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THREE PAPERS ON BRAZILIAN TRADE AND PAYMENTS

Eliana A. Cardoso

Rudiger Dornbusch

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Cambridge MA 02138

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ABSTRACT

This report brings together three separate, short papers on problems of Brazilian trade and payments. The following topics are addressed: the determinants of export behavior in the manufactures sector, measures of the real exchange rate and the monetary approach applied to the external balance.

In the paper on export behavior of manufactures, we report estimates of an export supply equation. We show that for the period 1959-1977 exports of manufactures were determined by productive capacity, the relative price (inclusive of subsidies) facing exporters and the domestic output gap. The equation describes well the behavior of exports and documents on export price elasticity of unity and a significant responsiveness of exports to the level of domestic demand relative to capacity.

The study of real exchange rates examines a number of different empirical measures of external competitiveness. Specifically, we look at the manufactures terms of trade, the relative wholesale prices in Brazil and abroad, export prices relative to home prices and export prices relative to prices in world trade. The comparison of these real exchange rate measures points out the important role that composition effects played in Brazilian export growth. A large fraction of Brazilian exports is in the area of processed foods that experienced a particularly sharp increase in their relative price in world trade in 1968-1974.

The paper dealing with the monetary approach explains reserve and exchange rate behavior in terms of domestic credit and the determinants of nominal money demand. It corrects earlier estimates in the literature and, while sustaining the success of a monetary approach, it also qualifies that approach by drawing attention to the role of monetary liabilities of the consolidated banking system.

Eliana A. Cardoso
Instituto de Planejamento Economico
e Social
Rio de Janeiro, Brazil

Rudiger Dornbusch
Department of Economics
Massachusetts Institute of Technology
Cambridge, Massachusetts 02139

(617) 253-3648

AN EQUATION FOR BRAZILIAN MANUFACTURING EXPORTS

Manufacturing exports are of central concern in macro-economic policy making. The responsiveness of the sector to price incentives provides a policy avenue to improve the external balance without sacrifing employment. At the same time neglecting to maintain price incentives for that sector will show a deterioration in export performance. These are very much the lessons of the last twenty years and this paper seeks to quantify the effects by estimating an export supply equation.

There is now already a body of empirical evidence on the Brazilian foreign trade sector and in particular on export performance. Export behavior attracted interest in particular because it were the target of an extensive subsidy and incentive policy and because the transition to a stable real exchange rate regime in the late 1960s was expected to benefit in particular the export performance. Among the important research on Brazilian export performance we mention here in particular the studies by Coes (1979) and Tyler (1976) as well as the recent work by Barata (1979). Early papers dealing with the question were those by Pastore et al (1976) and Lemgruber (1976). A more recent review is presented in Carvalho and Haddad (1978) who also report new findings.

Comparability of our results, reported below, with these various studies is made difficult for a number of reasons. One major problem is that most of these studies report reduced form equations rather than export supply functions. In other equations disaggregation is pushed further than in our study or scale and trend variables differ substantia ly. Finally the data period differs with most of the studies mentioned above.

The choice of an aggregate export supply equation for manufacturing, on which we report here, is motivated by the need for a reasonable number to provide a basis for judging the implications of such broad policies as real depreciation or changes in subsidies. We also would want to establish whether domestic cyclical movements affect exports.

Section 1 presents a model of export supply. The important feature of that model is the recognition that for a country like Brazil exports are only a small part of total manufacturing output. In section 2 we report our estimates of this model. In section 3 some concluding remarks and suggestions for extension are offered.

1 - Export Supply Behavior

Our export supply behavior is based on three hypothesis: First, that Brazil is substantially a price taker in world markets for her manufactures exports. (The "small country" assumption). Changes in Brazilian export supplies will

not affect the world market price of these goods and world market prices can be taken as a proxy for the world price of Brazilian goods.

Our second assumption is that there is a "normal" share of exports in manufacturing production. The normal share is determined by the real rewards to exports as compared to domestic sales. The higher the relative reward to exports the larger the share of manufacturing output devoted to exports.[1]

The third assumption is that export supply behavior is affected by domestic cyclical effects. With domestic demand high relative to capacity, goods are diverted from exports to domestic sales. Conversely with demand low the share of exports in manufacturing output will be above normal. Export activity over the business cycle thus shows a residual character.

There are two interpretations for the cyclical effect on exports. One is to think of the home market as a "customer market" in the sense of Okun (1973) where at list prices demands are met over the business cycle on the basis of long-term implicit contracts. There is thus an essential nonprice element that is captured by the cyclical variable. The other way of looking at the same point is to argue that over the

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[1] This aggregation corresponds to the home goods-traded goods distinction in the "dependent economy model". See, for example, Salter (1959).

business cycle transactions and list prices move apart and that cyclical variables capture this deviation that is essential to the export/home sales choice. Since the two interpretation are clearly not in conflict we offer them both as plausible interpretations.

With these preliminary remarks we turn to equation (1) that specifies our export supply behavior:

$$(1) \qquad x = a_o + a_1 p + a_2 y$$

Here x denotes the share of exports in manufacturing production, p is the world price of manufactures in cruzeiros, adjusted for export subsidies, compared to the home price of these goods. The variable y measures cyclical excess demand.The theoretical specification discussed above argues that the coefficient $a_1 > 0$ and that $a_2 < 0$.

A slightly different specification would capture the dynamics of export adjustment. This theory would describe (1) as the target level of the export ratio, $\bar{x}$, and posits an adjustment process for the actual ratio, x, as follows:

$$(2) \qquad x = x_{-1} + \gamma(\bar{x} - x_{-1}); \qquad 0 < \gamma < 1.$$

Substituting from (1) this yields following equation:

$$(3) \qquad x = (1 - \gamma)x_{-1} + \gamma a_o + \gamma a_1 p + \gamma a_2 y$$

Both specifications (1) and (3) are tested below. Equation (3)

here is a popular formulation that has been described as a disequilibrium model (See Goldstein and Khan, 1977).

That are the facts the theory is to explain? In Table 1 we show an index of the share of exports in manufacturing production, an index of the relative price and of the excess demand or "gap" variable, in percent. (See also Chart 1).

Table 1

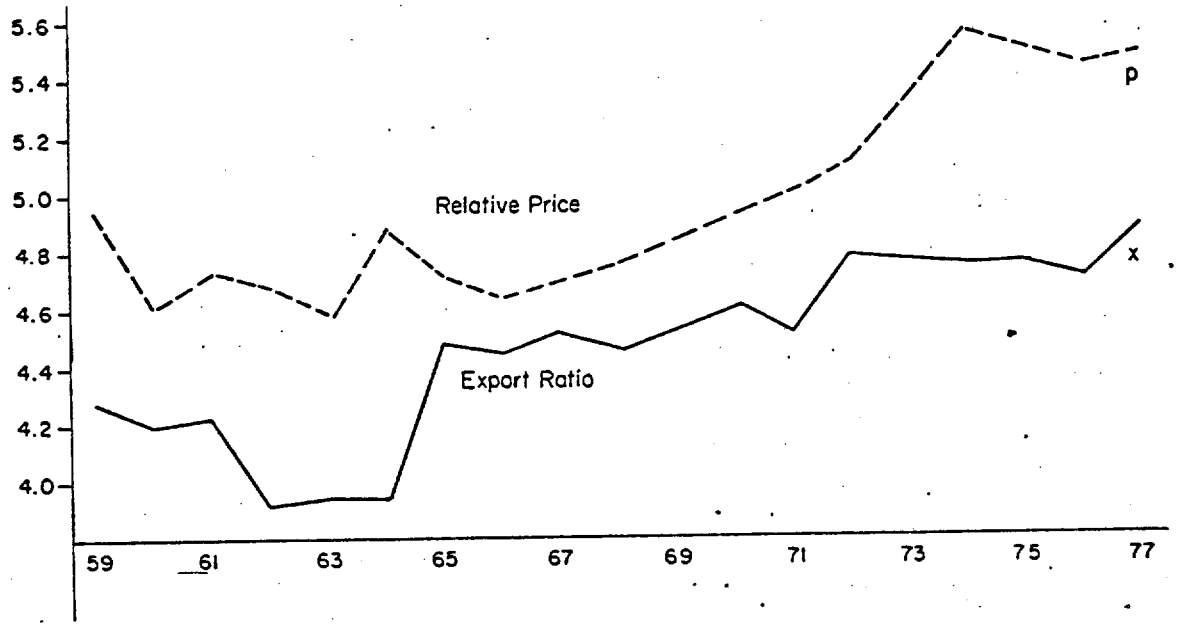
Some Facts

	x	p	y
1959	72.0	141.0	7.2
1963	52.5	99.4	1.7
1967	92.5	112.8	-18.2
1970	100.0	138.9	- 8.8
1977	131.5	242.7	4.4

NOTE: For data see Appendix.

The table shows that over the period 1959-77 the index for the export share of manufactures production rose by 60%, although the pattern was one of substantial decline to 1962/63 with a continuing growth thereafter. The relative price deteriorated to 1962/63 and showed a strong increase thereafter, particularly in the seventies. The relative price behavior reflects of course both the purchasing power parity oriented exchange rate policy and the progressive granting of export subsidies. (See Cardoso, 1979 for a series and further

CHART 1 THE EXPORT RATIO AND RELATIVE PRICES



references). The gap complements our series in that it help explain export growth in the period of protracted economic slack from 1964 to 1970.

2 - The Estimates

Table 2 reports estimates with annual data for the two specifications of the export ratio. The data are described in detail in the appendix and we limit ourselves here to a broad description. The dependent variable, x, is the log of the ratio of the export quantum index for manufactures to the production index for manufactures. The index thus represents a quantity share index for exports.

The relative price, p, is measured by the log of the world price of manufactures, converted into cruzeiros and adjusted by a subsidy series from Cardoso (1979). The price is deflated by the domestic wholesale price of manufactures.

The cyclical variable, y, is the percentage deviation of manufacturing output from its trend value. The series used here is due to Lemgruber (1979).

Table 2
The Estimates

	Const.	p	y	x_{-1}	R^2	DW	SER	Rho
1. 1960-77	.33 (.44)	.83 (5.57)	- .016 (- 3.0)		.78	1.79	.15	.25
2. 1961-77	- .44 (-1.01)	.51 (3.23)	- .012 (-3.63)	.53 (3.63)	.86	2.10	.13	-.32

Note : t-statistics in parenthesis.

Now consider the findings in Table 2. As a summary remark, the equations bring quite striking confirmation for the theoretical specification. All parameters have the expected sign, they are precisely estimated and the equation explains a substantial part of the variability in the export share. More particularly our findings are the following:

(i) The export share depends significantly on the relative reward of exporting versus home sales. The supply elasticities are estimated with substantial precision and are summarized as follows:

Table 3

Supply Elasticities of Exports

Eq.	Shortrun	Longrun
1.	.83	
2.	.51	1.09

The longrun elasticity of supply is thus around unity.[2] Interestingly, the difference in specification does not in an important way alter the estimate of the elasticity of supply.

(ii) The cyclical effects clearly influence the export ratio. An increase in the gap due to a demand expansion will reduce the export ratio. The order of magnitude is that a one

[2]The longrun elasticity is calculated in equation 2. as .51/(1-.53) = 1.09 since in the longrun $x = x_{-1}$.

percentage point rise in the gap will reduce the export ratio by 1.6 to 2.5 percent, depending on the equation estimates. Major changes in demand relative to trend output, such as the 1964/70 decline in activity, clearly exert an important effect on export performance.

(iii) There is evidence for adjustment lags. The significant coefficient for the lagged endogenous variable shows that adjustment is not instantaneous. The mean lag is measured by the ratio $(1 - \gamma)/\gamma$ and thus is just above one year. It is interesting to note that the dynamic specification does not significantly alter the parameter estimates. The same is the case for estimates without correction for serial correlation that are reported in the appendix. This stability across estimation methods and specifications suggests that the theoretical model captures the essential determinants of export behavior.

3 - Concluding Remarks:

The equation estimates have important implications for macroeconomic policy. They clearly point to a direct adverse effect of demand expansion on exports and to the need to maintain exporters real rewards. The next step from here is to test details of the specification offered here. In particular four questions stand out:

(i) Do subsidies and relative price changes exert different effects or is the proper specification that of

collecting them in a compositive variable, p.

(ii) Is the assumption that Brazil is a price taker warranted, or is the proper formulation one that includes a model of Brazilian export price formation.

(iii) Are there omitted variables such as real material costs or real exchange rate variability, introduced in Barata (1979) and Coes (1979) respectively, that have demonstrable effect on the export performance?

(iv) Our dependent variable is export relative to production of manufactures. One question is whether the implied unit elasticity is justified. Another concerns the proper production or sale variable. Should it be actual production of manufactures or a measure of potential output in manufactures?

These questions form part of further work in this area. For the moment though, we should note that the short available sample and the robust results in the reported equations do not make these extensions seem very urgent or promising.

APPENDIX

This appendix presents the data and sources for the quantity and price indices used in the estimation. Table A-3 presents the OLS estimates.

Table A-1

Quantum indices for exports (Q_x), Industrial Production (Q_I) and the output gap (y): BRASIL, 1959-1977

	Q_x	Q_I	$\log\left(100Q_x/Q_I\right)$	y
1959	35	48,0	4,29	- 1,43
1960	35	52,6	4,20	1,00
1961	40	58,2	4,23	3,97
1962	32	62,8	3,93	2,25
1963	33	62,9	3,96	- 2,77
1964	35	66,1	3,97	- 7,00
1965	56	63,0	4,49	-11,10
1966	59	69,2	4,45	-14,30
1967	66	71,3	4,53	-16,40
1968	70	80,8	4,46	-12,60
1969	86	90,6	4,55	- 9,98
1970	100	100,0	4,61	- 8,36
1971	104	114,3	4,51	- 2,71
1972	155	129,6	4,78	1,55
1973	177	150,1	4,77	7,73
1974	194	164,9	4,77	10,20
1975	206	175,2	4,77	8,92
1976	214	193,9	4,70	10,70
1977	265	201,4	4,88	8,39

SOURCES: Q_x and Q_I Conjunture Economics, January 1975 and July 1979 y : Lemgruber (1979 Table IX, column 9).

Table A-2

Indices for the Exchange Rate (E), The Subsidy Rate (S), International Prices of Manufactures Exports (P*) and Domestic Prices of Manufactures (P), Brazil 1959-77.

Years	E	S	P*	P	$p = \log (0,01 \left(\frac{ESP*}{P}\right)$
1959	3,410	100,0	83	2	4,952
1960	4,132	100,0	74	3	4,624
1961	5,934	100,0	78	4	4,761
1962	8,449	100,0	77	6	4,686
1963	12,574	100,0	87	11	4,599
1964	27,699	100,4	96	20	4,894
1965	41,216	105,0	86	33	4,725
1966	48,296	105,0	89	43	4,654
1967	58,013	121,6	88	55	4,726
1968	73,955	126,5	90	71	4,776
1969	88,719	131,6	95	86	4,860
1970	100,000	138,9	100	100	4,934
1971	115,210	141,3	111	117	5,040
1972	129,309	142,1	124	136	5,121
1973	133,493	143,4	175	156	5,369
1974	147,963	147,0	246	202	5,579
1975	177,076	149,1	244	262	5,505
1976	232,513	150,6	233	357	5,432
1977	308,085	150,0	261	497	5,492

SOURCE: E, P*, P: Conjuntura Econômica, January 1975, April 1977 and July 1979, S from Cardoso (1980, Table 1).

Table A-3
OLS Estimates

		p	y	x_{-1}	R^2	DW	SER
1. 1959-77	0,08	0,88	-0,016		0,78	1,60	0,15
	(0,14)	(7,46)	(-3,87)				
2. 1960-77	0,26	0,53	-0,012	0,46	0,85	2,44	0,13
	(-0,49)	(3,14)	(-3,24)	(2,55)			

NOTE: t-statistics in parenthesis.

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NOMINAL AND REAL EFFECTIVE EXCHANGE RATES FOR BRAZIL: 1959 - 1978

The analysis of trade issues such as the performance of the export sector or the prediction of import growth require measures for the domestic and international competitiveness of the traded goods sectors. The US dollar exchange rate has long ceased to provide a relevant index. Not only has high Brazilian inflation required offsetting depreciation, but the advent of generalized floating and the associated large movements in key bilateral exchange rates, have made any particular nominal exchange rate quite uninformative as a guide. The problem is further complicated by the fact that external exchange rates have moved out of line with purchasing power parity (PPP) and that relative commodity prices in world markets have shown substantial variability. Under these conditions, where do we look for measures of competitiveness?

The importance of the issues becomes obvious when we look at the domestic currency price of foreign exchange. The rapidly rising price index of course does not correspond to a one-for-one gain in competitiveness. What matters for competitiveness is prices relative to costs or one price relative to the price of an alternative use or an alternative,

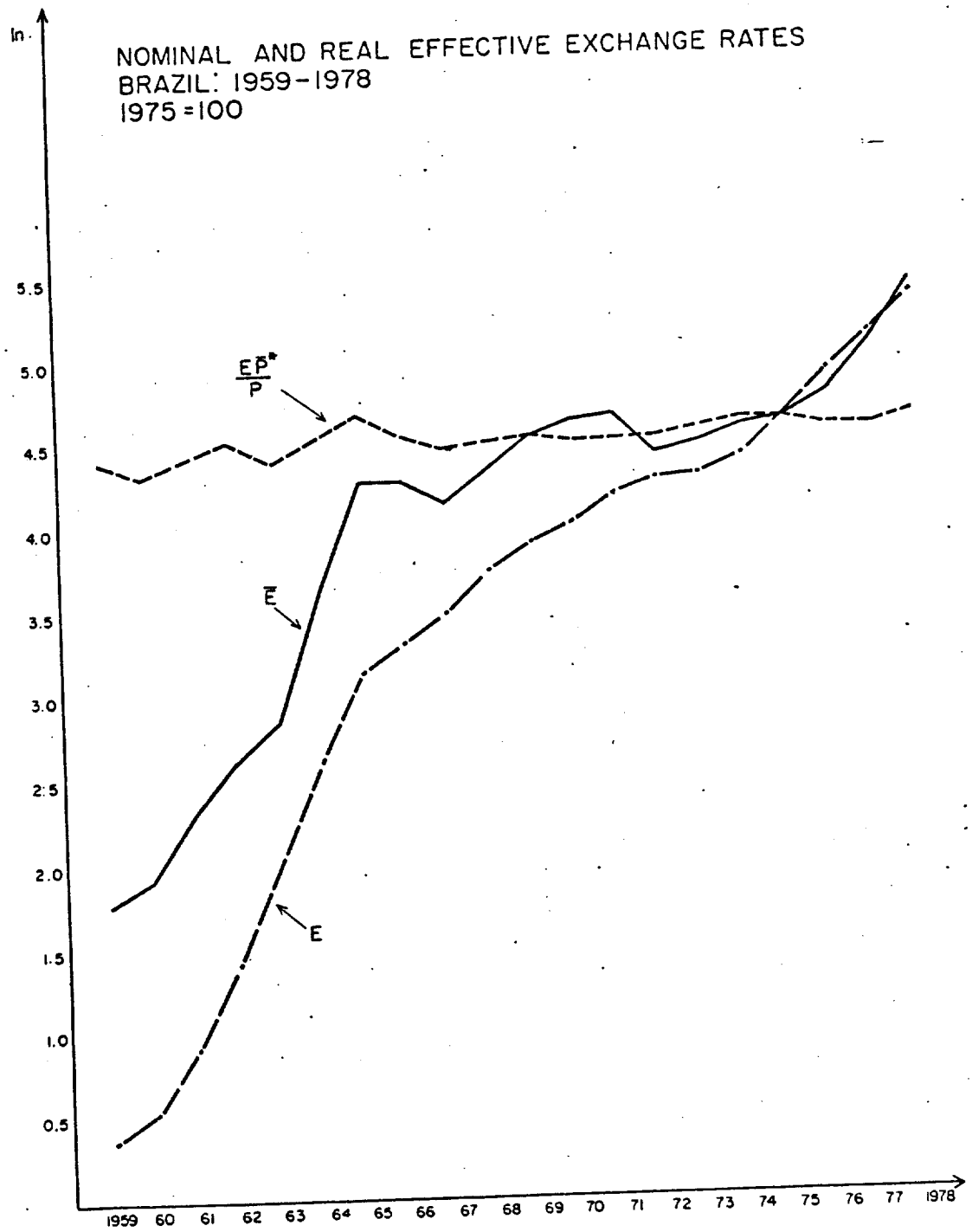
competing supplier. Real exchange rates are measures of competitiveness and they behave on occasion quite differently from nominal exchange rates. This is patently the case for Brazil where exchange rate policy, since 1968, has been oriented toward stabilizing real exchange rates. The policy of a crawling peg, designed to offset inflation differentials through exchange depreciation, is quite evident from the series for the real exchange rate shown in Figure 1.

This paper is addressed to developing and interpreting various alternative measures of the real exchange rate. Section 1 states the problem. Section 2 shows the evidence for four different measures of the real rate and in view of the evidence, offers some comments on Brazilian export performance in the last fifteen years. The appendix develops the gory details of compiling the series.

1. Measures of Competitiveness:

Suppose we are interested in the performance of manufactures export sector and want to develop price or cost measures that indicate whether that sector is growing more or less competitive. It is natural to think of competitiveness in terms of demand or supply. On the supply side we would think of an increase in competitiveness or profitability—and thus an expansion in export supply—if export prices rise relative to the prices of manufactures in the home market. If so, we would expect increasing amounts of manufactures production to be diverted toward exports and away from home sales.

Figure 1



$E\bar{P}^*/P \equiv$ Real Effective Exchange Rate

$\bar{E} \equiv$ Nominal Effective Exchange Rate

$E \equiv$ Nominal Dollar Exchange Rate

A natural measure of competitiveness on the supply side, then, is the ratio of export prices of Brazilian manufactures, P_x relative to domestic manufactures wholesale prices, P. The first measure is then our supply side index of competitiveness:

(1) $\Theta_s = P_x/P$ = manufactures $\frac{\text{export price}}{\text{home sales price}}$

Before proceeding further we need a word about price definitions. Throughout price comparisons are only meaningful when prices are quoted in a common currency. As a convention we conduct all price comparisons in cruzeiros and thus translate all foreign currency prices into cruzeiros at the relevant exchange rate. All cruzeiro prices are denoted by P's all foreign currency prices by *'s, the cruzeiro price of foreign exchange is E.

A second index of competitiveness comes from the foreign demand side for Brazilian exports. Here we look at the competitiveness of Brazilian exports by comparison with foreign competitors. The relevant price comparison here is the price of manufactures in world trade compared to Brazilian export prices.[1]

(2) $\Theta_d = EP^*_x/P_x$ = manufactures $\frac{\text{world trade prices}}{\text{export prices}}$

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[1] Again to clarify notation P^*_x is the foreign currency price of competitors, E is the price of foreign exchange and hence EP^*_x is the cruzeiro price of competitors.

where P^*_x is an index of manufactures export prices in the world (compiled by the UN as we shall see below) and P_x is again the Brazilian manufactures export price. We would expect an increase in Θ_d, a rise in competitors prices relative to the Brazilian prices, to lead to increased foreign demand for Brazilian exports and therefore to an improved export performance. This would be the case if there was not an important difference between a country like Brazil and major industrialized countries like Germany or the US. In the latter manufactures trade is mainly intra-industry trade in differentiated products—a Mercedes for Peugeot—. For Brazil the case is more one of exporting canned coffee and importing not coffee but specialty tools. For industrialized countries Θ_d still serves as a measure of competitiveness and as such is regularly reported in the IMF International Financial Statistics. For Brazil we stick with Θ_d as a measure of different baskets relative price.

Why would we study separate indices for the demand and supply side? There are two reasons. The first is that at the level of aggregation at which indices are available relative price changes may give the spurious impression of changes in competitiveness. We will see a striking example of that below. The other reason is that both demand and supply side competitiveness matter. Suppose we had constant costs on the supply side and unchanging domestic

competitiveness, Θ_s, and/that in world markets our competitiveness increased. Then we would expect exports to rise as indicated by the measure Θ_d. Conversely, suppose Brazil was a minor supplier in world markets, as she surely is for many goods, then changes in supply side competitiveness are an important indicator of export performance. Clearly the indices are complementary measures.

There are two further indices which are readily available and further help identify the sources of change in export performance. One of these is an index of Brazil's terms of trade in manufactures. This is simply the ratio of manufactures export and import prices, P_x and P_m respectively:

$$(3) \qquad \Theta = P_m/P_x = \text{manufactures } \frac{\text{import prices}}{\text{export prices}}$$

The terms of trade index serves primarily as an indication of the relative prices of the product basket that Brazil exports and that she imports. For example processed food is a major export item,while capital goods are a major import item. The terms of trade index thus is taken mainly as an indicator of relative prices of different baskets of manufactures, rather than as an index of competitiveness.

The fourth index is a broad measure of cost levels in the rest of the world compared to Brazil. As measures of

costs we take economy-wide wholesale prices and the argument is that Brazilian competitiveness is enhanced and thus export potential is improved, if foreign wholesala prices (in cruzeiros, of course) rise relative to Brazilian wholesale prices. Denoting home and foreign wholesale prices by $\bar{P}$ and $E\bar{P}^*$ respectively we have:

$$(4) \qquad \Theta_c = E\bar{P}^*/\bar{P} = \text{wholesale prices} \quad \frac{\text{world}}{\text{domestic}}$$

This last measure, incidentally, is the one already shown in Figure 1 as the real exchange rate.

To summarize, we have developed four measures that identify changes in price competitiveness, in relative prices within manufactures and of relative costs. We would expect for a relative constant terms of trade Θ a rise in Θ_c, Θ_s and Θ_d to be an indication of enhanced export performance. We look at all measures in combination to be aware that there are important relative price changes that may obscure the pattern of changing cost competitiveness.

2. The Evidence:

Figure 2 shows the four measures of real exchange rates we have introduced above. Consider first the ratio of economy-wide wholesale prices. This is our measure of relative cost levels and comes closely to a purchasing power parity measure of real exchange rates because it represents the broadest basket of goods. We already showed the index Θ_c in Figure 1 to contrast the real exchange rate with the behavior of the nominal exchange rate. In Figure 2 it serves as a benchmark for identifying special factors in any of the other indices.

The outstanding fact about the relative cost index is its substantial variability prior to 1968 and the subsequent relatively stable behavior. The explanation for the difference in behavior is quite clearly the exchange rate regime of Brazil. Until 1968 exchange rate policy was one of infrequent, large depreciations that were designed to undo the loss in competitiveness due to domestic inflation. Since 1968 the mini-devaluation policy has substantially smoothed that process. Interestingly, though, the real exchange rate since 1968 has been by no means constant.

Against the background of the measure of relative economy-wide cost or price trends we now look at the indices specific to the Brazilian export sector.Consider first the measure of competitiveness on the supply side,

Θ_s. Figure 2 shows the high variability in the early 60s and, since 1967, an absolutely striking increase in the relative prices of exports compared to home sales of manufactures. This extraordinary increase, further reinforced by important subsidies, lies behind the impressive export performance.[2] Before proceeding, note also that since 1974 the price increase has ceased and the index shares the minor variations common to all.

The supply side indicator of competitiveness provides a ready rationalization of export growth. Not so the demand side indicator, Θ_d. On the contrary, the demand side indicator shows that Brazilian competitiveness declined sharply throughout the 1965-74 period. This would suggest, then, that Brazil should have had serious export problems.

Facing the conflicting message of the two indicators we look at the manufactures terms of trade, Θ. They share the same pattern as the demand side indicator and thus alert us to the possibility that we are looking not at a loss of competitiveness but rather at a change in relative prices of different groups of commodities in world trade. Indeed, what we are observing in both the

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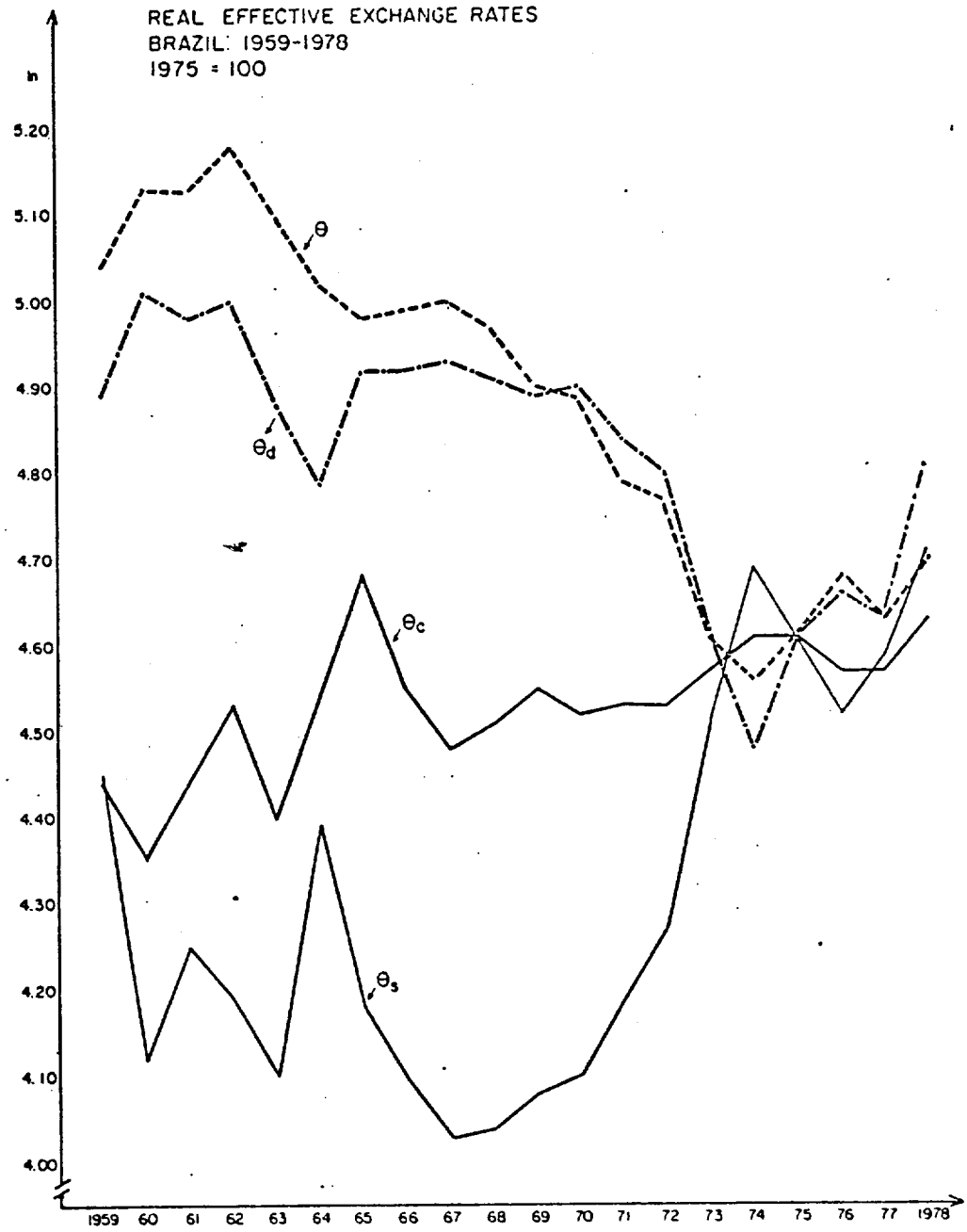
[2] See Cardoso, E. and Dornbusch, R. (1980) "An Equation for Brazilian Manufactures Exports". RBE, forthcoming.

Figure 2


REAL EFFECTIVE EXCHANGE RATES
BRAZIL: 1959-1978
1975 = 100
ln
5.20
5.10
5.00
4.90
4.80
4.70
4.60
4.50
4.40
4.30
4.20
4.10
4.00
θ
θd
θc
θs
1959 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 1978

terms of trade and the demand side indicator is the fact that Brazil was exporting a group of goods the world relative price of which was rising quite rapidly. Brazil was in the right product mix to benefit from the boom in (processed) foodstuffs.

The details of the "commodity composition effect" are quite simply these: During the period 1967-74 the average share of industrialized foodstuffs in exports was 33%. The prices of these goods rose at an average annual rate of 21% compared with only 7% on average for manufactures at large. The important share of foodstuffs on the export side explains then the dominance of this relative price effect in comparing demand and supply side indicators of competitiveness.

The relative price effects are, a neglected explanation for the export performance in the period. Not only was it true that export prices rose relative to home prices and that subsidies reinforced the profitability; it was also true, that Brazil was in a booming sector.

APPENDIX

Definitions and Sources:

P : The Brazilian index for manufactures wholesale prices is an index in cruzeiros reported in Conjuntura Econômica, column 18.

$\bar{P}$: The Brazilian index for wholesale prices is an index in cruzeiros reported in Conjuntura Econômica, column 2.

P_x : The Brazilian export prices of manufactures is obtained by multiplying the dollar price of Brazilian exports of manufactures reported in Conjuntura Econômica, column 144, by the exchange rate.

P_m : The Brazilian import prices of manufactures is obtained by multiplying the dollar price of Brazilian imports of manufactures reported in Conjuntura Econômica, column 192, by the exchange rate.

P_x^* : The price of manufactures in world trade is an index in US$ reported in the U.N. Statistical Yearbook.

$\bar{P}^*$: The foreign wholesale price is a trade weighted average of wholesale prices of the main trading partners. We used moving weights for three periods as shown in Table 1. We converted the price indices into $US using the respective countries dollar exchange rate. The resulting index of foreign prices, $\bar{P}^*$ was then converted at the official exchange rate into cruzeiros to yield $E\bar{P}^*$.

$\bar{E}$: The nominal effective exchange rate was constructed as the trade weighted index of the cruzeiro price of foreign exchange $\bar{E} = E \sum_{i=1}^{8} a_i E_i$, where, E_i is the

index of the dollar price of the ith currency and E is the index of the cruzeiro price of US dollar. The dollar exchange rates are reported in IFS Yearbook. The logarithms of the nominal effective exchange rate are shown in Table 2.

The four measures of real exchange rates are formed by taking the price ratios defined in the text. The logarithms of the data are shown in Table 3.

Table: 1

WEIGHTS FOR THE EFFECTIVE EXCHANGE RATE

PERIODS / COUNTRIES	1958-64	1965-71	1972-78
1. U.S.A.	.557	.433	.338
2. Germany	.110	.123	.145
3. Netherlands	.071	.084	.129
4. Japan	.032	.053	.107
5. Italy	.051	.092	.086
6. U.K	.063	.061	.072
7. Argentina	.069	.101	.061
8. France	.047	.053	.062
Sum	1	1	1

Note: The weights were obtained from the shares of these countries in Brazilian exports.

Source: Boletim do Banco Central, several issues.

Table: 2

Nominal Effective Exchange Rates

Brazil: 1959 - 1978

1975 ≡ 100

YEARS	$\ell n \bar{E}$	$\ell n E$
1959	1.76	.37
1960	1.91	.52
1961	2.31	.92
1962	2.60	1.44
1963	2.85	1.86
1964	3.61	2.62
1965	4.26	3.15
1966	4.26	3.31
1967	4.16	3.49
1968	4.35	3.73
1969	4.54	3.91
1970	4.62	4.03
1971	4.66	4.18
1972	4.44	4.29
1973	4.49	4.32
1974	4.58	4.43
1975	4.61	4.61
1976	4.78	4.88
1977	5.08	5.16
1978	5.41	5.40

Note: $\bar{E}$ ≡ Nominal Effective Exchange Rate

E ≡ Nominal Dollar Exchange Rate

Source: IFS Yearbook 1979

Table : 3

Indices of Real Exchange Rates

Brazil: 1959 - 1978

1975 ≡ 100

YEARS	$\ell n\ \Theta_c$	$\ell n\ \Theta_s$	$\ell n\ \Theta_d$	$\ell n\ \Theta$
1959	4.44	4.45	4.89	5.04
1960	4.35	4.12	5.02	5.13
1961	4.44	4.25	4.98	5.13
1962	4.53	4.19	5.00	5.18
1963	4.40	4.10	4.88	5.10
1964	4.54	4.39	4.79	5.02
1965	4.68	4.18	4.92	4.98
1966	4.55	4.10	4.92	4.99
1967	4.48	4.03	4.93	5.00
1968	4.51	4.04	4.91	4.97
1969	4.55	4.08	4.89	4.90
1970	4.52	4.10	4.90	4.89
1971	4.53	4.19	4.84	4.79
1972	4.53	4.27	4.80	4.77
1973	4.57	4.51	4.62	4.61
1974	4.61	4.69	4.48	4.56
1975	4.61	4.61	4.61	4.61
1976	4.57	4.52	4.66	4.68
1977	4.57	4.59	4.63	4.63
1978	4.63	4.71	4.81	4.70

NOTE: The measures of effective exchange rates are defined in the text.

SOURCES: IFS Yearbook 1979
U.N. Statistical Yearbook, several issues.
Conjuntura Econômica, several issues.
Boletim do Banco Central, several issues.

BRAZIL'S EXTERNAL BALANCE: AN EVALUATION OF THE MONETARY APPROACH

This paper discusses the extent to which the "monetary approach" can serve as an explanation of the Brazilian external balance. Recent work by Connolly and Dantas (1979) claims that "The simple models of exchange market pressure tested here perform fairly well in the 1955-75 period and very well during 1962-75, in explaining movements of reserves and the exchange rate". We show that their analysis is flawed in a number of respects but that, when all corrections are applied, their conclusions substantially stand.

In a first part we briefly review the monetary approach. The second section presents empirical evidence and in the final section we comment on the Connolly-Dantas paper.

1. The Monetary Approach

The monetary approach to the balance of payments grew out of policy oriented modelling at the IMF (1978) with some ancestry in Dutch theory, Prais (1961). The approach received its main emphasis toward the end of the 1960s, particularly associated with Harry G. Johnson (1972), Robert Mundel (1971) and their students (see Frenkel and Johnson, 1978). The particular model to be discussed here is due to Girton and Roper (1977) who estimated it for the case of Canada.

The monetary approach recognizes the relationship between the balance sheet of the consolidated banking system, the external balance and monetary aggregates. Denoting net foreign assets, the money stock and domestic credit by NFA, M and DC respectively, the balance sheet identity of the banking system states:

(1) $NFA + DC \equiv M$

where M denotes <u>all</u> liabilities of the consolidated banking system. The monetary approach uses this identity, combined with assumptions about the monetary sector and the exchange rate regime, to establish a link between money demand changes, changes in domestic credit and changes in net foreign assets.

Denoting by Δ a change we obtain from (1):

(1)' $\Delta NFA \equiv \Delta M - \Delta DC$

In (1)' we still have an identity. The next step is to convert it into a theory by imposing the assumption that money supply always equals money demand. Denoting the change in money demand by ΔM^d and imposing the assumption $\Delta M = \Delta M^d$ converts (1)' from an identity into a theory, namely the monetary approach:

(1)" $\Delta NFA = \Delta M^d - \Delta DC$

The monetary approach asserts that under fixed exchange rates changes in money demand increase net foreign assets of the consolidated banking system while credit expansion leads to a precisely offseting loss in net foreign assets. With exchange

rates flexible or managed, as we see below, the approach amounts to a statement about changes in net foreign assets and/or appreciation. A rise in domestic credit,for example, leads to an offsetting decline in foreign assets or to exchange depreciation, higher prices and thus higher money demand. These details are spelled out below.

The attraction of the monetary approach is that it offers a very aggregative, simple framework for the analysis of net foreign assets. In terms of complexity it thus compares favorably with the alternative approach that would specify separate equations for exports, imports and capital flows, and in this way build up a model of the external balance and changes in net foreign assets. We now develop the monetary approach and start by expressing (1) in percentage changes:

$$(2) \qquad r \equiv \Delta M/M - d$$

where $r \equiv \Delta NFA/M$ and $d \equiv \Delta DC/M$ are used for national convenience.

The next step is to impose monetary equilibrium with nominal money demand determined by the price level, real income and the nominal interest rate:

$$(3) \qquad M = PY^{\phi}e^{-hi}$$

where, P, Y and i denote the level of prices, real income and the nominal interest rate. The functional form is that

assumed by Cagan (1956).

Differencing (3) yields:

(3)' $\Delta M/M = p + \phi y - h\Delta i$

where lower case letters represent percentage changes; thus $p \equiv \Delta P/P$. Substituting (3)' - the demand determined changes in nominal money - into equation (2) yields:

(2)' $r = p + \phi y - h\Delta i - d$

The model is closed by the assumption of purchasing power parity:

(4) $P = EP^*$

where E is the cruzeiro price of foreign exchange and P* the given foreign price level. Differencing (4) leads to an equation for the domestic rate of inflation:

(4)' $p = p^* + e$

After substitution in (2)' we obtain the final form of the equation describing changes in reserves and exchange rates:

(5) $r - e = p^* + \phi y - h\Delta i - d$

The equation implies the following predictions:

i) An increase in external inflation leads to reserve increases or appreciation, one-for-one.

ii) Growth in real income leads to reserve accumulation or appreciation.

iii) An increase in interest rates leads to a reserve outflow or depreciation.

iv) An increase in domestic credit creation leads to an equal reserve decumulation or depreciation.

The theory thus implies sign restrictions on two of the right-handside variables - real income and interest rates - and the tighter restrictions of plus and minus unity on foreign inflation and domestic credit creation respectively.

Empirical work would estimate the equation (5)':

$$(5)' \qquad r-e = a_o + a_1 d + a_2 p^* + a_3 y + a_4 \Delta i$$

and test the restrictions $a_o=0$, $-a_1 = a_2 = 1$, $a_3>0$, $a_4<0$.

Equation (5)' is of course not a test of the monetary approach but rather a joint test of four hypothesis: (i) the monetary approach, (ii) continuous money market equilibrium, (iii) the functional form and determinants of money demand and (iv) continuous purchasing power parity. There are further hypotheses introduced, once the choice is made on what are the data counterparts of p^*, y and i and how to estimate the equation.

Equation (5)' is what Girton and Roper (1977) call an "exchange market pressure" formulation of the monetary approach

and is the model that Connolly and Dantas (1979) applied, in a modified form, to the Brazilian data . We now proceed to an estimate of (5)'.

2. Estimates for Brazil 1958-1978

The exchange pressure model of the monetary approach was estimated with annual data for Brazil for the period 1958-1978. The data are described in detail in the appendix we note here simply that foreign inflation was represented by the US wholesale price index, the alternative cost of holding money, because there is no sufficiently long interest series, was proxied by the Brazilian inflation rate of the general price level. Finally domestic credit creation measures the growth of domestic credit less nonmonetary liabilities of the consolidated banking system.

In Table 1 we report the empirical evidence. First we observe that the model explains a large fraction of the variation in exchange market pressure, but that there remains considerable serial correlation even after first-order correction. The theory is supported in that all coefficients have the expected signs: specifically, a higher rate of credit creation is reflected in reserve losses or depreciation; higher foreign inflation leads to reserve gains or appreciation. A higher growth rate of home income implies increased reserve gains or appreciation while increased, home inflation, by raising the opportunity cost of holding

money, gives rise to reserve losses or depreciation.

Not only are the signs in accordance with the theoretical specification, but the parameter estimates also accord substantially with the theory. Thus domestic credit creation shows a coefficient of approximately minus unity; the foreign rate of inflation has a coefficient that is significan ly different from unity.

The two equations reported in Table 1 differ in the formulation of the income variable. In the first equation we use the current growth rate of income in the other a three year moving average. The specification of the income variable substantially affects the estimates and the precision of estimates of foreign inflation, real growth and the alternative cost of holding money. The formulation that uses a three year moving average implies a less precise estimate for foreign inflation and a more precise estimate of real income growth and changes in the alternative cost of holding money. Along with a more precise estimate for the exchange market effect of real income growth we obtain, though, an unacceptably high estimate of the income elasticity as being 3.13.

In Chart 1 we show a graph of actual and predicted values corresponding to equation (1) in Table 1. It is apparent that the equation tracks well the main movements in the exchange market pressure variable. In particular the 1964 episode is well-accounted for by the model.

Table 1

$$r-e = a_0 + a_1 d + a_2 p^* + a_3 y + a_4 \Delta p$$

1958-1978	a_0	a_1	a_2	a_3	a_4	R^2	DW	SER	Rho
1.	-.03	-.99	1.56	1.01	-.46	.89	1.58	.18	-.41
	(-.17)	(-7.51)	(2.27)	(0.72)	(- 1.74)				
2.	-.18	-.93	.77	3.13	-.77	.91	1.64	.16	-0.47
	(-1.26)	(-9.30)	(1.04)	(1.99)	(-2.66)				

NOTE: The income growth variable in equation 1. is the current growth rate of real GDP; in equation 2 it is a three-year moving average. All equations estimated with a correction for first-order serial correlation. t-statistics is parenthesis.

Our conclusion on the empirical evidence is that the monetary approach model describes well the behavior of the exchange pressure variable, although the magnitude and precision of some of the coefficient estimates --income,foreign inflation and the alternative cost of holding money--are not entirely satisfactory.

3. A Comparison With The Connolly-Dantas Estimates

In Table 2 we report estimates by Connolly-Dantas (1979). It is apparent that their results, especially for the period 1962-1975 are quite splendid. Specifically the coefficients are all significant and they all have magnitudes entirely compatible with the theoretical specification. Moreover, the equation for 1962-75 shows no evidence of serial correlation, after a minor first-order correction. What then accounts for the difference between these results and those we report in Table 1? The differences arise in part from the equation specification, in part from data differences:

i. Connolly-Dantas estimate their equations without a constant. This procedure will tend to raise estimated statistics on the remaining variables.

ii. The equations are estimated without a variable measuring the opportunity cost of holding money. Connolly-Dantas note that they omit the alternative cost of holding money "for simplicity" although it is quite apparent that this amounts to a serious misspecification of money demand,surely incompatible with the monetary approach.

Chart 1

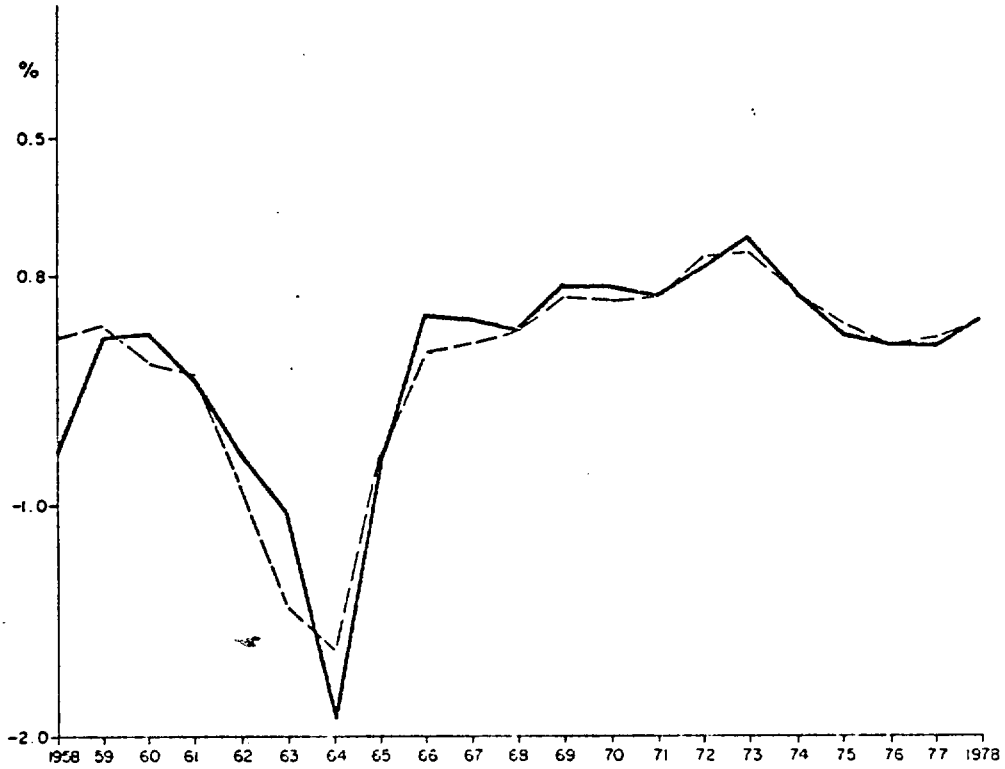

%
0.5
0.8
-1.0
-2.0
1958 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 1978

Table 2

The Connolly-Dantas Equation

$$r\text{-}e = a_o + a_1 d + a_2 p^* + a_3 y$$

		a_o	a_1	a_2	a_3	R^2	DW	SER	Rho
1.	1955-75		- 1.01	1.29	1.27	.68	2.22	.81	-.11
			(- 7.42)	(1.27)	(1.26)				
2.	1962-75		- 1.01	1.21	1.46	.91	2.00	.13	-.12
			(-13.09)	(2.04)	(2.45)				

SOURCE: Connolly-Dantas (1979, Table 1).

iii. There are data problems, to judge from the detailed description provided in the appendix to Connolly-Dantas. The first concerns the real income series. Connolly Dantas seem to be using the IMF series which has a break in 1964. Failure to note that break leads to a calculated real income growth rate of 23.3 percent for 1964. It appears that this incorrect number is being used.

iv. The perhaps more serious data problem concerns the series for the growth of domestic credit of the consolidated banking system. This series is constructed, according to their appendix, by taking the difference between the growth rate of M_1 and the growth of net foreign assets, both expressed as a fraction of M_1. That procedure would be correct only if the consolidated banking system had only M_1 as a liability. The presence of time deposits, and more importantly of nonmonetary liabilities, implies that domestic credit cannot be calculated in that manner. In our work reported above we used the definition of net domestic credit by adjusting the banking system's credit outstanding for all nonmonetary liabilities.[1]

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[1] A further difficulty we encountered was our inability, even reconstructing the Connolly-Dantas data according to their description to reproduce their equations. Our estimates using their data are:

$$r\text{-}e = a_o + a_1 d + a_2 p^* + a_3 y$$

1. 1962-75	-.14 (-.87)	- .95 (- 6.7)	.12 (.15)	2.95 (1.97)	.90	2.07	.13	-.10
2. 1962-75		- 1.05 (-11.5)	.40 (.54)	1.80 (2.72)	.89	2.17	.12	-.18

4. Concluding Remarks

The problems in estimation, unwarranted constraints and data seem sufficient to cast serious doubt on the quality of the results and the claim that the monetary approach does explain well the evolution of exchange market pressure in Brazil. In view of these doubts our earlier estimates, in Table 1 with a more complete model and better data, and covering a more recent period restore some confidence in the monetary approach. The model does explain the behavior of the exchange market pressure in a satisfactory way, but it is quite clearly not a last word on the issue. Not only are their problems left in matching coefficient estimates with the theory, there are also the serious issues related to the endogeneity of some of the right-hand side variables that have been noted in the literature.

As an exercise in the monetary approach the Brazilian case is of particular interest because it draws attention to the role of nonmonetary liabilities. To use the monetary approach for financial programming in Brazil it would actually be necessary to control net domestic credit. But that implies estimates of nonmonetary liabilities ranging from bank debt to import deposits. It is these nonmonetary liabilities, and not only the difficulty of predicting nominal money demand, that make financial programming particularly hard.

APPENDIX: The Data.

This appendix describes the data used in estimating the equations in Table 2. The series for domestic credit and net foreign assets, as well as the data on the US price index, were obtained from the IMF, International Financial Statistics/ (IFS), Yearbook 1979, and July 1978. The remaining data came from Conjuntura Economica (CE) and the Boletim do Banco Central do Brasil (BCB) as indicated below.

1. Net Domestic Credit Creation (d):

Net domestic credit is defined as the difference between domestic credit (line 32 in IFS) and nonmonetary liabilities (lines 36b + 37a + 37r in IFS). To obtain mid-year estimates we averaged the end of year data for the current and the preceding year. The growth rate, as a fraction of lagged money, is defined as:

$$d = \Delta DC/M_{t-1}$$

where M is the money stock (lines 34 + 35 in IFS) obtained as an average of the current and preceding and of year data. The revisions are bridged by using the previous series, reported in IFS July 1978 through 1972 and the new series in IFS 1979 for the remaining years.

2. Net Foreign Asset Changes (r):

As net foreign assets we use line 31n less line 36c1 in IFS. The data are end of year, hence we use the averaging

described above. Changes in net foreign assets, as a fraction of lagged money are defined as:

$$r = \Delta NFA/M_{t-1}$$

The series on net foreign assets starts in 1955. Hence our first observation, as defined here is for 1957.

3. Real Income Growth (y):

Real income growth is formed as a three year moving average of the growth rates of real GDP. Denoting the real GDP growth rate by $\bar{y}$, the variable is calculated as:

$$(3) \qquad y = \frac{1}{3}(\bar{y} + \bar{y}_{-1} + \bar{y}_{-2})$$

Through 1966 we used the data from CE, April 1977. Growth rates from 1966 on were calculated on the basis of the new series reported in IFS, 1979. (The old series corresponds to that reported in IFS until 1964, the new series starts in 1965; the break in the series is not indicated). The preliminary estimate of 1979 real growth comes from BCB, March 1979.

4. Foreign Inflation (p*):

Foreign inflation is measured by the rate of inflation of the annual average US wholesale price index: IFS, 1979, line 63.

5. Exchange Depreciation (e):

The exchange rate data are obtained from the annual

average exchange rate reported in CE, April 1977 and July 1979. The rate of depreciation, e, is the percentage rate of change of the annual average.

6. Change in the Alternative Cost of Holding Money (Δp):

The alternative cost of holding money is measured as the rate of inflation of the "general price level". The rate of inflation is calculated from the index reported in CE. The variable p is the change in the inflation rate thus calculated. The CE issues were April 1977 and July 1979.

Table

	r	e	p*	d	y	Δp	$\bar{y}$
1957	0.00	0.0188	0.0270	0.27	0.069	- 0.057	0.0520
1958	- 0.04	0.7081	0.0150	0.29	0.077	- 0.012	0.0550
1959	- 0.06	0.2104	0.0018	0.37	0.056	0.248	0.0673
1960	- 0.04	0.2115	0.0018	0.43	0.097	- 0.086	0.0767
1961	0.00	0.4362	-0.0037	0.44	0.103	0.078	0.0853
1962	- 0.35	0.4238	0.0018	0.90	0.053	0.146	0.0843
1963	- 0.64	0.4883	-0.0037	1.27	0.015	0.238	0.0570
1964	- 0.72	1.2029	0.0019	1.48	0.029	0.146	0.0323
1965	- 0.35	0.4880	0.0203	1.14	0.027	-0.332	0.0237
1966	0.00	0.1718	0.0344	0.42	0.038	-0.188	0.0313
1967	0.02	0.2012	0.0018	0.33	0.048	-0.097	0.0377
1968	0.04	0.2748	0.0245	0.36	0.112	-0.041	0.0660
1969	0.15	0.1996	0.0392	0.25	0.100	-0.034	0.0867
1970	0.08	0.1272	0.0361	0.22	0.088	-0.010	0.1000
1971	0.07	0.1521	0.0333	0.24	0.133	0.012	0.1070
1972	0.16	0.1224	0.0445	0.08	0.117	-0.034	0.1127
1973	0.21	0.0324	0.1307	0.24	0.140	-0.019	0.1300
1974	0.04	0.1084	0.1883	0.35	0.098	0.136	0.1183
1975	0.06	0.1968	0.0929	0.43	0.056	-0.010	0.0980
1976	0.01	0.3131	0.0460	0.38	0.090	0.136	0.0820
1977	0.02	0.3250	0.0612	0.38	0.047	0.014	0.0650
1978	0.08	0.2776	0.0784	0.39	0.060	-0.040	0.0660

NOTE. For definitions see text $\bar{y}$ is a three-year moving average of y.

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