implied speed of adjustment [1 - A3]:	0.393	-0.137	0.711	0.539	(1.20)

cont.

(cont.)

TABLE 2

F statistics for tests of coefficient equality

Sum of sums of squares over the five intervals:	0.04170277
Sum of squares of regression for the whole sample:	0.10501923
F statistic for equivalence of all regression coefficients:	5.314 (16, 56) [0.000]
F statistic for equivalence of A1, A2, and A3:	4.988 (12, 56) [0.000]
F statistic for equivalence of A1:	3.786 (4, 68) [0.008]
F statistic for equivalence of A2:	2.881 (4, 68) [0.029]
F statistic for equivalence of A3:	3.712 (4, 68) [0.009]

F statistics for test of equivalence of variance of error term

around the least-squares piecewise estimate

	F statistic	Degrees of freedom	Marginal significance
Interval 1:	1.589	13, 56	0.116
Interval 2:	2.918	56, 8	0.055
Interval 3:	2.306	56, 14	0.043
Interval 4:	1.607	11, 56	0.122
Interval 5:	1.130	56, 10	0.447

TABLE 3

Principal Macroeconomic Data Series, Brazil 1961 - 1980

Year	Percentage change over preceding year of:					
	(1) National-income deflator	(2) Real national income	(3) Average "M-1" money supply	(4) Average real M-1 money supply [(3)-(1)]	Velocity of circulation of M-1 [(2)-(4)]	(6) Exports (in US dollars)
1961	+31.0	+10.2	+44.3	+13.3	-3.1	+10.6
1962	+57.9	+5.3	+54.6	-3.3	+8.6	-13.5
1963	+76.7	+1.5	+58.6	-18.1	+19.6	+15.5
1964	+87.7	+2.9	+83.9	-3.8	+6.7	+1.7
1965	+54.8	+2.7	+83.7	+28.9	-26.2	+11.6
1966	+39.3	+3.8	+37.4	-1.9	+5.7	+9.2
1967	+28.9	+4.9	+35.9	+7.0	-2.1	-5.0
1968	+27.7	+11.2	+41.6	+13.9	-2.7	+13.8
1969	+20.4	+9.9	+32.5	+12.1	-2.2	+22.9
1970	+17.6	+8.8	+28.6	+11.1	-2.3	+18.5
1971	+18.8	+12.0	+30.1	+11.3	+0.7	+6.0
1972	+18.5	+11.2	+31.0	+12.5	-1.3	+37.5
1973	+21.2	+14.0	+46.4	+25.2	-11.2	+55.3
1974	+32.9	+9.5	+39.1	+6.2	+3.3	+28.3
1975	+34.5	+5.6	+32.2	-2.2	+7.8	+8.9
1976	+45.6	+9.7	+41.0	-4.6	+14.3	+16.8
1977	+42.4	+5.4	+37.7	-4.7	+10.1	+19.7
1978	+41.1	+4.8	+40.3	-0.8	+5.6	+4.4
1979	+57.0	+6.7	+51.4	-5.6	+12.3	+20.4
1980	+95.9	+7.2	+75.8	-20.1	+27.3	+32.1

(Source: Calculated from the national-income data series discussed in Appendix B; monetary data are calculated from the quarterly data series given in Appendix B; exports data are from Conjuntura Economica, various issues.)

TABLE 4

Estimated Brazilian Demand-for-Money Parameters

Interval	Implied real-income elasticity	Implied expected-inflation coefficient	Implied interest-rate coefficient	Implied speed of adjustment
1961:1-1965:1	0.00	-0.875	0.00	0.393
1965:2-1968:1	-0.395	-2.42	0.00	0.00
1968:2-1972:3	2.04	-5.64	0.00	0.711
1972:4-1976:2	4.20	0.00	-31.1	0.539
1976:3-1979:4	0.00	-0.535	0.00	1.00

Source: Estimated from the results and discussion of Section 3.

R E F E R E N C E S

Baer, Werner, "The Brazilian Boom 1968-72: An Explanation and an Interpretation." World Development (August 1973).

Baer, Werner and Paul Beckerman. "The Trouble with Index-linking." World Development (September 1980).

Barbosa, F. H. "A Demanda de Moeda no Brasil: uma Resenha da Evidencia Empirica." Pesquisa e Planejamento Economico, 8 (1), 1978.

Beckerman, Paul. "Indexacao Financeira e o Efeito Realimentador Inflacionario Brasileiro." Pesquisa e Planejamento Economico (August 1979).

Beckerman, Paul. "Index-linked Government Bonds and the Efficiency of Monetary Policy." Journal of Macroeconomics (Fall 1980).

Cardoso, Eliana A. "A Money Demand Equation for Brazil." Boston University, Center for Latin American Development Studies, Discussion Paper Series, No. 45, May 1981.

Chow, Gregory. "Tests of the Equality between Two Sets of Regression Coefficients." Econometrica, 28 (1960).

Cline, William R. "Brazil's Aggressive Response to External Shocks," in William Cline, ed., World Inflation and the Developing Economies, (Brookings: Washington, D.C., 1981).

Goldfeld, Stephen and Richard Quandt. Nonlinear Methods in Econometrics (North-Holland Press: Amsterdam, 1972).

Goldfeld, Stephen and Richard Quandt. "The Estimation of Structural Shifts by Switching Regressions." Annals of Economic and Social Measurement, 2/4 (1983).

Johnston, J. Econometric Methods (McGraw Hill: New York, 1972).

Judd, John P. and John L. Scadding. "The Search for a Stable Money Demand Function." Journal of Economic Literature (September 1982).

King, Kenneth. "O Emprego de Deflatores Inadequados e o Problema de Erro Comun nas Variaveis em Estudos Econometricos." Pesquisa e Planejamento Economico (dezembro 1971).

Leiderman, Leonardo. "The Demand for Money under Rational Expectations of Inflation: FIML Estimates for Brazil." Boston University, Center for Latin American Development Studies, Discussion Paper Series, No. 44, August 1980.

Lemgruber, Antonio C. "Inflation in Brazil," in L. B. Krause and W. S. Salant, eds., Worldwide Inflation (Brookings: Washington, 1977), pp. 413-441.

Moura da Silva, Adroaldo. Emprego e Precos no Curto Prazo. Ensaios Economicos, No. 2, Instituto de Pesquisas Economicas da Universidade de Sao Paulo (1979).

Ness, Walter. "Financial Markets Innovation as a Development Strategy: Initial Results from the Brazilian Experience." Economic Development and Cultural Change (April 1974).

Pastore, Affonso Celso. "Comunicacao: O Emprego de Deflatores Inadequados e o Problema de Erro Comum nas Variaveis em Estudos Econometricos." Pesquisa e Planejamento Economico (junho 1972). (Comment on the article by Kenneth King previously cited.).

Poirier, Dale J. The Econometrics of Structural Change (North-Holland: Amsterdam, 1976).

Quandt, Richard. "Tests of the Hypothesis that a Linear Regression System Obeys Two Separate Regimes." Journal of the American Statistical Association, 67 (1972).

Silveira, A.M. "The Demand for Money: The Evidence from the Brazilian Economy." Journal of Money, Credit and Banking (February 1973).

Simonsen, Mario H. Gradualismo x Tratamento de Choque (APEC: Rio de Janeiro, 1970).

Vinod, Hrishikesh and Aman Ullah. Recent Advances in Regression Methods (Marcel Dekker, Inc., New York, 1981).

APPENDIX A

Estimation of a Demand-for-Money Function Assuming Inflationary Expectations To Be Formed "Rationally" on the Basis of the Estimated Function

Suppose that the "true" demand-for money function has the form

$$m(t) = M(t) - p(t) = V(t) - b\ x\ (t) + u(t), \tag{1}$$

where M(t) is the (log) nominal money supply "at the start" of period t; p(t) is the (log) price level determined "over the course" of period t; x(t) is the expectation of [p(t)-p(t-1)] generally held by the public "at the start" of period t; V(t) is the "other variables" in the money-demand function known "at the start" of period t [e.g., V(t) = a y(t) + h (1+n), where (log) y(t) is real national income and (log) (1+n) is "one plus" a nominal interest rate]; and (log) u(t) is a normally distributed variable with mean zero, not generally known by the public at the start of period t. If the expectation is assumed to be rationally formed on the basis of this function, difficulties arise for carrying out the estimation. Suppose that the public forms x(t) "rationally" at the start of period t on the basis of its knowledge of M(t) and V(t) using (1). Re-arranging (1),

$$p(t) = M(t) - V(t) + b\ x(t) - u(t),$$

hence

$$p(t) - p(t-1) = M(t) - p(t-1) - V(t) + b\ x(t) - u(t).$$

At the start of period t, the mathematical expectation of [p(t) - p(t-1)] is given by

$$E[p(t) - p(t-1)] = M(t) - p(t-1) - V(t) + b\ x(t).$$

Therefore, if each economic agent forms x(t) "rationally,"

$$\begin{aligned} x(t) &= E[p(t) - p(t-1)] + v(t) \\ &= [M(t) - p(t-1) - V(t) + b\ x(t)] + v(t), \end{aligned} \tag{2}$$

where v(t) is a normally distributed variable with mean zero. Assuming that each economic agent supposes that all other economic agents from precisely the same expectation,

$$x(t) = [M(t) - p(t-1) - V(t) + b\ x(t) + v(t)]/[1-b]. \tag{3}$$

Substitute (3) into (1) and multiply both sides of the equation by (1-b):

$$M(t) - p(t) = V(t) - b\ \{ [M(t) - p(t-1) - V(t) + b\ x(t) + v(t)]/[1-b] \} + u(t);$$

$$(1-b)\ [M(t) - p(t)] = (1-b)\ V(t) - b\ [M(t) - p(t-1) - V(t) + v(t)] + (1-b)\ u(t).$$

Re-arrange to obtain

$$m(t) = M(t) - p(t) = V(t) - b\ [p(t) - p(t-1)] + e(t), \tag{4}$$

where

$$e(t) = (1-b)\ u(t) - b\ v(t).$$

Equation (4) can be estimated by standard econometric techniques only if e(t) can be assumed to be normally and independently distributed with mean zero. The presence of "b" in the formula for e(t) obviously makes this assumption problematic. If

$$v(t) = -u(t),$$

then

$$e(t) = u(t).$$

This would be the case of perfect foresight. Alternatively, it may be assumed that

$$u(t) = [\ b\ v(t) + h(t)\ ] / [\ 1 - b\ ], \tag{5}$$

where h(t) is an independently, normally distributed variable. This assumption implies that

$$e(t) = h(t).$$

The intuition behind this strong assumption is that u(t) arises from the combined effects of the expectation error v(t) and the general error h(t) on [p(t) - p(t-1)]. Making this assumption permits us to avoid the perfect-foresight assumption, but it is scarcely less strong. It is important to note that if (5) is assumed, x(t) cannot be a "rational expectation", strictly speaking, because v(t) is no longer independently distributed. It may be fair enough, however, to describe (5) as a "quasi-rational" expectation.

The principal advantage of estimating a money-demand equation such as (4), rather than an equation incorporating a more sophisticated inflation-expectations-formation mechanism, is that (4) is relatively simple, for both estimation and prediction. Once the parameters of (4) have been estimated, predictions of p(t), and hence of m(t), can easily be made on the basis of predicted values of M(t) and of the variables incorporated in V(t). More sophisticated inflation-expectations-formation mechansims tend to reduce the number of degrees of freedom in the estimation.

APPENDIX B

Data Sources

The basic monthly-data sources were the following.

1. Money supply. The money-supply series was compiled from two issues of the Fundacao Getulio Vargas publication, Conjuntura Economica, April 1977 and September 1981.

2. Wholesale price indices. The wholesale-price series was compiled from Conjuntura Economica, April 1977 and September 1981.

3. Rates of return on exchange acceptances. A series of rates of return on exchange acceptances was compiled from two issues of the Boletim do Banco Central do Brasil, March 1977 and July 1981.

4. National income. National-income data are a problem for all quarterly macroeconomic work on Brazil because a quarterly national-income series is not available. A further difficulty arises from the frquent revisions of the national-income accounts: when the Fundacao Getulio Vargas revises the accounts, it changes only the most recent years.

This writer has constructed a quarterly national-income series as follows. The basic data were three series of annual real-income data, for the years 1960-1968, 1965-1974, and 1970-1980, and a quarterly series of industrial consumption of electric power in the Rio de Janeiro-Sao Paulo areas, 1960:1 to 1980:4. The annual real-income data were published in various publications of the Fundacao Getulio Vargas: (1) Sistema de Contas Nacionais, published in November 1973; and two issues of Conjuntura Economica, (2) December 1979 and (3) December 1981. The data for the overlapping parts of the series were inconsistent because of the revisions. Thus, the 1965-1968 data were higher in the second series than in the first, and the 1970-1974 data were higher in the third series than in the second. A single 1961-1980 series was constructed by supposing that the data of the first series for 1961-1964 would have been revised upward by the same (geometric) average ratio as the 1965-1968 data in forming the second series; and then by supposing that the data for 1961-1969 data would have been revised upward in a similar way to form the third series. The series thus generated was denominated in 1970 prices.

The following ordinary-least-squares regression was then carried out for the years 1960-1980:

$$
\begin{array}{lll}
\log Y = & 4.57565 & + \; 0.845862 \log E, \\
 & <38.59> & \quad <65.49>
\end{array}
$$

where Y is annual real income and E is annual electrical consumption. This equation was then used to generate a quarterly national-income series from the quarterly electricity-consumption series (the last column of the table on the following page). In spite of the extreme simplicity of the generating equation, the resulting national-income series roughly conforms to what is known from other sources (including contemporaneous newspaper accounts and Brazilians' recollections) to have been the nation's business cycle. (Claudio Contador has informed the writer, however, that there may be a lag of one to three months between the consumption of electrical power and the entry of the data in the power-company statistics.)

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