THE EFFECTS OF MINIDEVALUATIONS ON THE BRAZILIAN ECONOMY

Thesis for the Degree of Ph. D.

MICHIGAN STATE UNIVERSITY

EDUARDO MATARAZZO SUPLICY

1973

This is to certify that the

thesis entitled

THE EFFECTS OF MINIDEVALUATIONS ON

THE BRAZILIAN ECONOMY

presented by

Eduardo Matarazzo Suplicy

has been accepted towards fulfillment
of the requirements for

Ph.D. degree in Economics

Mordechai Kreinin
Major professor

Date June 12, 1973

O-7639

ABSTRACT

THE EFFECTS OF MINIDEVALUATIONS ON
THE BRAZILIAN ECONOMY

By

Eduardo Matarazzo Suplicy

On 20 August 1968 the Brazilian National Monetary Council decided to follow a new system of adjustments to the foreign exchange rate. From that date, small adjustments would be made at short intervals in order to prevent the substantial differences between internal and external prices that characterize an inflationary economy with a pegged exchange rate. The minidevaluations constitute an attempt by policy makers to minimize the degree of exchange rate risk while avoiding the possible destabilizing effects of a free exchange rate.

The purpose of the dissertation was to study the impact of minidevaluations on the Brazilian balance of payments and on the domestic economy. The main findings of the study were the following: The system of minidevaluations of the exchange rate at short intervals proved to have several advantages over the system of sharp devaluations at long intervals for the Brazilian economy. The main advantage was the greater stability in the relation

between internal and external prices for those involved in the foreign sector of the economy. Thus, the exchange rate risk involved in export, import, direct foreign investments, and international loan operations was practically eliminated.

It was shown that Brazilian exports were positively affected by the policy of minidevaluations. The regression analysis showed that this policy made exports of manufactures more responsive to changes in the level of real income and significantly more responsive to changes in the level of real remuneration to exporters. This latter occurred both through changes in the real exchange rate and changes in the level of fiscal incentives. Exports of primary products also were shown to be positively affected by the smaller fluctuations in the real exchange rate under the minidevaluations.

The econometric analysis of imports indicated that a significant shift in the parameters of the import function took place as a result of two causes: the lowering of import tariffs and the policy of minidevaluations. Imports became more responsive to income changes and especially responsive to changes in the real exchange rate adjusted for dollar inflation, tariffs, auction fees, and other trade barriers.

Minidevaluations have had two major impacts on capital movements. First, they substantially diminished destabilizing short-term capital movements which previously had been harmful to the value of the cruzeiro. Second, along with other measures, they constituted a necessary condition for the exceptional influx of foreign capital into Brazil that has occurred since 1968. The regression analysis of direct foreign investments indicated that they were responsive to profit opportunities--which were represented by the rate of growth of the economy--and to the decrease in the exchange rate risk caused by the minidevaluations. It was seen that the differential between domestic and foreign levels of real interest rates played an important role in attracting foreign loans and financing into Brazil. The portfolio approach to analyzing capital flows showed that interest differentials and the evaluation of risk, as determined by the exchange rate policy, political factors, and other events, were all important in determining the influx of foreign capital. By normalizing the expectations of economic units and by establishing the conditions for reasonable economic calculations in foreign exchange operations, minidevaluations have helped the government in forecasting and managing future developments with respect to the foreign indebtedness and reserve position of the country. Under minidevaluations, the exceptional growth in exports, imports, and capital flows was accompanied by a similar increase in service payments and receipts. Among service payments the items which registered larger increases were capital income (interest, profits, and dividends), transportation, and travel. Among service receipts, transportation and capital income increased most.

The econometric analysis of price behavior indicated that minidevaluations have not constituted an inflationary factor. On the contrary, they may have aided the government in its pursuit of gradual stabilization of prices in Brazil.

Finally, evidence was presented that minidevaluations had a positive impact on the growth performance of the economy. Qualifications as to the nature of this growth were made and suggestions for further research were cited.

THE EFFECTS OF MINIDEVALUATIONS ON THE BRAZILIAN ECONOMY

By

Eduardo Matarazzo Suplicy

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Economics

1973

To Marta,

with all my love.

ACKNOWLEDGEMENTS

I wish to acknowledge the help and encouragement received from the members of my dissertation committee, Professors Mordechai E. Kreinin, Chairman, Jan Kmenta, and W. Paul Strassman of Michigan State University, and Professor Clark W. Reynolds of Stanford University. I have drawn heavily on Professor Kreinin's knowledge of international economics and I am extremely grateful to his dedicated and detailed criticism of my work. I greatly benefited from Professor Kmenta's review of my econometric results and from Professor Strassman's critical remarks and suggestions. My lengthy discussions with Professor Reynolds and his encouraging and substantial comments were most helpful.

I am indebted to William G. Tyler, Carlos Von Doellinger, Juergen B. Donges, Paulo H. Pereira Lira, Fernão C. B. Bracher, Joel Bergsman, and others who have written about minidevaluations and the foreign sector of the Brazilian economy.

I wish to thank those friends with whom I have had vivid discussions and those who have encouraged me to proceed with my graduate studies. Among these are José

David Langier, Luiz Carlos Bresser Pereira, John R. Moroney, Ary Bouzan, Alberto Oliveira Lima, Paulo Roberto Silva, Jorge da Cunha Lima, Manoel Whitaker Salles, and Antonio Angarita Silva. I am grateful for the encouragement received from Gustavo de Sá e Silva and Carlos José Malferrari, Directors of EAESP.

I wish to acknowledge the generous financial support given to me by the Escola de Administração de Emprêsas de São Paulo, Fundação Getúlio Vargas, the Ford Foundation (1971), the International Center for the Advancement of Management Education, Stanford University (1972), and the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior, CAPES (1973).

I wish to thank Annibal V. Villela, Superintendent of INPES-IPEA and all those that I have interviewed to gather information. These will be mentioned by name in the text.

I am grateful to Gary Ingvaldson for assisting me in the Computer Center, to David Allen and Elizabeth Johnston for their editing help, and to Irene Orr for her patience and goodwill in typing the manuscript.

My greatest debt is to my dear wife, Marta, who has so enriched my daily life and who has encouraged me most, and to my children Eduardo and André, who gave me so many joyous moments along this journey. I am also grateful to my brothers and sisters for their encouragement and especially to Tetê for her help in sending information.

Finally, I am grateful to Papai and Mamãe, and to Luiz and Noêmia, for being such wonderful parents.

TABLE OF CONTENTS

Chapter | Page

LIST OF TABLES

Table		Page
III-6.	Brazil's Total Exports and Shares in World Exports and in Exports of Less Developed Countries, 1946-1972	103
III-7.	Export Values of Most Important Basic Exports of Brazil (FOB US$1,000,000)	105
III-8.	Performance Indexes of Brazilian Basic Exports (Base year 1946 = 100)	106
III-9.	Price Indexes of Some Basic Export Goods Dollar Price (Base Period: 1965-1967 = 100)	108
III-10.	Share of Major Basic Export Goods in Total Brazilian Exports 1964-1971	111
III-11.	Brazilian Exports by Sectors, 1964-1972 (Index Numbers Base: 1964=100)	113
III-12.	Brazilian Exports by Sectors, Percentage Share in Total Exports 1964-1971	115
III-13.	Brazilian Exports to Different Economic Regions, Percentage Participation of Each Region, 1964-1971	117
IV-1.	Variables Used in Regression Analysis of Exports of Manufactures. Definitions, Sample Means and Correlation Coefficients .	127
IV-2.	Regression Analysis to Explain the Behavior of Brazilian Exports of Manufactures (X_{1t}). Ordinary Least Squares Regressions with log X_{1t} as the Dependent Variable; 33 Quarterly Observations from 1st Quarter of 1964 to 2nd Quarter of 1972 (2nd Quarter 1964 deleted due to Unusual Political Events).	129
IV-3.	Test of Effects of Minidevaluations on Exports of Manufactures (X_{1t}) with a Distributed-Lag Model. Ordinary Least Squares Regressions with Log X_{1t} as the Dependent Variable . .	136
IV-4.	Test of Effects of Minidevaluations on Exports of Manufactures (X_{1t}) with the Best Fitted Models. Ordinary Least Squares Regressions with log X_{1t} as the Dependent Variable . .	139

Table		Page

Table		Page

LIST OF FIGURES

LIST OF APPENDICES

INTRODUCTION

On 20 August 1968 the Brazilian National Monetary Council decided to follow a new system of adjustments to the foreign exchange rate. From that date, small adjustments would be made at short intervals in order to prevent the substantial differences between internal and external prices that characterize an inflationary economy with a pegged exchange rate. The minidevaluations constitute an attempt by policy makers to minimize the degree of exchange rate risk while avoiding the possible destabilizing effects of a free exchange rate.

The purpose of this dissertation is to study the impact of minidevaluations on the Brazilian balance of payments and on the domestic economy. The main question to be examined is whether or not this system of adjustment was among the key economic policies that were responsible for the exceptional dynamism of the country's foreign sector and of the whole Brazilian economy from 1968 to 1972.

In the first chapter the current state of the debate regarding the advantages and disadvantages of pegged and several degrees of flexibility in the foreign exchange rate will be reviewed. In particular, the advantages of a system of small adjustments within short periods of time as opposed to sharp devaluations separated by long intervals will be analyzed.

Chapter II will present the historical background. After examining the role of foreign exchange policy in fostering import substitution in Brazil since the Second World War, the characteristics of the new policy of minidevaluations will be described.

The next four chapters will analyze the merchandise trade performance of Brazil before and after the adoption of the policy of small adjustments in the exchange rate. Chapter III will examine the behavior of Brazilian exports from 1964 to 1972. Quantitative estimates of incentives for exporters which will be used later in econometric studies and some recent studies of Brazilian exports will be discussed. In Chapters IV, V, and VI econometric models will be used to assess the effect of different systems of adjusting the exchange rate--sharp devaluations from 1964 to 1968 and minidevaluations from 1968 to 1972--on exports of manufactured goods, on exports of primary products, and on imports, respectively.

An evaluation of the effects of different exchange rate systems on capital flow movements, the foreign indebtedness position, and accumulation of foreign reserves will be made in Chapter VII. An attempt will be made to apply the portfolio approach to an analysis of capital movements. To complete the analysis of the foreign sector the behavior of the major service items from the late forties to the early seventies, but mainly during the minidevaluations, will be discussed.

In Chapter VIII attention will turn to the domestic economy. Econometric models that explain price behavior and growth will be used to test the effect of minidevaluations on two major objectives of economic policy pursued by all administrations in the past decade: gradual price stabilization and acceleration of economic growth.

Finally, Chapter IX will summarize the findings and conclusions of the study. The minidevaluations will be viewed in the larger context of general development strategy. Qualifications will be made and suggestions for further research will be cited.

The ratio of exports and imports to the gross domestic product for the years 1967 to 1971 is shown in Table i-1 to give an indication of the importance of the foreign sector in the Brazilian economy. Brazil's balance of payments is listed for the same years in Table i-2 so as to indicate the importance of each trade item within the foreign sector of the economy.

TABLE i-1.--The Ratio of Brazilian Exports and Imports to Gross Domestic Product 1967-1971.

	Gross Domestic Product (GDP) in current Cr$ millions[2]	Exports of Merchandise in current Cr$ millions[1]	Ratio of Exports to GDP %	Imports of Merchandise in current Cr$ millions[1]	Ratio of Imports to GDP %
1967	71,485.3	4,264.7	6.0	4,291.9	6.0
1968	99,269.9	6,177.9	6.2	6,826.2	6.9
1969	131,681.5	9,214.2	7.0	8,982.0	6.8
1970	172,500.0*	10,844.7	6.2	12,903.6	7.5
1971	225,500.0*	15,373.8	6.8	19,216.1	8.5

Sources: Brasil, Comércio Exterior, Exportação 1971, CACEX, Banco do Brasil; and Conjuntura Econômica, 26 (November 1972, 99.

*Preliminary estimates.

TABLE i-2.--Brazil's Balance of Payments, 1967-1971.

	U.S. $ Millions				
	1967	1968	1969	1970	1971
A--Trade Balance	213	26	318	232	- 346
Exports (FOB)	1654	1881	2311	2739	2904
Imports (FOB)	-1441	-1855	-1993	-2507	-3250
B--Services	- 527	- 556	- 630	- 815	- 978
Receipts	185	20	290	378	444
Payments	- 712	- 761	- 920	-1193	-1422
C--Transfers	77	22	31	21	12
Receipts	107	75	82	87	94
Payments	- 30	- 53	- 51	- 66	- 82
D--Balance on Current Transactions (A+B+C)	- 237	- 508	- 281	- 562	-1312
E--Net Capital Flow	27	541	871	1015	1832
F--Net Errors and Omissions	- 35	- 1	- 41	92	35
Surplus (+) or Deficit (-)	- 245	32	549	545	555

Source: Boletim do Banco Central do Brasil, 8, no. 2 (February 1972).

CHAPTER I

ANALYSIS OF FIXED, FLEXIBLE, AND SEVERAL DEGREES OF FLEXIBILITY OF EXCHANGE RATES

Since the publication of Milton Friedman's classical essay, "The Case for Flexible Exchange Rates,"[1] in 1953, numerous works have dealt with all aspects of the different degrees of flexibility in exchange rates.[2] Although the debate still goes on, few countries have pursued policies other than that of fixed exchange rates since the advent of the 1944 agreement, following the rules of the International Monetary Fund. Therefore, few experiences have

---

[1]Milton Friedman, "The Case for Flexible Exchange Rates," in Milton Friedman, Essays in Positive Economics (Chicago: University of Chicago Press, 1953), pp. 157-203.

[2]The arguments favoring fixed rates, flexible rates, and several degrees of flexibility are summarized in Mordechai E. Kreinin, International Economics: A Policy Approach (New York: Harcourt, Brace, Jovanovich, Inc., 1971), Chap. 10, pp. 169-76, and are extensively discussed in M. O. Clement, Richard L. Pfister, and Kenneth J. Rothwell, Theoretical Issues in International Economics (Boston: Houghton, Mifflin Co., 1967), Chap. 6. A concerted effort to find the best approach to greater albeit limited flexibility of foreign exchange rates is represented in George N. Halm, ed., arranged by C. Fred Bergsten, George N. Halm, Fritz Machlup, and Robert V. Roosa, Approaches to Greater Flexibility of Exchange Rates: The Burgenstock Papers (Princeton: Princeton University Press, 1970).

displayed the flexibility necessary for an empirical determination of how they would work. Since 1968 Brazil has realized small devaluations within short periods of time; this policy now can be examined and may well offer new insights into this field of discussion.

The System of Fixed Exchange Rates

As used here, fixed exchange rates refer to the adjustable peg that exists today under the articles of the International Monetary Fund. The present system of international monetary organization requires countries to commit themselves to maintain the foreign values of their curriencies within a narrow margin of a fixed par value by acting as residual buyers or sellers of currency in the foreign exchange market, subject to the possibility of effecting a change in the par value itself in case of "fundamental disequilibrium."

Advantages and Disadvantages

The existence of a single currency within a nation's frontiers has the following advantages: It simplifies the profit-maximizing computations of producers and traders; it facilitates competition among producers in different parts of the country; and it promotes the integration of the economy into a connected series of markets, including both the markets for products and the markets for the factors of production (capital and labor). By analogy, fixed exchange rates similarly will encourage the integration of the national markets which compose the world economy into an international network of connected markets, with beneficial effects on efficiency and growth.[3]

This analogy, however, is defective. First, the factors of production, as well as goods and services, are free to move throughout a domestic economy, except for the existence of barriers created by distance and cultural differences. In the international economy, the movement of labor is in general restricted by national migration policies, and the movement of capital is limited by barriers created by national laws. Tariffs and other barriers to trade also inhibit the movement of goods. Those barriers prevent the system of fixed exchange rates from establishing the equivalent of a single international money in the sense of a currency the purchasing power and usefulness of which tends to equality throughout the market area. Moreover, if the ridigity of exchange rates is maintained, not by appropriate adjustments of the relative purchasing power of the various national curriencies but by variations in the national barriers to trade and payments, it contradicts the argument for fixed exchange rates as a

---

[3]This analogy is based on the discussion by Harry G. Johnson, "The Case for Flexible Exchange Rates, 1969," in Harry G. Johnson and J. E. Nash, U.K. and Floating Exchanges (London: The Institute of Economic Affairs, 1969), reprinted in Halm, ed., Approaches to Greater Flexibility, pp. 91-111.

means of attaining the advantages internationally that are provided domestically by a single currency.

Second, acceptance of a single currency and its implications is not necessarily beneficial to particular regions within a nation. The pressures of competition in the product and factor markets promoted by adoption of a single currency frequently result instead in prolonged regional distress in spite of the apparent freedom of labor and capital to migrate to more remunerative areas. On an international scale, the likelihood of regional distress is substantially greater because of the previously mentioned barriers to mobility of both factors and goods. Yet there is no international government, nor any effective substitute established by international cooperation, to compensate and assist regions of nations suffering through the effects of economic change occurring in the environment of a single currency.

It is commonly believed that the fixed-rate system exercises "discipline" over the nations involved in it and prevents them from pursuing "irresponsible" domestic policies. But this belief is a myth since nations have the option of evading discipline by using intervention or devaluation. The system obliges nations either to accept whatever rate of inflation or deflation emerges from the policies of other nations in the world economy or to employ whatever policies of intervention in international trade and payments they consider to be appropriate.

Defenders of the fixed-rate system argue for a solution along two complementary lines: "harmonization" of national economic policies in accordance with the requirements of a single world currency system; and progressive evolution toward international control of the growth of international liquidity, combined with "surveillance" of national economic policies. But countries have shown themselves extremely reluctant to accept the surrender of national sovereignty in domestic economic policy. This is due to the lack of an international mechanism for compensating those who lose out through adherence to the rules of the single currency game and to the fact that nations differ sharply in their views on priorities among policy objectives, especially with respect to the relative undesirability of unemployment and inflation.

The System of Flexible Exchange Rates

Under this system, fixed exchange rates are abondoned altogether. The values of all currencies are permitted to fluctuate (or float) in terms of each other in response to market conditions of supply and demand.

Advantages and Disadvantages

The main advantage of flexible exchange rates derives from the law of supply and demand: The value of all currencies settles at a price that clears the market for foreign currencies. In a competitive market, if quantity demanded exceeds quantity supplied at a given price, the price of the good is increased until the market is clear. The same holds true if quantity supplied is less than quantity demanded at a given price. Exchange fluctuations then maintain a continuous equilibrium in the balance of payments. This solves one of the main problems of economic policy, because external adjustment does not conflict with policies which are needed for domestic stabilization.

The need for reserves is thus drastically reduced and might even be eliminated. The issue of how to generate adequate reserves in the international financial community is resolved because adjustment of the balance of payments is immediate and continuous rather than postponed for a long period until strong pressure forces action.[4]

Fluctuating rates make monetary policy more effective as a tool for the achievement of domestic stabilization. Suppose a central bank wishes to cope with a depression by lowering interest rates. Under a fixed exchange rate, the lower interest rates would encourage investments to the extent that they are sensitive to the cost of credit. The effect of this policy is limited by that sensitivity. At the same time, capital funds would flow out of the country seeking higher interest rates.

---

[4]See Egon Sohmen, International Monetary Problems and the Foreign Exchanges (Princeton, J.J.: International Finance Section, Department of Economics, Princeton University, 1963).

The result would be a growing balance-of-payments deficit. If the exchange rate were flexible, this deficit would lead to a depreciation of the exchange rate, which would encourage exports and discourage imports. The improvement in trade balance, through the multiplier mechanism, would result in a domestic expansion in employment and output. In the case of inflation, the reverse sequence would take place if the central bank were to combat inflation by raising interest rates. If the currency of the country with high interest is weak, however, short-term capital would not flow in unless forward coverage was available.[5]

Opponents of a fluctuating exchange rate believe that the fluctuations represent a considerable risk for those involved in all types of international transactions.[6] This risk, they assert, tends to lower the volume of foreign trade and investments. They argue that commodity traders and investors only can make advance estimates of costs and prices with fixed rates. In open economies, highly

---

[5]See Robert A. Mundell, "Flexible Exchange Rate and Employment Policy," Canadian Journal of Economics and Political Science, 27 (November 1961), 509-17; and Robert A. Mundell, "The Monetary Dynamics of International Adjustment Under Fixed and Flexible Exchange Rates," Quarterly Journal of Economics, 84 (May 1960), 227-57, both reprinted as chap. 17 and 11 of Robert A. Mundell, International Economics (New York: The MacMillan Company, 1968. See also Egon Sohmen, Flexible Exchange Rates: Theory and Controversy (Chicago: University of Chicago Press, 1961).

[6]This discussion follows the clear survey of arguments in Kreinin, International Economics, pp. 170-76.

dependent on foreign trade, constant exchange fluctuations would introduce continuous variations in the domestic price level as well as in the structure of relative domestic prices. Disruptive fluctuations then would occur such as incessant reallocation of resources and loss of confidence in the currency as a store of value.

The risk introduced by fluctuating exchange rates, however, depends upon the size of the fluctuations, and they are not necessarily large, as Canada's ten years of experience with the system indicates.[7] If fluctuations are expected to be small, it should be relatively cheap to insure against them in the foreign exchange market. Indeed, in the highly competitive market of exchange rates, if the underlying supply and demand factors involve a high measure of response to price change, the fluctuating rates can be expected to be reasonably stable. Under such conditions of high elasticities, it requires only a small change in the exchange rate to bring forth whatever quantity response is made necessary by any change in either demand or supply conditions.

Elasticities in international markets, however, may be low in the short run since it takes time for trade to respond to relative price variations. Also, merchandise trade may be characterized by high elasticities for large

---

[7]See Rudolf R. Rhomberg, "Canada's Foreign Exchange Market: A Quarterly Model," International Monetary Fund Staff Papers, 7 (April 1960), 439-56.

price changes but low elasticities for small price changes. The significant transaction costs in international trade may account for that. In such a case, exchange fluctuations might be very large. But the supply and demand for foreign exchange is governed by more than just trade transactions. Capital flows movements may offset part of the pressure in the exchange market that result from trade flows.

Some opponents of flexible exchange rates concede that the underlying factors of goods, services, and investment transfers make for reasonably stable--although fluctuating--exchange rates. They contend, however, that even small fluctuations in the exchange rate can elicit and feed upon speculative activity. Suppose the value of a currency rises in terms of foreign currencies. Speculators then may expect it to rise further, and they purchase that currency in large quantities. These self-justifying expectations and actions would bring about the anticipated increase in the value of the exchange rate. The opposite would happen in the case of a decline. Therefore, the mild variations underlying market factors would be converted by the speculators into sharp fluctuations. Speculation would be destabilizing in nature.

In rebuttal, advocates of flexible rates say that it is not reasonable to assume that speculation would be destabilizing in nature.[8] In order to make profits, speculators need to sell when the currency's price is high and to buy when it is low. Therefore, on the average, speculators would narrow rather than aggravate the range of fluctuations. On the other hand, proponents of flexible rates go on to argue that speculation can be more destabilizing under fixed rates than under flexible rates. Under a pegged rate, when a currency is weak, the speculator knows with reasonable certainty that the movement, if it happens, can only be in one direction: devaluation. He will sell his holdings in order to buy a strong currency, and he is almost certain to gain. Such speculation is often both destabilizing and excessive. Fluctuating rates, on the other hand, offer more risk and therefore may dampen speculative activity.

Opponents of flexible exchange rates assert that these promote inflation for two reasons. First, under this system governments are no longer subject to the discipline exerted by the fixity of the exchange rate. Under fixed rates, governments are forced to avoid inflationary policies for they lead to deficits in the balance of payments and also impose inflation in other countries. What the fixed-rate system really imposes, however, is not the <u>need</u> to conform to the average world trend of prices but the <u>obligation</u> to do so. This trend is not

---

[8]See Friedman, "Case for Flexible Exchange Rates."

stable in general and may be either inflationary or deflationary. Moreover, under pegged rates, countries can evade the safeguards against rapid inflation in several ways: by drawing reserves and borrowing, by imposing restrictions on international trade and payments, and also by devaluing their currencies.[9]

The second reason that flexible rates might be inflationary is their tendency to be characterized by random depreciations. These, by raising the cost of living, provoke wage and price increases, which could result in further depreciation and continuous inflation. Adjustments in that exchange rate should be made only gradually, however, under flexible rates and would be less likely to require drastic revisions of wage- and price-setting decisions than they would under a fixed-rate system. On the other hand, the extent to which increases in the cost of living produce compensatory wage increases depends very much on the economic climate set by the government's income, fiscal, and monetary policies.

Proposals for Greater Flexibility of Exchange Rates

After considering all of the merits of the case, many economists and practitioners believe that complete exchange flexibility could result in monetary indiscipline and that it could be injurious to international transactions.

---

[9] See Johnson, "Case for Flexible Exchange Rates."

Several proposals have been put forward for altering the present IMF system so as to achieve more flexibility of exchange rates.[10]

Optimum Currency Area

The proposal for an optimum currency area involves the establishment of fixed exchange rates between closely knit countries which, taken together, could be looked upon as regions of one and the same country. Free fluctuations would be permitted among such blocs, which would be called optimum currency areas. There are several guidelines for determining which countries could compose such an area.

First, countries within a currency area should have a high measure of coordination in fiscal and monetary policies as well as a high level of mobility of labor and capital among them. When resources are highly mobile, the adjustment process occurs by their movement from a deficit (depressed) region to a surplus (prosperous) region. These conditions should then help to lubricate the adjustment mechanism.[11]

---

[10]The Burgenstock Papers, cited in Footnote 2, constitute a confrontation between academic economists and practitioners from the banking and business world. They provide an intensive study of various proposals for limited flexibility in the exchange rates.

[11]Major contributions on the theory of optimum currency areas are: Robert A. Mundell, "A Theory of Optimum Currency Areas," American Economic Review, 50 (September 1961), 657-65; Ronald I. McKinnon, "Optimum Currency Areas," American Economic Review, 53 (September

Second, the area should be large enough to allow most international transactions to be carried on within the bloc. Thus, the fluctuations between the composite exchange rate of the area and those of other areas would not seriously affect domestic price levels.

Third, the size of the currency area should be such as to minimize the costs of adjustments under the income and switching mechanisms.[12] The cost of achieving external balance through domestic income policy depends mainly on the marginal propensity to import (m). The ratio 1/m indicates how much income would have to be decreased to produce a fall in imports by one unit of value, say, one dollar. The cost of devaluation, on the other hand, is the deterioration of the terms of trade, ignoring internal redistribution effects. Assuming export-supply elasticities equal to infinity, the effects of a 1 percent devaluation would be an improvement in the balance of payments of $(\eta_m + \eta_x - 1)$ percent and a worsening in the terms of trade by 1 percent. Therefore, to improve the balance of payments by one dollar, the terms of trade

---

1963), 717-25; and Peter B. Kenen, "The Theory of Optimum Currency Areas: An Eclectic View," in Robert A. Mundell and Alexander K. Swoboda, eds., Monetary Problems of the International Economy: Papers and Discussions (Chicago: University of Chicago Press, 1969), pp. 41-60.

[12]See H. Robert Heller and Mordechai E. Kreinin, "Adjustment Costs, Optimal Currency Areas, and International Reserves"; and Kreinin, International Economics, pp. 174-75, 351-52.

cost amounts to $1/(\eta_m + \eta_x - 1)$ where η_m is the elasticity of demand for imports in the devaluing country and η_x is the elasticity of foreign demand for exports of the country in question. (In the case of finite export-supply elasticities the cost would be smaller.) The cost of devaluation would be greater or smaller than the cost of income adjustment depending on whether $1/(\eta_m + \eta_x - 1)$ is greater or smaller than $1/m$. At a certain degree of "closedness" of a country or group of countries, the two costs of adjustment would be equal. This break-even point would determine the optimum size of the currency area.

In addition to the suggestion of establishing optimum currency areas, three other major proposals have been advanced for permitting the foreign exchange market to make automatic adjustments within limited ranges. These are the "wider band," the "crawling peg," and the movable band proposals.[13]

The wider band proposal would retain the present IMF system of pegged exchange rates and would permit exchange rates to fluctuate to, say, 5 percent on either side of par. Adjustments in balances of payments then would be more rapid, and the need for reserves would be lessened.

---

[13] See George N. Halm, Toward Limited Flexibility of Exchange Rates (Princeton: International Finance Section, Department of Economics, Princeton University, 1969), reprinted as chap. 1 in Halm, ed., Approaches to Greater Flexibility.

Under the crawling peg or sliding parity proposal, daily fluctuations in par value would be confined within present or somewhat wider limits, but a country in disequilibrium would make preannounced small changes in its parity every month until equilibrium was attained. The two advantages of the system are that the country could make parity adjustments before the pressure became too explosive and that some of the political stigma attached to large, discrete exchange variations would be removed. On the other hand, if speculative activity were to be stimulated by preannounced exchange adjustments, the country would have to manipulate interest rates or resort to other measures to stem destabilizing capital flows.

A variation of the crawling peg proposal would make the parity on any business day a moving average of the rates actually set in the market over some fixed period of the immediate past. The par value would gradually adjust itself upward or downward over time to the market pressures of excess supply or excess demand for the currency.

An even more flexible proposal would be that of the movable band, which would combine wider bands with the crawling peg. Evaluation of how this suggestion would work in practice has been hindered by the relative lack of direct experience in application. Analyzing Brazil's experience with a system of minidevaluations, a variation of the crawling peg proposal, from August 1968 to the present early 1973 therefore is likely to contribute significantly to this rich field of discussion.

Sharp Devaluations in Countries with Chronic Inflation: A Special Problem

The degree of flexibility of the exchange rate is specially relevant for those countries which have been confronted with high rates of inflation for long periods. During the past two decades this has been the case for several Latin American nations. Using December 1963 as a base period, with an index number equal to 100, the consumer price index in October 1972 was 898 in Argentina, 1,577 in Brazil, 1,825 in Chile, and 5,375 in Uruguay. The annual rate of inflation in each of these countries during the last ten years was almost always greater than 10 percent and sometimes even surpassed 100 percent.[14] All four governments have been attempting, with varying degrees of success, to curb the endemic inflationary process.

While simultaneously combating inflation and promoting development, one major decision the governments face is how to adjust the exchange rate. Once the existence of chronic inflation is admitted, and thus the inevitability of depreciation of the domestic currency is accepted, three possible methods are available for adjusting

---

[14] International Financial Statistics, 26 (April, 1973).

the exchange rates: sharp devaluations at relatively wide intervals; continuous depreciation of a floating exchange rate; or relatively frequent but small devaluations at short intervals.

The system of sharp and periodic (between periods of one or two years) devaluations has presented very difficult problems for economies in which it has been applied. The case of Argentina, for example, has been thoroughly analyzed by Diaz Alejandro in his treatise on the effects of discrete devaluations. His analysis is discouraging:

> The policy of sharp devaluations followed by a pegging of the peso tended to yield alternating periods of under- and overvaluation of the peso. Such a policy aggravated the erratic gyrations of relative prices. The similarities of the circumstances under which the devaluations of November 1955, January 1959, and April 1962 were undertaken are striking. All of them took place with gold and foreign-exchange reserves nearing a vanishing point, in the midst of a frenzy of speculation and severe social and political disturbances. They were also taken under inflationary conditions, closely following large increases in money wages and the money supply; tighter fiscal and monetary policies tended to follow rather than precede devaluations.[15]

The system of completely flexible exchange rates, as seen above, is feared by most practitioners, even in countries with relatively stable price levels, because of

---

[15]Carlos F. Diaz Alejandro, Exchange-Rate Devaluation in a Semi-Industrialized Country: The Experience of Argentina, 1955-1961 (Cambridge, Mass.: The M.I.T. Press, 1968), p. 191.

possible destabilizing effects and possible detrimental effects on international transactions. This fear, of course, is aggravated in countries in which inflation is chronic.

The System of Mini-Adjustments

The system followed by the Brazilian monetary authorities has consisted of changing the official exchange rate, that is, the value of the cruzeiro with respect to that of the dollar, by relatively small amounts at time intervals which have varied from 14 to 70 days. The basic guiding principle in making the adjustment is the difference between the domestic rate of inflation and that of Brazil's main trading partners.[16] Other factors considered by the authorities are the movement of short- and medium-term interest rates in Brazil as compared to those prevailing in foreign capital markets and also the trends in the balance of payments and in the international investment position of the country. To prevent a speculative capital exodus the authorities pursue rates of par value adjustments which are lower than the difference between the nominal interest rates at home and abroad. The exact amount and timing of adjustment are never publicly known before hand.

---

[16] Since October 1972 the National Monetary Council has been quoting the value of the cruzeiro not only with respect to the dollar but also with respect to the other main currencies.

In view of continuous inflation at higher rates than in most other countries there was no need of appreciations during the period covered in this study, from August 1968 to December 1972.[17] Because of this, the word minidevaluations has been chosen to identify the new Brazilian exchange system throughout this dissertation.

This system of small changes in the exchange rate within short intervals can be expected to be the most appropriate for countries with chronic inflation and perhaps even for countries with more stable economies.[18] It can be considered as a variation of the crawling peg or the creeping peg system. Juergen Donges has considered a devaluation of 1 or 2 percent every two to five weeks

---

[17] In view of the sharp 10 percent devaluation of the dollar on 12 February, 1973, the Brazilian authorities--for the first time--decided to revalue the cruzeiro by 3 percent with respect to the dollar. This action was taken two days after the decision of the U.S. government.

[18] The advantages of minidevaluations are well discussed in two articles by Paulo H. Pereira Lira, "Cruzeiro o Preço Exato da Moeda," Revista Economica, Jornal do Brasil (26 March 1971), 32; and "Endividamento Externo e Desenvolvimento," Revista Economica, Jornal do Brasil (31 March 1972, 120. See also Banco Central do Brasil, "Nuevo Metodo de Reajuste en Brasil," CEMLA: Boletin Mensual 15 (January 1969), 1-3; William G. Tyler, "As Taxas de Câmbio Cadentes e a Inflaçâo Endemica," Revista Brasileira de Economia, 22 (December 1968), 80-93, and "Exchange Rate Flexibility Under Conditions of Endemic Inflation: A Case Study of Recent Brazilian Experience," unpublished paper, USAID, 1971; Juergen B. Donges, Brazil's Trotting Peg, A New Approach to Greater Exchange Rate Flexibility in Less Developed Countries (Washington, D.C.: American Enterprise Institute for Public Policy Research, August 1971); and Fernão Carlos Botelho Bracher, "Sistema Cambial de Taxa Flexivel," O Estado de São Paulo, 24 (November 1968), 71. This section draws heavily from these contributions.

too fast to be characterized as a "creeping" movement and has called the system the "trotting peg."[19]

The main advantage of a system of small adjustments performed within short periods of time is that it guarantees a reasonably satisfactory exchange rate level for those involved in foreign trade and finance. It prevents the occurrence of long periods of increasing overvaluation with consequent depletion of foreign reserves and of periods with substantial undervaluation with consequent accumulation of foreign reserves as would normally occur in a highly inflationary economy using discrete devaluations over long time intervals.

In order to avoid a chronic overvaluation of the exchange rate, assuming no modification in the rules of foreign trade, periods of undervaluation should alternate with periods of overvaluation so that the long-run average exchange rate remains approximately equal to the equilibrium exchange rate. Figure I-1 illustrates this case.[20]

Political factors make it difficult, however, both to estimate what the equilibrium exchange rate is and to maintain periods of undervaluation of the exchange rate. What is more likely to occur, therefore, is governmental devaluation of the domestic currency each time which only approximates that value believed to be the equilibrium

---

[19] Donges, Brazil's Trotting Peg.

[20] For the discussion of Figures 1 to 5, see Tyler, "As Taxas de Câmbio."

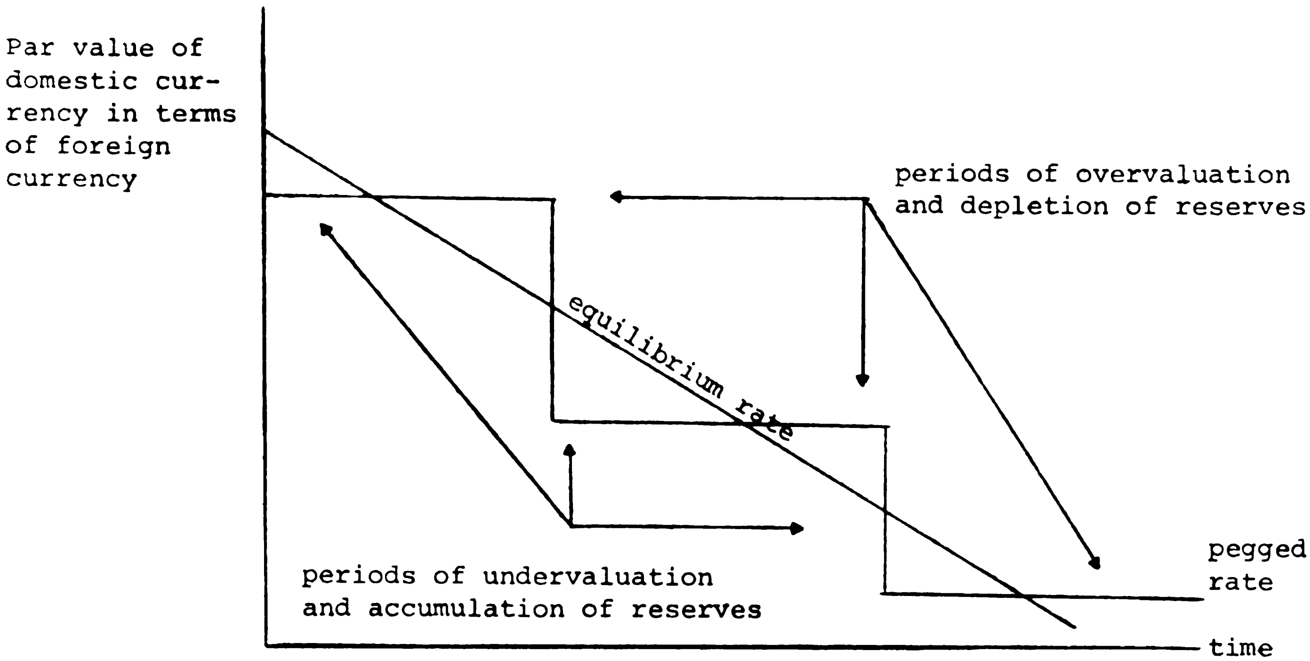


Figure I-1.--The Equilibrium and the Pegged Exchange Rate Under Sharp Devaluations.

exchange rate. In this case, periods of temporary equilibrium follow periods of overvaluation, as illustrated in Figure I-2. The consequence is a long-run depletion of foreign exchange.

Under the system of mini-devaluations, the periods of overvaluation and undervaluation of the par value of the domestic currency are minimized. The par value closely follows the equilibrium value, as illustrated in Figure I-3.

A more rational allocation of resources is to be expected from the system of minidevaluations which maintains a relatively stable relationship between internal and

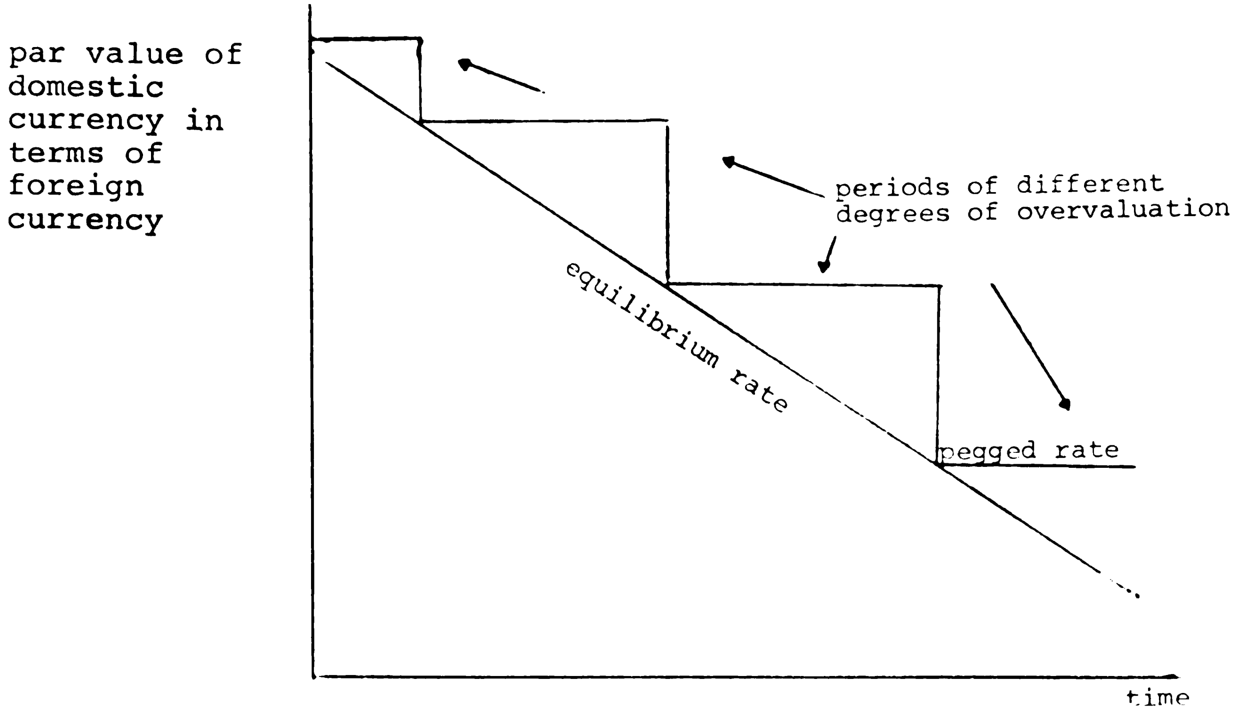


Figure I-2.--The Equilibrium and the Pegged Exchange Rate
Under Sharp Devaluations (Alternative Situation).

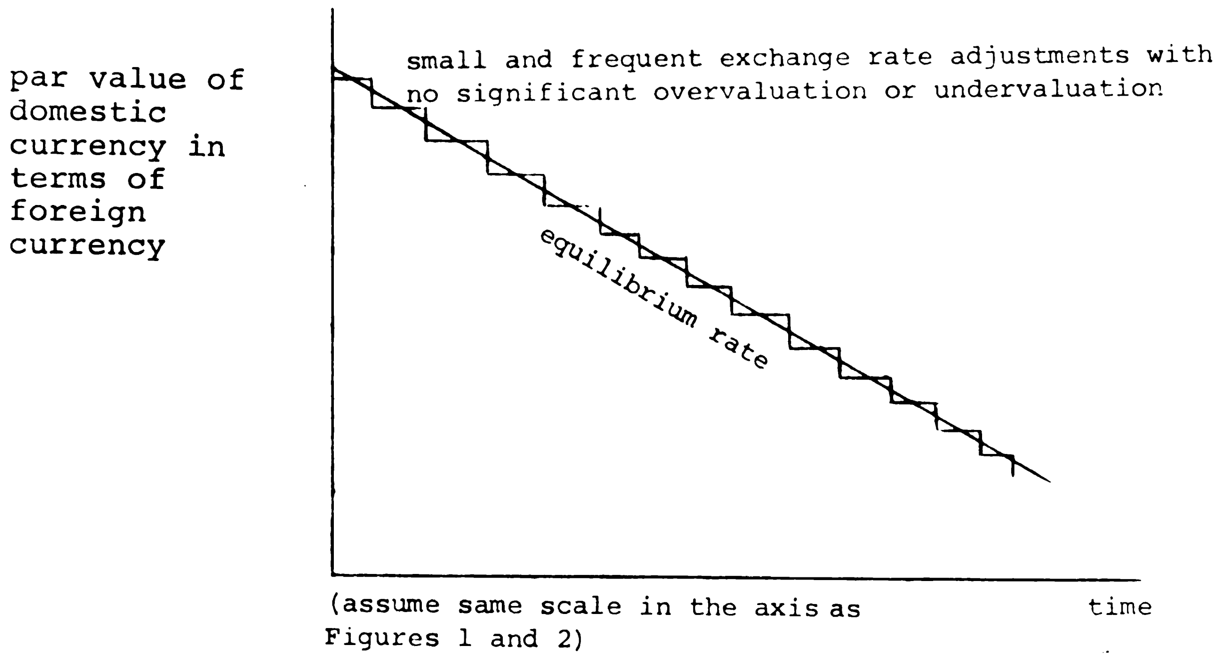


Figure I-3.--The Equilibrium and the Pegged Exchange Rate
Under Minidevaluations.

external prices. Uncertainty is diminished for those who have to make decisions about the productive capacity of exportables and importables in the economy.

Under the system of sharp devaluations within long intervals, the exporter normally faces a substantial exchange risk because he is never sure of the timing or size of the next adjustment. Once the exporter fixes a sales price in terms of foreign exchange for his product, the domestic inflationary process results in increasing costs and in a decreasing margin of profits in terms of domestic currency. Figure 4 illustrates the case for a firm facing constant returns to scale and a fixed price in terms of foreign currency. Assuming that inflation raises the costs of production with time and that discrete devaluations occur over long intervals, the firm will experience alternate periods of profits and losses.

Assuming that production costs are affected by the domestic inflation and that small devaluations within short intervals follow approximately the same rate of inflation, the profit margin of the firm tends to be more stable, as illustrated in Figure 5. Elimination of the exchange risk should greatly affect the expectations of exporters. This should have a positive effect on investments in the export sector, on exports, and hence on the growth of the economy.

Should the country follow a policy of small and frequent devaluations, the relative sizes of which are

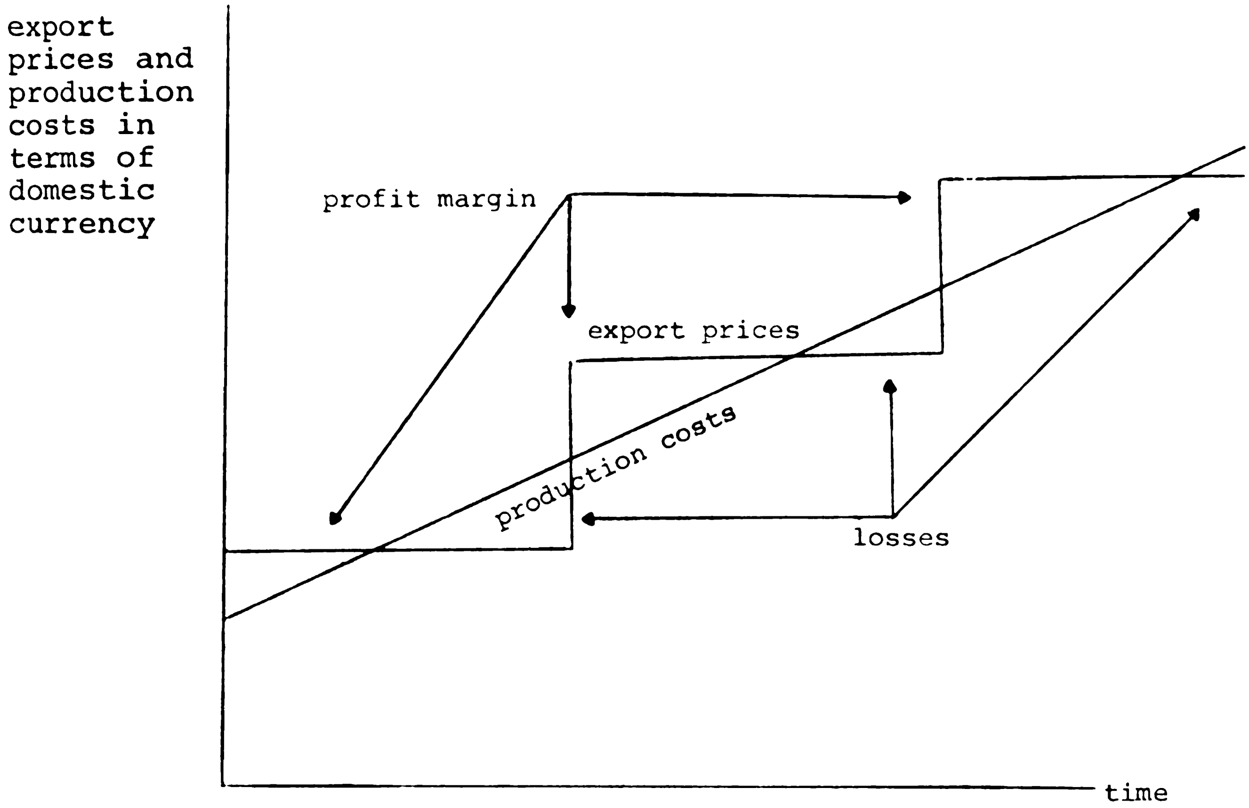


Figure I-4.--Profitability of Exporter Under Sharp Devaluations.

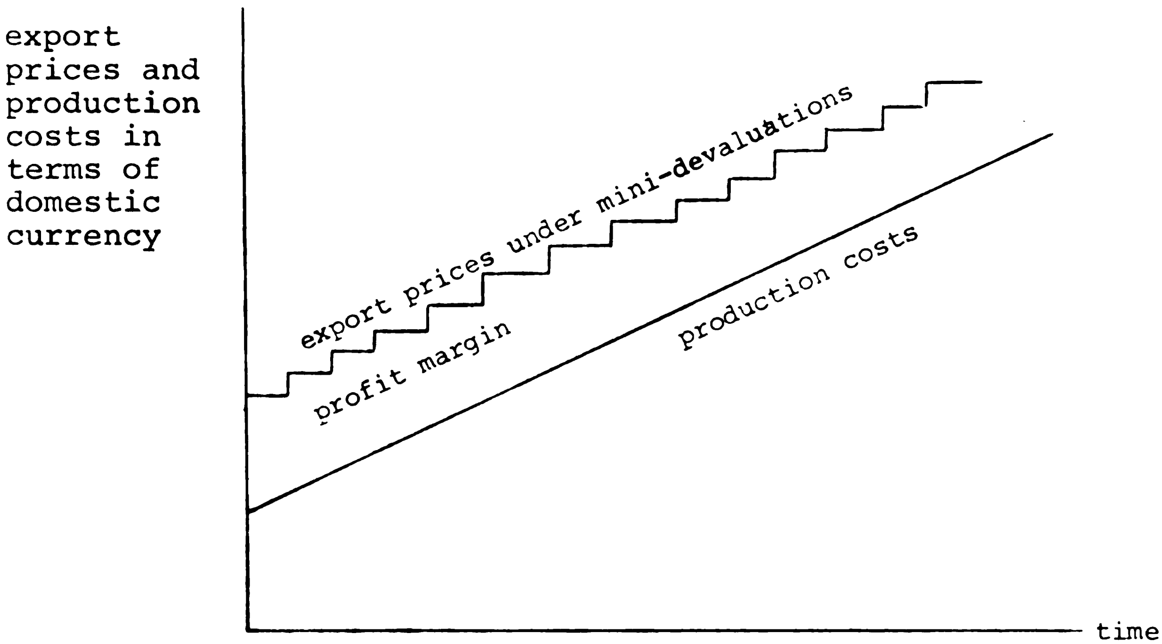


Figure I-5.--Profitability of Exporter Under Minidevaluations.

equal to the rate of domestic inflation less the average rate of inflation of its main trading partners, then one may expect the profit margin of the exporter to be reasonably stable for two reasons. First, if inflation is prevalent in the main trading countries, the price of the good in terms of foreign currency is expected to increase approximately by the same rate of inflation. Second, the price of the export good in domestic currency increases as minidevaluations occur. Figure 5 also serves to illustrate the net result of these forces.

The government of a developing economy knows that attainment of an accelerated growth path requires an expansion of imports--mainly machinery and intermediate products to feed the processes of investment and industrialization. This increase in import needs may represent a balance of payments problem. Therefore, the government may be interested in promoting exports so as to eliminate the foreign exchange bottleneck and to generate additional aggregate demand in order to stimulate the economy. Promotion of exports can be implemented through several tax exemption and subsidy devices which have the effect of increasing the relative price obtained by export sales with respect to that obtained by domestic sales.

Under a system of sharp devaluations at long intervals in an inflationary economy, fiscal incentives to export are likely to have only a limited beneficial effect. On the other hand, the system of frequent small adjustments in the exchange rate has the advantage of providing the continuity of all incentives to export.

The system of minidevaluations is expected to have a stabilizing impact on production, employment, and inventories in the economy and thus to promote greater efficiency. Under the system of sharp devaluations, exporters who believe that a devaluation is to occur soon try to retain their production in stock until the adjustment is effected. Just after devaluation, exporters have incentives to produce more and to sell the accumulated stock. While exports are encouraged, the reverse occurs with imports, and what happens to imports has an effect on production and sales of their competing domestic products.

The elimination of the exchange risk under the system of minidevaluations also affects international loan operations. Firms and state agencies may take advantage of the money market abroad where real interest rates may be lower and long-run funds more abundant.

One of the main problems involved in the system of sharp devaluations is the destabilization of speculative movements. Whenever a significant change in the foreign exchange rate is anticipated, people convert domestic currency into foreign curriencies, which results in a periodic intense pressure in the domestic credit market. Funds which normally serve domestic financing are temporarily diverted to buy foreign currencies. Once the devaluation is effected, individuals convert the foreign currency into domestic currency to obtain a profit, the size of which depends upon the size of the adjustment. Then the money is loaned in the domestic market for a relative high (due to inflation) nominal interest rate. When a new devaluation is expected, the domestic currency, plus the interest gained, is converted into foreign currency, and so on. High speculative gains serving no useful function from the nation's point of view accrue to individuals.

Under the system of frequent small devaluations, there is no incentive for anyone to buy foreign exchange simply for the purpose of gaining from devaluation. If devaluations occur, say, at intervals of 20 to 50 days, the interest rate policy can be used to prevent speculation. Because the market rate of interest in an inflationary economy tends to be greater than the rate of inflation, it is easy for the government to pursue minidevaluations at an average rate smaller than the monthly rate of return that an investor can obtain in the domestic market. If the expectation is such that a small devaluation may occur any time within the next 50 days, this element of surprise discourages speculation even more.

Under the minidevaluation system the old taboo that usually accompanies devaluations in most countries--

the monetary authorities denying that it will occur until the last minute--is also abolished. It removes all reasons for agitation, rumors, or speculation. The public simply knows that the exchange rate is to be readjusted in accordance with the conditions of the economy vis-à-vis the international situation.

Finally, some observations can be made with respect to the possible effects of the system of minidevaluations upon the evolution of domestic prices. There is no rigid relationship between the domestic prices and the foreign exchange rate. The behavior of the former is also affected by other elements, such as movements in interest rates and capital flows, which serve as references to evaluate the convenience of adjusting the exchange rate. The tendency, therefore, is for internal prices to affect the level of the exchange rate.

The extent to which exchange rate devaluations may affect the inflationary process depends upon the relative value of imports and exports with respect to the total supply of goods in the economy. Prices of imports and exports in domestic currency rise with devaluation. Under a system of sharp devaluations this may result in sudden and large compensations for accumulated maladjustments in several sectors of the economy. The impact of the inflationary forces should be much smoother under a system of minidevaluations, which should help the government in curbing inflation. In addition, the higher productivity of the economy permitted by minidevaluations also fights inflation.

Summary

The system of minidevaluations of the exchange rate at short intervals have several advantages over the system of sharp devaluations at long intervals, especially in a highly inflationary economy. The main advantage is the greater stability in prices for those involved in the foreign sector of the economy. Thus, the exchange risk involved in export, import, direct foreign investments, and international loan operations is eliminated. For a developing economy promoting exports, minidevaluations represent the continuity of incentives to export. The stabilizing effect on production, employment, and inventories in the sector of importables and exportables and the elimination of destabilizing speculative movements should result in a more rational allocation of resources throughout the economy, with a consequent increase in productivity. The smoother and expected adjustments in the exchange rate involve no difficult political problems in decision making and should help the government in achieving its objective of slowing down inflation. The system of minidevaluations should greatly facilitate the process of external adjustment for the government of a country. To what extent these beneficial effects of the system adopted by the Brazilian monetary authorities in 1968 actually have occurred will be examined in detail in the following chapters.

CHAPTER II

HISTORICAL BACKGROUND OF FOREIGN EXCHANGE POLICY OF BRAZIL

The exchange rate policy has figured importantly in shaping Brazil's economic development. Several types of exchange policies and differing degrees of control have been utilized in the period since the Second World War. Rates of import and export exchange frequently have varied quite drastically; bonuses, charges, and auctions have comprised a *de facto* system of multiple exchange rates. The import exchange rate policy has been employed to gain revenue and especially to promote growth through the fostering of the production of import substitutes. The exchange policy served as a protectionist instrument before the system of specific duties, which was rendered ineffective by inflation, was changed into the more functional *ad valorem* system by the general tariff reform of 1957. The exchange policy also hindered the growth and diversification of exports until the mid-1960s.[1]

Beginning in the late 1930s, the Brazilian economy, which had been based mainly on the export of primary

---

[1]See Tyler, "Exchange Rate Flexibility."

products, gradually transformed into a highly industrialized and diversified one, with a decreasing dependency on external supplies. This progressive relative decrease of foreign trade with respect to the Gross Domestic Product (GDP) is illustrated in Table II-1.[2] In 1939 cruzeiros, the ratio of imports to GDP fell from an average of 22.4 percent between 1920 and 1929 to 6.1 percent between 1961 and 1967. The highest was 28.7 percent in 1925, following a peak year for the purchasing power of exports, and the lowest was 4.5 percent in 1965, a year of industrial recession. In physical terms, the increase in imports (measured by a weighted index of merchandise based on relative prices) was very small: 2.4 percent per year between 1920 and 1947 and only 0.3 percent per year between 1947 and 1967 (exponential growth rates). The import quantity index also fluctuated widely, as reflected in the bottom and peak indexes, respectively, during the four decades: 61.5 (1921) and 155.7 (1928); 66.0 (1932) and 114.8 (1937); 59.9 (1942) and 197.9 (1947); 181.3 (1953) and 289.0 (1951); 162.6 (1965) and 243.2 (1960).

The physical quantity of exports expanded at a rate of 1.0 percent per year (exponentially) between 1920 and 1947 and declined by 0.3 percent per year between 1947 and 1967. The growing gap that developed between the

---

[2]As originally prepared by the Getulio Vargas Foundation. See Mario Henrique Simonsen, Brasil 2002 (Rio de Janeiro: 1972), APEC Editora, pp. 95-101.

TABLE II-1.--Indicators of Brazilian Foreign Trade, 1920-1967 (Indexes base: 1939 = 100).

Year	Quantity Indexes: Import (MQI)	Quantity Indexes: Export (XQI)	Index of Terms of Trade (T of T)	Index of Purchasing Power of Exports (XQI x T of T)	Values in Billions of Cr$ of 1939: Imports (M)	Values in Billions of Cr$ of 1939: Gross Domestic Product (GDP)	Import coefficient (M/GDP) (%)
1920	90.6	55.2	118.8	65.7	4.4	21.3	20.7
1921	61.5	54.8	97.7	53.5	3.0	21.9	13.7
1922	77.0	58.3	161.3	93.8	3.8	22.8	16.7
1923	91.5	63.3	182.2	115.3	4.5	24.4	18.4
1924	120.6	57.8	251.3	145.0	5.9	24.0	24.6
1925	138.4	56.4	251.0	141.7	6.8	23.7	28.7
1926	135.5	55.7	247.5	137.8	6.6	24.2	27.3
1927	133.9	61.8	208.9	129.2	6.6	26.2	25.2
1928	155.7	60.0	241.0	144.7	7.6	30.8	24.7
1929	154.9	63.2	220.6	139.4	7.6	31.7	23.8
1930	98.5	66.4	146.5	97.2	4.8	30.6	15.7
1931	73.2	74.0	142.7	105.5	3.6	28.6	12.6
1932	66.0	51.4	187.3	96.2	3.2	30.4	10.5
1933	91.2	64.1	160.1	102.6	4.5	33.2	13.6
1934	95.8	69.7	164.7	114.9	4.7	35.2	13.3
1935	92.5	74.1	115.4	85.5	4.5	34.7	13.0
1936	95.8	80.1	119.9	96.0	4.7	39.4	11.9
1937	114.8	77.2	124.7	96.2	5.6	40.7	13.8
1938	103.8	93.5	94.7	88.5	5.1	41.7	12.2
1939	100.0	100.0	100.0	100.0	4.9	41.7	11.8
1940	86.2	81.1	93.5	75.8	4.2	48.1	8.7
1941	88.1	89.5	105.1	94.1	4.3	57.8	7.4
1942	59.9	78.3	109.4	85.7	2.9	57.7	5.0
1943	71.4	84.0	109.0	91.6	3.5	61.4	5.7
1944	86.0	83.9	126.0	105.8	4.2	60.0	7.0
1945	91.8	82.1	143.6	117.9	4.5	61.7	7.3
1946	122.5	106.5	142.7	151.9	6.0	66.7	9.0

1947	197.9	101.7	153.9	156.5	9.7	68.1	14.2
1948	170.8	106.4	144.6	153.8	8.4	74.5	11.3
1949	175.4	98.4	152.5	150.0	8.6	78.7	10.9
1950	196.8	83.3	253.4	211.2	9.6	82.6	11.6
1951	289.0	88.8	248.7	220.8	14.2	86.9	16.3
1952	262.3	72.6	220.7	160.2	12.9	91.7	14.1
1953	181.3	80.3	226.4	181.6	8.9	94.7	9.4
1954	243.7	68.4	294.4	200.0	1.9	102.0	11.7
1955	193.4	78.5	230.4	180.8	9.5	108.9	8.7
1956	190.3	84.1	233.4	196.2	9.3	110.9	8.4
1957	231.9	79.6	233.6	186.0	11.4	118.6	9.6
1958	217.9	75.5	227.5	171.8	10.7	126.4	8.5
1959	245.2	88.4	222.0	196.2	12.0	135.7	8.8
1960	243.2	86.2	209.3	180.4	11.9	144.8	8.2
1961	231.0	91.3	208.7	190.5	11.3	155.3	7.3
1962	233.5	84.6	195.0	164.9	11.4	163.6	7.0
1963	226.6	96.7	190.3	184.0	11.1	166.3	6.7
1964	196.4	82.9	230.1	190.8	9.6	171.4	5.6
1965	162.6	82.9	243.6	201.9	8.0	178.1	4.5
1966	210.9	94.3	223.3	210.6	10.3	184.1	5.6
1967	233.4	82.9	239.1	198.2	11.4	193.2	5.9

Source: Mario Henrique Simonsen, Brasil 2002 (Rio de Janeiro: APEC Editora, 1972), pp. 96-98.

physical quantity of imports and exports after the 1930s was made possible by: (1) an improvement in the terms of trade during certain periods, particularly the late 1940s and first half of the 1950s; (2) the flow of direct investment into the country. Foreign corporations have shown a continuously strong propensity to invest in Brazil as compared to other Third-World countries; and (3) the increase in foreign indebtedness, especially in periods when the terms of trade took a turn for the worse, as in 1962 and 1963.

There was a decrease not only in the share of aggregate imports in Gross Domestic Product but also in the share of imports in the market supply of most commodities. Import-substituting industrialization proceeded at a rapid pace. By 1949, most common nondurable consumer goods already had been substituted with domestic production. In that year imports amounted to only 4 percent of the total internal supply of such goods. Imports of intermediate products contributed 25 percent, while consumer durables and capital goods accounted for approximately 60 percent. By 1959 the share of imports in consumption of durables, intermediate, and capital goods had been reduced respectively to 6, 12, and 33 percent. By the mid-1960s the Brazilian industrial system was exceptionally integrated. The share of imports of intermediate and capital goods was less than 10 and 20 percent, respectively. Between 1949 and 1964 industrial production more than tripled, while imports of manufactured goods decreased 30 percent.[3]

The Role of Foreign Exchange Policy in Fostering Import Substitution

The key parts that exchange rate policies as well as tariff and nontariff barriers took in this process are described below. The factors that led to the adoption of these policies are related to world conditions of the last fifty years, which were not always favorable to trade expansion. The Great Depression adversely affected Brazil's export revenue, especially from coffee, discouraging further dependency on the foreign sector. In 1928 Brazil exported some 15 million bags of coffee at about US 23 cents a pound; in 1931-1932 the same quantity of bags was exported at 7 to 9 cents a pound. Brazil, then, confirmed the belief that the industrialized countries suffer from unemployment and curtailment of production during a serious depression but not from a large reduction in prices; countries which are essentially primary producers do not experience a large reduction in production or employment, but their exports do undergo a sharp decline in price. The 1930 exchange rate of Cr$8.30 ("old" cruzeiros) to the dollar changed to Cr$18.70 in 1939. Although the Second

---

[3]See Celso Furtado, Obstacles to Development in Latin America, translated by Charles Ekker (Garden City, New York: Anchor Books, 1970).

World War favored Brazil's terms of trade in its generation of a heavy demand for exports, the possibility of export shipments was restricted, and a drastic rationing of imports was made necessary. This resulted in an increase in the foreign exchange reserves from about US$70 million to some US$700 million in 1945. The rate of exchange was unaltered, at Cr$18.70 per dollar. Of the US$700 million reserves, about one-third was in sterling and not freely usable; Great Britain declared its inability to pay except by transferring its capital investments.[4] During 1945-1947, the Brazilian Government, concerned with the level of coffee prices in international markets, kept the foreign exchange rate constant at the war period rate, even though price levels in Brazil had increased much more than in the industrial countries, particularly the United States. Experience had shown that partly because of inelastic demand for coffee the devaluation of the cruzeiro would cause a decline in international coffee prices. Also, the tariff system was based on specific prices per item and the rates had not been adjusted for the new higher prices. The interests of coffee-export groups prevailed over the interests of the new industries that had developed during the war years.[5]

---

[4]See Eugenio Gudin, "The Chief Characteristics of the Postwar Economic Development of Brazil," in The Economy of Brazil, ed. by Howard Ellis (Berkeley: University of California Press, 1969), chap. 1, pp. 5-7.

[5]See Furtado, Obstacles to Development, pp. 115-16.

1947-1953: Overvaluation and Import-Licensing Controls

Scarcely a year of liberation of imports and overvaluation of the cruzeiro exhausted reserves and increased foreign indebtedness. From June 1947 to January 1953, a licensing system was used to control both the level and structure of Brazil's imports. A system of rationing foreign exchange supplies to five different categories was instituted. Priorities were given to raw materials and semiprocessed products so that the productive capacity of the country would continue operating. Machinery for expanding national productive capacities was assigned secondary priority, whereas consumer items classified as "nonessentials" had the lowest priorities. Around 1949, the Law of Similars--under which imports of products "similar" to those locally produced were prohibited--began to be applied and was enforced with gradually increasing frequency during the succeeding decade.

The maintenance of an increasingly overvalued exchange rate, kept at Cr$18.70 to the dollar, characterized the export policy in the period 1945-1953. The quantity and value of exports declined steadily from 1946 until the Korean War. From 1949 onward, exporters of certain products which were being priced out of the market were allowed to sell foreign exchange directly to importers of nonessential goods. This limited effective devaluation for some export products was important just before and after the Korean War boom.

The outbreak of that war, and the fear that it would become another world conflict, caused imports to soar from US$950 million in 1949 to US$1,703 million in 1951 and to US$1,702 million in 1952. Part of this expansion was financed by the export boom and part by compensatory financing. Over 55 percent of the increase in imports was in capital machinery and equipment. At the same time, however, many imports were difficult to obtain because of the war. In 1952, exports fell sharply, which aggravated the deficit in the balance of payments. These events strengthened the belief of the government that dependency on imports should be diminished.[6]

1953-1959: Multiple Exchange Rates, Taxes, and Bonuses

The picture was significantly changed in the period 1953 to 1957. In January 1953, a free exchange market was established to cover financial operations and tourism. In October 1953, the system of multiple exchange rates with bonus and taxes was instituted.[7] The official exchange rate was kept fixed as a base. On the export side, different rates were established: for coffee, the exchange rate

---

[6] See Joel Bergsman, Brazil, Industrialization and Trade Policies (Oxford: OECD, Oxford University Press, 1970), chap. 3.

[7] See Alexander Kafka, "The Brazilian Exchange Auction System," Review of Economics and Statistics, 38 (August 1956), 308-22.

was the official rate of Cr$18.36 plus a bonus of Cr$5.00, or a total of Cr$23.36 per dollar; for other products, the bonus was Cr$10.00, or a total of Cr$28.36 per dollar. The bonuses changed from time to time as did the administrative setup. The average export exchange rate rise paralleled the domestic price level but with lags. The system lasted until 1959, and the quantum and the value of exports did not change substantially during the period.

On the import side, import licenses were eliminated and replaced by auction sales of foreign exchange licenses. The monetary authority (SUMOC) allocated available foreign exchange among five different categories. Each auction corresponded to a specific category and was subject to minimal premia. Some imports, however, were not subject to the auction system. Among these were items for governmental agencies, wheat, newsprint, and petroleum products. The rate for these products was the official exchange rate plus eventual surtaxes which could be determined by the monetary authority. These goods accounted for about one-third of total imports. The other imports were classified into five categories: (1) inputs to agriculture, certain pharmaceuticals and inputs to the pharmaceutical industry, and some other essential commodities; (2) essential raw materials (that is, for favored industries, almost all producers of intermediate goods); (3) other raw materials "essential" spare parts and equipment (again for favored industries); (4) fresh fruit and other spare parts and equipment; and (5) all other commodities (most finished consumer goods).

The same bias in ranking that characterized the licensing period (1947-1953) continued during the exchange auction period (1953-1957), but the magnitude of the price effects differed. The lowest exchange rates were applied to imports of capital and current inputs to agriculture and some favored industries; the next lowest were applied to other producer goods, and the third lowest rates were applied to finished consumer goods.

The net result of the purchase and sale of foreign exchange went to the Fund of "Agios." Financial transfers and tourism were under the free market.

Continuous inflation required revision of the exchange rates for maintenance of export profitability. In January 1955, four export categories were established, each with a different exchange rate level. Larger remuneration was given to products facing greater problems in continuing to be exported. In May 1956, the bonuses of some of the categories were increased.

The functioning of the multiple exchange system led to increasing difficulties. Interest groups constantly complained and exerted pressure in the interest of changing import lists. Some domestic enterprises were discouraged, while the production of highly protected luxury consumption goods was stimulated. On the other hand, the monetary authorities were late in adjusting export exchange rates.

This was due in part to the decrease in the balance of exchange operations available to the Fund of "Agios" that occurred in each adjustment of the export exchange rate. This in turn resulted in a decrease in the extra budgetary revenue used by the government in its financial operations. Higher export remuneration was deleted in the case of some goods as a means of preventing increases in domestic prices.[8]

Foreign firms were given a special incentive to invest in Brazilian industry by issuance of the SUMOC Instruction 113 of 1955. This regulation exempted foreign firms associated with Brazilian enterprises from the need to provide foreign exchange "cover" for the importation of machinery, an advantage denied to wholly Brazilian-owned firms. It was resorted to intensively during 1955-1960 and figured importantly in the establishment of the automotive and other industries.

Additional credit and exchange facilities were extended to domestic and foreign firms by the government after 1956 to promote industrialization. The subsidy given to the industries from 1955 to 1960 by such means was estimated by Eugenio Gudin at about 1 billion dollars. Consumers in general, people not living in the industrial areas, and agriculturists in particular bore most of the costs of industrialization. The monopolistic gains

---

[8] Conjuntura Econômica, 24, No. 1 (1970), 60-62.

resulting from protection, although substantial, were not included in this estimation.[9]

Until 1957, custom duties were regulated by the tariff of 1934 expressed in specific sums of cruzeiros. With inflation and with the depreciation of the cruzeiro after 1940, those tariffs became ineffective but were replaced by import licenses and exchange controls.

In August 1957, a new law instituted ad valorem tariffs ranging up to 150 percent and reduced the number of import categories to only two: (1) general, for products the domestic supply of which was unsatisfactory, and (2) special, for most finished goods and for most producer goods which were available domestically. The exchange auctions were maintained. Fertilizers, newsprint, wheat, petroleum, petroleum products, and amortization and interest payments on foreign loans important for development were placed in a separate category. Here, a very low exchange rate, equal, in general, to the average rate for exports, was used.

The system governing imports that was introduced in 1957 remained basically the same until March 1967, when the scheduled tariff was revised downward, and the multiple rates were eliminated. Some changes, however, such as restrictions and exemptions to limit or facilitate certain imports, were introduced along the way.

---

[9]Gudin, "Chief Characteristics," pp. 10-11.

On the export side, many products were transferred to the free exchange market in 1957. In December 1959, all products other than coffee, cocoa, mineral oil, and castor beans could be sold on the free market. The continuous inflation, however, together with occasional adjustments in the export rate, resulted in wide variations and uncertainty as to the export exchange rate.

The real rate was characterized by an average (of absolute values) monthly variation of over 3.8 percent. The real rate dropped 10 to 15 percent in several periods of three to six months. The rate for individual products varied even more, causing more uncertainty during 1953-1959.[10] This discouraged exports, which, having totalled more than US$1,500 million in both 1953 and 1954, dropped to less than US$1,300 million in both 1958 and 1959. Exports of manufactured products (classes 5,6,7,8 of NBM--Nomenclatura Brasileira de Mercadorias), however, starting from a relatively low level of around US$9 million annually in 1953-1954, rose to an annual level of US$12 to US$13 million in 1958-1959. This might have been due to occasional undervaluation--although with wide variation--of the export rate for such goods during part of this period.[11]

---

[10] See Bergsman, Brazil, pp. 35-36.

[11] See Donges, Brazil's Trotting Peg, p. 12.

1960-1964: Gradual Abolishment of Multiple Exchange Rates

In March 1961, under some pressure and with advice from the International Monetary Fund, the monetary authorities moved toward the simplification and abolishment of the multiple exchange rate system. Under SUMOC Instruction 204, import exchange operations began to be effected at free market rates, and the subsidy on essential imports of oil, wheat, newsprint, and so forth, was drastically reduced. The special category of finished consumer goods, however, still was maintained with exchange auction. The exchange rate was effectively devalued 100 percent. In May 1961, export coffee operations also passed to the free-exchange market, although the government retained a "contribution quota" on each dollar exported to be applied in purchases of surpluses and in the infrastructure of coffee agriculture. Exports, including manufactured goods--still less than 3 percent of total exports--performed relatively well in 1961. But the ensuing 1961-1964 period was marked by social unrest and political instability. Many restrictions again were placed on imports. Essential imports (oil, wheat, and newsprint) again were subsidized periodically. Inflation began to spiral, and devaluation again was allowed to lag behind price increases. To offset the effects of exchange overvaluation to some extent, exchange premiums ("bonecos") which varied according to product were used.

1964-1968: Unified Exchange Market, But Still With Sharp Adjustments

In 1964, three distinct exchange markets and rates were in operation: (1) the bank rate, used for official transactions abroad; (2) the so-called manual rate, used in the exchange houses for touristic purposes; and (3) the black or "parallel" market, used for unauthorized transactions. In May 1964, these different exchange rates were unified by governmental action. All export and import operations passed through the free exchange market, where the exchange rate was pegged periodically by the monetary authorities. But the period from 1964 to 1968 also was characterized by overvaluation and by sharp discontinuities. Between December 1964 and January 1968, the cruzeiro was devalued three times, by 19, 23, and 18 percent, at respective intervals of 323, 454, and 325 days. This occurred in spite of the stated intention of the government in March 1964 to maintain a realistic exchange rate in order to eliminate distortions and to promote exports.[12] Moreover, in August 1967, the monetary

---

[12] See Brasil, Ministerio do Planejamento e Coordenação Econômica, Programa de ação economica do govêrno revolucionário 1964-1966 (PAEG), 2d ed. (Rio de Janeiro, 1965), pp. 47-49, 131. The stated objective of the PAEG was to gradually establish a unified market for all exchange transactions with a free and flexible exchange rate, which would be given stabilizing support by the Bank of Brazil. Celso Furtado's Plano Trienal also pledged to maintain realistic exchange rates and to keep the same real level. See Presidência da Republica, Plano Trienal de Desenvolvimento Economico e Social 1963-1965, (Sintese) (Rio de Janeiro: December 1962), p. 78.

authorities stopped selling dollars to all comers, which promoted the reestablishment of the black market. Exchange control was less tight in this period, however, than usual after the Second World War.

In March 1967, the Brazilian economy moved toward import liberalization. Tariffs generally were lowered and the special category for imports was abolished. The very strict protection (tariff plus exchange rate premium) for these finished consumer goods dropped from the 180-220 percent to the 60-100 percent range.[13] Tariffs on other products were reduced by approximately 20 percent.

Important measures were taken during this period regarding the flows of capital and payment of returns. Laws 4131 (of 1962, modified in 1964) and 4390 and Decree 55,726 (February 1965) regulated both the remittance abroad of returns on investments of foreign firms and the manner in which foreign firms could raise short- and medium-term loans either with their mother company or with international financial institutions. SUMOC Instruction 289, of January 1965, governed and promoted the ability of foreign firms to obtain short-term loans (up to one year) abroad. In August 1967, Central Bank Resolution #63 made it possible for both national and foreign firms to raise short-term loans abroad using banks as intermediaries.

---

[13]See Bergsman, Brazil, pp. 36-37. After December 1968 the tariffs on many of those products were raised by 100 percentage points.

Beginning in 1964, the government began to promote exports through a series of incentives which will be described in detail below. Of key importance among them was the new exchange policy of August 1968.

Some Detailed Estimates of the Level of the Real Exchange Rate in the Period 1946-1967

Taking into account protection against imports and implicit export taxes Joel Bergsman has estimated the free trade exchange rate and the real import and export rates for the period 1946-1967. These data are worth including for purposes of comparison with post-August 1968 events. The figures are shown in Table II-2, which includes index numbers of the real value of the free trade exchange rate and the real cruzeiro value of one dollar of exports or imports. The free trade exchange rate is an estimate of the rate which would maintain the balance of trade unchanged in the absence of tariffs, export taxes, and subsidies.[14] The level of protection due to tariffs, exchange premia, and other restrictions and exemptions averaged 86 percent. The free trade rate during the period 1954-1964 and the implicit export taxes averaged 31 percent of that rate. Both protection and export taxes declined after 1964 and

---

[14] See Bela Balassa and Daniel M. Schydlowsky, "Effective Tariffs, Domestic Cost of Foreign Exchange, and the Equilibrium Exchange Rate," Journal of Political Economy (May-June, 1968), 356-59; and Joel Bergsman, "Foreign Trade Policy in Brazil," unpublished study (Rio de Janeiro: U. S. AID, February 1971), pp. 56-57.

TABLE II-2.--Free-Trade, Import and Export Exchange Rates, 1946-1967.

Year	Free Trade Rate (Cr$/US$1.00)	Product Protection (percent of free trade rate)	Implicit Export Taxes (percent of free trade rate)	Indices of Real Values: Import Rate (free trade rate for 1954=100)	Indices of Real Values: Free Trade Rate (free trade rate for 1954=100)	Indices of Real Values: Export Rate (free trade rate for 1954=100)
1946						117
1947						111
1948						103
1949						98
1950						95
1951						79
1952						70
1953						74
1954	38	64	29	164	100	71
1955	57	61	28	204	126	92
1956	71	144	37	314	129	81
1957	81	114	35	275	129	84
1958	95	82	31	240	132	91
1959	160	82	29	283	156	111
1960	210	53	24	238	155	118
1961	350	75	30	322	185	129
1962	550	89	33	366	193	130
1963	830	101	33	333	166	110
1964	1700	76	29	330	187	133
1965	2500	57	25	281	179	134
1966	2800	34	22	190	142	112
1967	3100	20	13	150	125	109

TABLE II-2.--Continued.

Source: Joel Bergsman, Brazil, Industrialization and Trade Policies (Oxford: OECD, Oxford University Press, 1970), Table 3.4, p. 45.

Notes:

Coffee exports are not included.

The "free-trade rate" is an estimate of the exchange which would maintain equilibrium in the balance of payments if tariffs, export taxes, subsidies, and so forth, were removed.

"Product protection" is calculated as the import rate (including tariffs plus exchange premia, post charges, and so forth, less taxes on domestic production, with adjustments made for restrictions and exemptions) divided by the free trade rate, less unity.

"Export taxes" are calculated as unity, less the export rate divided by the free trade rate.

Indexes of real values were obtained by deflating the nominal rates by the index of wholesale prices excluding coffee (Conjuntura Econômica index No. 45).

The data for 1967 are for April-December only to show the effects of the February-March reforms.

Limitations on data and assumptions are discussed in Bergsman, Brazil, pp. 37-54, 242-58.

reached the relatively low levels of 20 and 15 percent respectively in 1967. The average product protection afforded to the industrial sector was only 30 percent in 1967. Years such as 1956 and 1961-1964 featured extremely high import prices, probably higher than necessary to prevent imports. The years of minimum import cost (1954, 1955, 1958, and 1960), however, also showed high protection--in the 50-80 percent range. From 1964 to 1967 the export and import real exchange rates moved lower and closer together.

The real value of the export exchange rate coincided with that of the import exchange rate in 1945-1946, when the cruzeiro was substantially overvalued. This overvaluation is evidenced by the serious balance of trade deficit in 1946 and by the maintenance of the nominal export rate that was adopted during the Second World War at a time when prices in Brazil had risen by 70 percent more than those in the United States.[15]

The overvaluation of the cruzeiro was continuously aggravated from 1946 to 1952 as the export rate fell 40 percent in real terms. From 1953 onward, the export exchange rate kept up with the rise in domestic prices in

---

[15]The term overvaluation, however, must be qualified. Import and export supply and demand elasticities, capital flow movements, debt service, the structure of import restrictions, and the like all would have to be considered in a study of an optimal or correct exchange rate level. See Tyler, "Exchange Rate Flexibility," p. 120.

terms of annual averages but still maintained the overvalued level. The exporter was further hampered by the variations which resulted from infrequent adjustments in the nominal exchange rate in the face of continuous inflation. The average month-to-month fluctuation in the real export rate in 49 months during the period 1948-1966 was over 5 percent. It was common for the real rate to drop 10 or 15 percent within periods of three to six months.[16]

The export rate of all exports (excluding coffee) followed a similar pattern of behavior in terms of levels and fluctuations; as discovered by Bergsman, this similarity was presented by the real effective exchange rate--including all bonuses and other gratifications--for manufactured exports. The effective exchange rate was calculated by dividing the current cruzeiro value of manufactured exports by the dollar receipts for such exports on a yearly basis. This sum then was deflated by the wholesale industrial price index to obtain the real effective exchange rate for industrial product exports. The data, as estimated by Tyler for the pre-minidevaluation period of 1946-1968, are shown in Table II-3.

The real effective rate for industrial exports declined 28 percent from 1946 to 1952 (Table II-3). This

---

[16]See Bergsman, Brazil, pp. 37-54; and Joel Bergsman and Arthur Candal, "Industrialization: Past Success and Future Problems," in The Economy of Brazil, ed. by Howard S. Ellis (Berkeley: University of California Press, 1969), p. 33.

TABLE II-3.--Real Effective Exchange Rate for Manufactured Product Exports, 1946-1968.

Year	Effective Exchange Rate (Cr$/US$)	Wholesale Industrial Price Index (1953=100)	Real Effective Exchange Rate (in constant terms of 1953)
1946	18.38	63	29.17
1947	18.38	62	29.64
1948	18.38	63	29.17
1949	18.38	66	27.84
1950	18.38	68	27.02
1951	18.38	80	22.97
1952	18.38	87	21.12
1953	23.36	100	23.36
1954	30.44	132	23.06
1955	47.88	150	31.92
1956	52.90	186	28.44
1957	61.58	218	28.25
1958	86.77	255	34.03
1959	126.03	366	34.43
1960	179.46	452	39.70
1961	246.38	644	38.26
1962	353.82	933	37.92
1963	531.04	1711	31.04
1964	1211.77	3137	38.63
1965	1810.61	6065	35.79
1966	2181.45	6701	32.55
1967	2621.71	8432	31.09
1968	3308.69	10993	30.10

Sources: See William G. Tyler, "Export Diversification and the Promotion of Manufactured Exports in Brazil," mimeographed USAID study, August 1969, Table IV-1, p. 117. Export data from SEEF, Comércio Exterior do Brazil, selected years. Wholesale industrial price index is Index 49 (old classification) of the National Economic Indicators Series published in Conjuntura Econômica by the Getúlio Vargas Foundation.

was less sharp than the 40 percent decline for all exports (Table II-2), but the peak and bottom years were the same for both categories. Recovery from the low level in 1952 occurred with the exchange reform and devaluation of 1953 and the subsequent exchange policy. SUMOC Instruction 147 established a premium rate for textile exports that substantially increased the industrial export rate in 1958. The highest yearly average of the period was attained in 1960, just after the exchange reform of late 1959. Another decline took place before the 1964 exchange reform, which resulted in another peak, followed by gradual deterioration up to 1968. As seen in this dissertation, the effective real exchange rate played an important role in stimulating and discouraging exports. The peaks reached in 1960-1961 and again in 1964-1965 were accompanied by substantial growth rates (ranging from 55 to 85 percent annually) in the still very low level of manufactured exports.

The Post-August 1968 Period: The Minidevaluations

Since August 1968 the Brazilian government has been devaluing the cruzeiro by relatively small amounts at fairly regular six-week intervals. As already described in Chapter I, the exact timing and amount of the mini-adjustments, although expected by the public, have never been precisely known. In making the adjustments, the monetary authorities have been primarily guided by the difference between inflation rates at home and those abroad, particularly, in the countries with which Brazil chiefly trades, and by the movements of interest rate differentials at home and in the principal international capital markets. Also taken into account are the current balance-of-payments situation, the amount of foreign reserves accumulated, and the foreign indebtedness position. Between August (exclusive) 1968 and December 1972, the official exchange rate was adjusted 35 times at intervals varying from 14 to 80 days. The average interval was 45 days, and the average rate of change was 1.5 percent. Table II-4 indicates that the total annual devaluations in the years 1969 to 1972 were about 7 or 8 percent less than the annual rates of inflation, measured by changes in wholesale prices of all commodities, in each of these years. The difference is partly due to external inflation. The difference between the domestic and external inflation rates, however, varies according to the price indexes used.

From August 1968 to December 1972 the consumer price index rose from 100 to 218 in Brazil and from 100 to 122 in the United States.[17] In the same period the wholesale price index for all commodities rose from 100 to 217 in Brazil and from 100 to 120 in the United States. On the other hand, during the same period, the industrial wholesale price index rose from 100 to 194 in Brazil and from

---

[17]In terms of consumer prices for both countries, Index 64 of International Financial Statistics, International Monetary Fund, various issues.

TABLE II-4.--Sharp Devaluations (1964-1968) and Minidevaluations (1968-1972).

Date	Exchange rate Cr$ per US$1.00		Days since last devaluation	Percentage change over exchange rate in effect since			Inflation (%) rate during the year (wholesale prices of all commodities)
	Purchase	Sale		last devaluation (re. purchase rate) (%)	one year before (%)	on 1/1 of current year (%)	
1964							91.30
12/28	1.825	1.820		57			
1965							51.20
11/16	2.20	2.22	323	20.54			
1966							37.40
1967							24.80
2/13	2.70	2.715	454	22.727			
1968							23.80
1/1	3.20	3.22	325	18.518	45.45		
8/27	3.63	3.65	236	13.437	34.44	13.43	
9/9	3.675	3.70	28	1.239	36.11	14.84	
11/19	3.745	3.77	56	1.904	38.70	17.03	
12/9	3.805	3.83	20	1.602	40.92	18.90	
1969							20.50
1/4	3.905	3.93	57	2.628	22.03	2.62	
3/19	3.975	4.00	43	1.792	24.21	4.46	
5/13	4.025	4.05	55	1.257	25.78	5.78	
7/7	4.075	4.10	55	1.242	27.34	7.09	
8/27	4.125	4.15	51	1.226	13.63	8.40	
10/3	4.185	4.21	37	1.454	13.87	9.98	
11/14	4.265	4.29	42	1.911	16.05	12.08	
12/18	4.325	4.35	34	1.406	13.66	13.66	

1970							21.80
2/4	4.38	4.41	48	1.271	12.16	1.27	
3/30	4.46	4.49	54	1.826	12.20	3.12	
5/18	4.53	4.56	49	1.569	12.54	4.73	
7/10	4.59	4.62	53	1.324	12.63	6.12	
7/24	4.62	4.65	14	0.653	13.37	6.82	
9/9	4.69	4.72	56	1.515	13.69	8.43	
11/4	4.78	4.81	47	1.918	12.07	10.52	
11/18	4.83	4.86	14	1.046	13.24	11.67	
12/22	4.92	4.95	34	1.863	13.75	13.75	
1971							20.50
2/9	5.00	5.03	49	1.626	14.15	1.62	
3/22	5.08	5.11	41	1.600	15.98	3.25	
5/13	5.16	5.195	42	1.574	15.69	4.87	
6/11	5.25	5.285	38	1.744	15.89	6.70	
8/15	5.37	5.405	54	2.285	16.23	9.14	
9/10	5.47	5.505	35	1.862	18.40	11.18	
11/10	5.60	5.635	61	2.377	17.15	13.82	
1972							18.48
1/28	5.75	5.785	80	2.679	16.87	2.679	
3/16	5.81	5.845	47	1.043	16.20	3.75	
5/8	5.88	5.915	53	1.204	15.74	5.00	
7/14	5.93	5.965	68	0.85	12.95	5.892	
9	5.99	6.025	53	1.012	11.55	6.96	
10	6.06	6.095	42	1.169	10.79	8.21	
11	6.13	6.165	36	1.155	9.46	9.46	
12/15	6.18	6.215	23	0.816	10.36	10.36	

Source: Conjuntura Econômica, Fundacao Getulio Vargas, several issues from 1970 to 1972. The inflation rate refers to the general wholesale price index of all commodities, column 16 of the National Economic Indexes published in Conjuntura Econômica. The percentage changes in the exchange rates were calculated with respect to the purchase rate.

100 to 117 in the United States a much smaller difference.[18] The inflation differential for industrial goods is approximately the same as the rise in the cruzeiro rate from 100 (Cr$3.65 in August 1968) to 170 (Cr$6.18 in December 1972).

Table II-5 shows the calculation of an index of exchange rate adjusted for both domestic and external inflation. Using the industrial wholesale price indexes in Brazil and the United States as the respective adjustment indexes, one obtains an index of real exchange rate adjusted for dollar inflation equal to 102 in December 1972 as compared to 100 in August 1968. This indicates that, for industrial goods, the cruzeiro has not become overvalued with respect to the dollar since the beginning of the minidevaluations. Alternatively, using the consumer price indexes in Brazil and the United States as the respective adjustment indexes yields a corresponding index equal to 95 in December 1972 as compared to 100 in August 1968 (not shown in Table II-5). Therefore, in terms of all consumer goods, the cruzeiro has become slightly overvalued with respect to the dollar since the beginning of the minidevaluations. The difference between consumer prices

---

[18] The wholesale general price index for Brazil is Index 24 of the National Economic Indexes, Conjuntura Econômica, Getúlio Vargas Foundation. For the United States the index is Index 63 of International Financial Statistics, International Monetary Fund, various issues. The wholesale industrial price index for Brazil is Index 51 of Conjuntura Econômica and for the United States is Index 63a of International Financial Statistics.

TABLE II-5.--Real Exchange Rate Adjusted for Dollar Inflation, 1968-1972.

Date	Official Exchange Rate Cr$ per US$1.00	Wholesale Industrial Price Index for Brazil (Aug. 1968 = 100)	Index of Exchange Rate Deflated by the Industrial Price Index (1)/(2) Aug. 1968 = 100	Wholesale Industrial Price Index for the United States	Index of Real Exchange Rate Adjusted for inflation in United States
	(1)	(2)	(3)	(4)	(3)x(4)
8/27/68	3.63(100)	100	100	100	100
12/72	6.18(170)	194	87.6	116.8	102.3

Source: Wholesale industrial price index in Brazil: Index 51, Conjuntura Econômica, Fundacao Getúlio Vargas. For the United States, Index 63a, International Financial Statistics, International Monetary Fund.

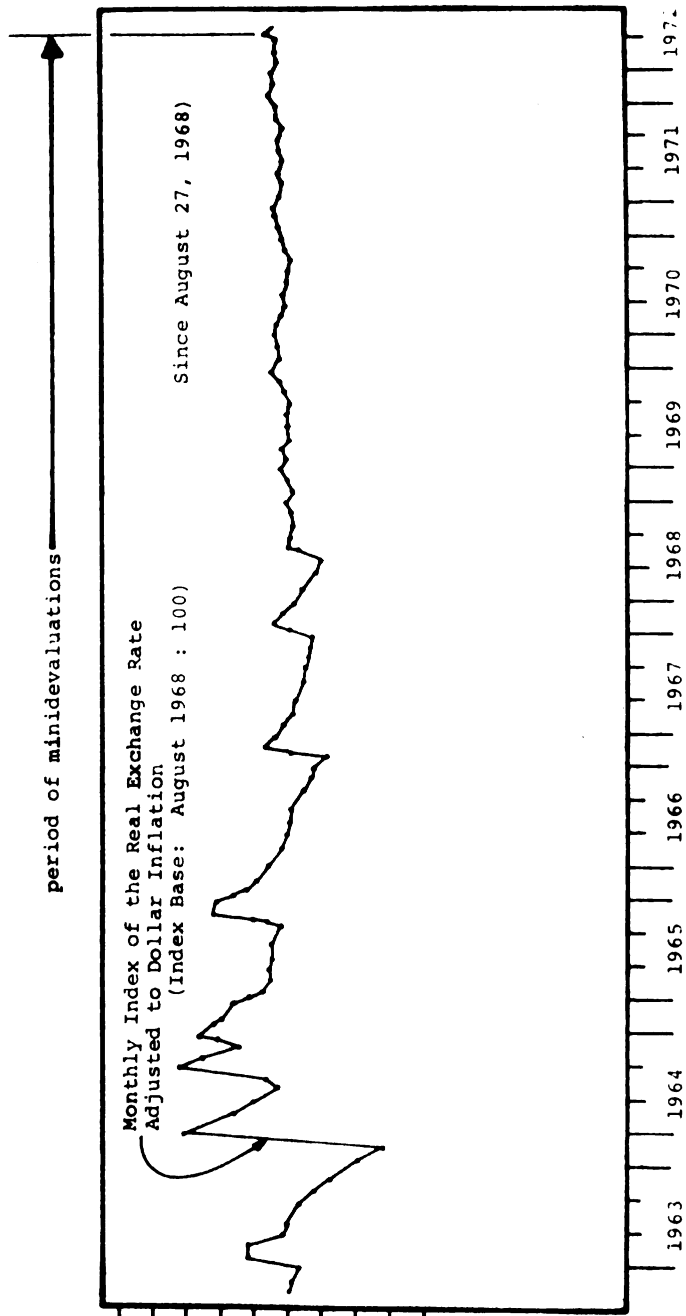
and wholesale industrial prices can be explained in terms of growth of output per capita. During periods of high rates of economic growth, the leading sectors have a higher increase in productivity and, in general, tend to have relatively lower increases in prices than other sectors. Rapid increases in real wages in the high growth sector, mainly industry, lead to increases in the cost of services and other goods to final consumers, which affects the consumer price index. This explains why during the period 1968-1972, years of very high economic growth in Brazil, the prices in industry increased relatively less than the consumer price index.[19] Stricter price guidelines for industrial goods than for other goods also account for the differential.

Figure II-1 shows that the real exchange rate adjusted for dollar inflation has fluctuated only mildly around the value of 100--the base index for August 1968--during the whole period of minidevaluations. In this case the Brazilian wholesale price index for industrial goods and the United States wholesale price index for all commodities were used as the respective adjustment indexes for domestic and external inflation. The calculations for the index of Figure II-1 are shown in Table B-2 of Appendix B.

---

[19] See Ronald I. McKinnon, Monetary Theory and Controlled Flexibility in the Foreign Exchanges, Essays in International Finance, No. 84 (Princeton: Princeton University Press, 1971), pp. 21-23.

Figure II-1.--The Effects of Changes in the Price Level (Brazilian Industrial Wholesale-Price Index) and in the Official Exchange Rate on the Real Exchange Rate for Exports Adjusted for Dollar Inflation (United States Wholesale-Price Index).


period of minidevaluations
Monthly Index of the Real Exchange Rate
Adjusted to Dollar Inflation
(Index Base: August 1968 : 100)
Since August 27, 1968)
150
140
130
120
110
100
90
80
70
60
1963
1964
1965
1966
1967
1968
1969
1970
1971

Certainly for industrial goods and somewhat less so for other goods, the application of the minidevaluations has arrested the recurrent decline in the real exchange rate that occurred prior to August 1968. As will be seen in the following chapters, this phenomneon had important effects on the Brazilian economy.

CHAPTER III

THE EFFECTS OF MINIDEVALUATIONS ON EXPORTS: THE OVERALL EVIDENCE

The Brazilian system of minidevaluations of the exchange rate provided the exporter with the prospect of a relatively stable relationship between internal production costs and world market prices. Because the participation of Brazil's nontraditional exports in the world market is very limited, the country's position is close to that of a perfect competitor,[1] and the demand for those products is highly elastic. Therefore, prior to August 1968, when the cruzeiro was devalued every 12 to 15 months, nontraditional exports yielded more or less stable dollar prices in the international markets, cruzeiro returns remained constant for prolonged periods, and costs of

---

[1]In fact, the nature of the position of potential exporters of manufactured products should be qualified. Most of them are not small firms without connections in the world market but, rather, are firms which are affiliated with multinational companies. In most cases the decision whether or not to export is made by the mother firm outside of Brazil. With this problem in mind, the Brazilian government has offered several incentives for multinational companies to export from Brazil. A very interesting study on this matter is one by Fernando Fajnzylber, Sistema Industrial e Exportação de Manufacturados, Análise da Experiência Brasileira (Rio de Janeiro: IPEA/INPES, 1971).

inputs and wages rose steadily. The new exchange policy corrected this situation of large fluctuations in the profit margins of export sales.

The international prices of the more traditional products such as coffee, cocoa, cotton, and sugar fluctuate widely in world markets. This made the virtual elimination of exchange rate risk, one of the reasons for fluctuations in cruzeiro prices, significant for exporters of such products. The minidevaluations also represented greater stability in the level of incentives for exporters. Various entrepreneurs stressed in interviews with the author in August 1972 (and confirmed by other writers[2]) that the system of minidevaluations, coupled with the whole battery of fiscal, financial, and other government-supported incentives, was largely responsible for the extraordinary growth of Brazilian exports from 1968 to 1972. While this growth was concentrated mainly in manufactures, it also featured other products, both nontraditional and traditional.

---

[2]See Carlos von Doellinger, Hugo de Barros Castro Faria, Jose Eduardo Carvalho Pereira, and Maria Helena T. T. Horta, Exportações dinamicas brasileiras, IPEA (Rio de Janeiro: 1971); Fajnzylber, Sistema Industrial e Exportação de Manufaturados; Tyler, "Exchange Rate Flexibility"; Donges, Brazil's Trotting Peg; and Helmut Hesse, "Promotion of Manufactured Exports as Development Strategy of Semi-Industrialized Countries: The Brazilian Case," Weltwirtschaftliches Archiv. Review of World Economics, 108, No. 2 (1972), 234-55.

Directors of some of the leading exporting firms, those which deal with traditional products such as coffee, cocoa, and cotton, and those which deal with nontraditional products, such as manufactured and other primary goods, all unanimously agreed that the system of minidevaluations constituted a sine qua non for the high performance of the export sector.[3] Tyler also interviewed manufactures about the fiscal, financial, and other types of incentives for exportation. All respondents stressed the importance of minidevaluations in diminishing entrepreneurial risk by enabling them to make more accurate predictions of export profitability.[4] Exporters also regard the exchange policy as a sign of government commitment to the promotion of exports. Thus, previous uncertainty as to the government's intentions has been substantially reduced. The new minidevaluation policy permits the exporters to make

---

[3]Interviews conducted by the author in August of 1972 with Mr. Horacio Coimbra, Director, Cafe Cacique (largest exporter of manufactured foods and of soluble coffee); Mr. Laerte Setubal, Director, Duratex SA (largest exporter of processed wood boards); the Superintendent of SAMBRA, Sociedade Algodoeira de Nordeste (largest exporter of traditional agricultural products); Mr. Eugenio Staub, Director, Staub SA (important medium-sized exporter of electronic parts); Mr. Luiz M. Suplicy Hafers, Director, Escritorio Suplicy (traditional export agent of coffee, cotton, and other agricultural products); and others.

[4]See Tyler, "Exchange Rate Flexibility," p. 19; and Hesse, "Promotion of Manufactured Exports," p. 238. See also William G. Tyler, "Fiscal Incentives for Manufactured Export Promotion: The Brazilian Case," Working Paper 72-01, Department of Economics, University of Florida.

long-range investment plans and marketing arrangements for selling his products in international markets. At the same time, the purchaser is assured of greater dependability of supply.[5]

In 1964 the total export revenue of Brazil rose from the stagnant level of about US$1.4 billion at which it had remained since 1947. From 1964 to 1967 export performance improved only moderately, but with the introduction of minidevaluations exports attained very high growth rates,

---

[5]In 1965 the author became directly familiar with the problem of dependability of supply and the on-again-off-again nature of export profitability while working with the Escritorio Suplicy which was trying to sell some Brazilian manufactured goods abroad. Some fiscal incentives already were in effect. These mainly were exemption from direct payment of the sales tax (IVC--Imposto de Vendas e Consignacões), later modified into the value-added ICM tax, which was put into effect in August 1964, and exemption from payment of the tax on industrial products (IPI--Imposto sobre Produtos Industrializados), introduced in August 1965. The government's slogan was: "Exporting is the Solution." Escritorio Suplicy was then export agent for several textile firms which wanted to sell cotton yarns and fabrics abroad, for a firm which produced canvas shoes, and for another which marketed paper-fiber boards. Although a 90 percent inflation had occurred during 1964, the firms wanted to start exporting after the 57 percent devaluation of the exchange rate in December of that year. They provided price lists in the beginning of 1965 which were sent to possible purchasers abroad. But inflation during 1965 was 52 percent in Brazil. By the middle of the year the firms needed to readjust their price lists because of increased costs. In November 1965 the author visited potential customers in the United States for a month. On 16 November the cruzeiro was devalued 20 percent, and new substantial price adjustments were made possible. Potential buyers, however, were inclined to avoid long-run commitments with suppliers whose price lists were subject to uncertain and drastic changes. The situation was different for primary products like coffee and cotton because purchasers of such commodities are used to wide fluctuations in market prices.

and Brazil's export revenue reached a total of $2.9 billion in 1971 and $4.0 billion in 1972.

The various Brazilian governments during the past decade have presented a battery of fiscal, financial, and institutional incentives for exporters, particularly those involved with industrial products. The incentives were intensified after 1968, which markedly affected the profitability of exports. A detailed examination of these incentives is presented in Appendix A. Estimates of their magnitude are essential in order to determine the effect of the exchange rate policy as precisely as possible.

Effects of Fiscal Incentives for Exports

William Tyler, Helmut Hesse, and others have estimated the effects of fiscal incentives on exports, mainly of manufactured products. Their results are discussed below.

Tyler's Estimates of Fiscal Incentives

Table III-1 shows the 1961-1971 index of remuneration to exporters of industrial products through fiscal incentives as calculaged by Tyler. The index indicates how much more a firm would obtain if it were to sell its product abroad rather than in the domestic market. Excluded from this table are the impacts of drawback provisions and of less important tax exemptions such as relief from the

TABLE III-1.--Index of Remuneration to Exporters of Industrial Products via the Fiscal Incentives to Export,[a] 1961-1971 (1st Quarter 1961=100), Tyler's Estimation.

Year		I.P.I.	I.C.M.	Income Tax	Tax on Financial Operations	Total
1961	I	100	100	100	100	100
	II	100	100	100	100	100
	III	100	100	100	100	100
	IV	100	100	100	100	100
1962	I	100	100	100	100	100
	II	100	100	100	100	100
	III	100	100	100	100	100
	IV	100	100	100	100	100
1963	I	100	100	100	100	100
	II	100	100	100	100	100
	III	100	100	100	100	100
	IV	100	100	100	100	100
1964	I	100	100	100	100	100
	II	100	100	100	100	100
	III	100	101	100	100	101
	IV	100	103	100	100	103
1965	I	100	103	100	100	103
	II	100	103	100	101	104
	III	105.02	103	100	101	109.02
	IV	115.07	103	100	101	119.07
1966	I	115.07	103	100	101	119.07
	II	115.07	103	100	101	119.07
	III	115.07	103	100	101	119.07
	IV	115.07	103	100	101	119.07
1967	I	115.07	103.10	102.8	101	121.97
	II	115.07	109.30	104.2	101	129.57
	III	115.07	109.30	104.2	101	129.57
	IV	115.07	109.30	104.2	101	129.57
1968	I	115.07	109.30	104.2	101	129.57
	II	115.07	109.30	104.2	101	129.57
	III	121.24	109.30	104.2	101	135.74
	IV	121.24	109.30	104.2	101	135.74
1969	I	121.24	109.30	104.2	101	135.74
	II	121.24	109.30	104.2	101	135.74
	III	127.41	109.30	104.2	101	141.90
	IV	127.41	109.30	104.2	101	141.90

TABLE III-1.--Continued.

Year		I.P.I.	I.C.M.	Income Tax	Tax on Financial Operations	Total
1970	I	127.41	109.30	104.2	101	141.90
	II	127.41	109.30	104.2	101	141.90
	III	127.41	109.30	104.2	101	141.90
	IV	127.41	109.30	104.2	101	141.90
1971	I	127.41	117.0	104.2	101	149.61
	II	127.41	117.0	104.2	101	149.61

Sources: Calculated from data supplied by the Ministry of Finance and CACEX; William G. Tyler, "Fiscal Incentives for Manufactured Export Promotion: The Brazilian Case," Working Paper 72-01, Department of Economics, University of Florida.

[a]Percentages are calculated from the domestic price base = 100. The term remuneration is used to mean the differential between domestic prices and possible export prices. See Appendix A for the description of all incentives.

tax on combustibles, lubricants, and electric energy, as well as other governmental fees. Adding up the tax incentives related to the tax on industrialized products (IPI), tax on circulation of goods (ICM), income tax, and tax on financial operations (see also Appendix A), reveals that the differential in remuneration between domestic and foreign markets became important for the first time in the last quarter of 1965, when it amounted to an average of 19 percent. This increased to a 35.74 percent differential in the second half of 1968. By the beginning of 1971, exporters could sell their products for an external price of about 50 percent less than the domestic price and still obtain the same level of remuneration.

Tyler also has calculated a real effective exchange rate for Brazilian manufactured exports adjusted for dollar inflation in order to compare that rate with the increase in local currency remuneration due to fiscal incentives. The Brazilian wholesale industrial price index was used to deflate the effective exchange rate, and the U.S. wholesale price index was employed to adjust for dollar inflation. Table III-2 shows that, even after accounting for dollar inflation, the Brazilian export exchange rate (in terms of cruzeiros per dollar) in real terms has fallen since 1961. A sharp decline occurred between 1961 and the first quarter of 1964, and a slight one occurred between the overthrow of João Goulart in 1964 and 1968. After the initiation of the minidevaluations in August 1968, however, the real effective exchange rate as adjusted to the dollar inflation has remained at approximately the same level and has fluctuated only moderately.

The combination of the real effective exchange rate as adjusted to dollar inflation with the fiscal incentives for export gives the rate of real effective remuneration. Table III-2 shows that this rate has increased approximately 27 percent since the second quarter of 1964. This increase has been due to the fiscal incentives which have more than offset the decline in the real exchange rate.

TABLE III-2.--Real Remuneration to Brazilian Industrial Exporters, 1961-1971 (in constant terms, that is, Cr$/US$ of the first quarter 1961), Tyler's Estimation.

		Dollar Inflation Adjusted Real Effective Exchange Rate[a] (X_2)	Index of Remuneration to Industrial Exporters via the Fiscal Incentives for Export[b] (X_3)	Rate of Real Effective Remuneration[c]
1961	I	.201	100.00	.201
	II	.223	100.00	.223
	III	.196	100.00	.196
	IV	.214	100.00	.214
1962	I	.209	100.00	.209
	II	.200	100.00	.200
	III	.216	100.00	.216
	IV	.218	100.00	.218
1963	I	.161	100.00	.161
	II	.170	100.00	.170
	III	.179	100.00	.179
	IV	.164	100.00	.164
1964	I	.160	100.00	.160
	II	.211	100.00	.211
	III	.191	101.00	.193
	IV	.211	103.00	.217
1965	I	.205	103.00	.211
	II	.198	104.00	.206
	III	.199	109.02	.217
	IV	.202	119.07	.241
1966	I	.202	119.07	.241
	II	.192	119.07	.229
	III	.188	119.07	.224
	IV	.177	119.07	.211
1967	I	.177	121.97	.216
	II	.184	129.57	.238
	III	.182	129.57	.236
	IV	.178	129.57	.231
1968	I	.184	121.57	.238
	II	.177	129.57	.229
	III	.173	135.74	.235
	IV	.183	135.74	.248

TABLE III-2.--Continued.

		Dollar Inflation Adjusted Real Effective Exchange Rate[a] (X_2)	Index of Remuneration to Industrial Exporters via the Fiscal Incentives for Export[b] (X_3)	Rate of Real Effective Remuneration[c]
1969	I	.186	135.74	.252
	II	.190	135.74	.258
	III	.189	141.90	.268
	IV	.192	141.90	.272
1970	I	.195	141.90	.277
	II	.192	141.90	.272
	III	.189	141.90	.268
	IV	.189	141.90	.268
1971	I	.189	149.61	.282
	II	.186	149.61	.279

Sources: Ministerio da Fazenda, Boletim do Comercio Exterior, various issues; Conjuntura Econômica; Federal Reserve Bulletin; William G. Tyler, "Fiscal Incentives for Manufactured Export Promotion: The Brazilian Case," Working Paper 72-01, Department of Economics, University of Florida.

[a]Instead of using the nominal exchange rate to calculate the real exchange rate, an effective exchange rate for manufactured exports was estimated and employed. The effective exchange rate incorporates exporter earnings from varying export bonuses which were widespread before 1963. It was calculated by dividing the cruzeiro value of manufactured exports by their dollar value. All values are in (new) cruzeiros.

[b]See Table III-1 above.

[c]The real effective remuneration to manufactured exporters is calculated as:

$$\frac{X_2 \cdot X_3}{100}$$

Hesse's Estimates of Fiscal Incentives

Helmut Hesse, in a manner similar to Tyler's, also has estimated the impact of fiscal incentives on the remuneration of exporters. His calculations are designed to answer the following question: what export price (in Cr$) would yield the same net profit as a price (including all taxes) on the domestic market, if all fiscal incentives are taken into account? Whereas Tyler calculated the impact of fiscal incentives on export remuneration from 1961 to 1971, Hesse has done the same for only one period, May 1971. He found that the combined fiscal incentives, on the average, permitted the export price to be reduced to 64 percent of the domestic market price without reducing net profits, as of May 1971. (These are approximately the same results found by Tyler, who estimated an almost 50 percent [49.61%] differential in remuneration between the domestic and foreign market during the first semester of 1971. That is, under Tyler's estimation, the combined fiscal incentives for exports of manufactures [excluding the drawback] permitted the export price to be reduced to 66.6 percent of the domestic market price without reducing net profits.) The variances among the 43 manufacturing sectors estimated by Hesse, however, are large. They range from 16 percent for tobacco products (which have extremely high indirect taxes), to 42 percent for beverages, to 59 percent for textiles and domestic appliances, and to 71-75 percent for meat, dairy products, cereals, other foods, fats and oils, sacks, bags and linen goods, lumber, chemicals, metal castings, and airplanes.

The breakdown for the 43 sectors of the various incentives as of May 1971, on the average, is the following. First, the IPI and ICM tax credits (subsidies) amounted to 14.7 percent of the fob value of exports. Because of these credits, an exporter could sell for a price equal to 87 percent of the domestic market price and receive the same net profit. Second, exemptions from indirect taxes on export products and on inputs in export production (drawback included) made it possible to reduce the export price to 76 percent of the domestic market price (84 percent if no rebate from the ICM paid on previous stages of production) without reducing net profit. The 24 percent differential between the export and domestic price is composed of an 8 percent IPI exemption, a 7 percent ICM exemption, an 8 percent rebate of ICM on previous stages of production, an 0.6 percent drawback, and 0.4 percent reduction from other indirect taxes. Third, the variance of the value of indirect tax credits and exemptions is quite large between the industrial sectors due to different tax levels. Finally, the corporate income tax exemption amounts to a subsidy of 3.3 percent of the domestic market price.

Tyler's Econometric Analysis of the Fiscal Incentives for Export and the Exchange Rate Level

Tyler specified a regression model in which the dependent variable is Brazil's manufactured exports and the independent variables are the fiscal incentives, the real exchange rate, a proxy for capacity utilization, and world demand. This model presents an identification problem, but given that Brazil's share in total world manufactures exports is less than 1 percent, one may assume that the demand for Brazil's industrial exports is perfectly elastic. Therefore, the model essentially represents an export supply function. Increases in the real exchange rate in fiscal incentives or in world trade shift the demand curve upward. The proxy for capacity utilization affects supply.

Using quarterly data from 1961 to 1970, the basic regression equation estimated was

$$\log X_1 = \underset{(3.174)}{-14.309} + \underset{(2.843)}{1.435} \log X_2 + \underset{(3.681)}{4.052} \log X_3 + \underset{(.959)}{.003} X_4 - \underset{(-4.476)}{.050} X_5$$

$R^2 = .90$ D. W. = 1.00

where:

X_1 = constant dollar value of Brazil's manufactured exports;

X_2 = dollar inflation adjusted real effective exchange rate (Cr$/US$1.00);

X_3 = fiscal incentives for export;

X_4 = total world imports; and

X_5 = proxy for capacity utilization (residuals from time regression line of Brazilian industrial production).

The t values appear in parentheses beneath the regression coefficients. The estimated Durbin-Watson statistic indicates a problem of significant autocorrelation of residuals. Whereas the independent variables X_2, X_3, and X_5 all are statistically significant at the 1 percent level, X_4 is significant at only about the 30 percent level. All variables show the expected signs.

In this regression study, the real effective exchange rate, X_2, shows a relatively high elasticity of 1.4, which indicated the importance of relative prices in affecting the supply of exports. X_5's negative sign and its high level of statistical significance indicate the existence of a recession-boom effect on capacity utilization and on exports. In periods of domestic recession, such as occurred in 1965, producers try to place their output in foreign markets. The regression coefficient of .050, however, is rather low. Therefore, this factor is not of overall importance and might diminish with time as the export of manufactures becomes a more regular activity.

The estimated elasticity of the fiscal incentive variable X_3 was 4.1, very high, more than double that of the real exchange rate. The interviews conducted by Tyler suggest that this result could be attributed to the indirect or qualitative effect of the fiscal incentives. As a result of the governmental incentives, producers became more and more interested in exporting. With time, this qualitative effect should be smoothed out, and the estimated parameter might fall to a value closer to the elasticity of the real effective exchange rate.

Tyler also has used a similar methodology to analyze the period between 1961 and 1968, and, quite interestingly, the results did not show the importance of the fiscal incentives. Tyler concluded, then, that the fiscal incentives were too recent, that they had affected only a few observations, and that there was a lag in their effect. That is why, although entrepreneurs had given importance to the fiscal incentives for exports, those incentives failed to be significant in the regression analysis for the earlier period.

Doellinger's Regression Analysis of Brazilian Dynamic Exports

The model utilized by Tyler to analyze Brazilian exports apparently was developed in collaboration with the IPEA (Instituto de Planejamento Economico e Social) group. This group, headed by Carlos Von Doellinger, ran regression equations similar to Tyler's to explain the behavior of exports of nontraditional primary products and

---

[6]See Tyler, "Fiscal Incentives," p. 33, note 10.

manufactured products from 1963 to 1968, that is, prior to the minidevaluations.[7]

Nontraditional primary products included all primary products except coffee, grains, cotton, cocoa, bananas, and carnauba wax. Those "traditional" primary products were excluded because the purpose of the research was to analyze the factors influencing the export expansion of products which did not have much importance in Brazil's foreign trade previous to the 1960s. For both nontraditional primary products and for manufactured products (Classes 5,6,7,and 8 of the SITC), Brazil's participation in world trade is marginal. Consequently, the international market price can be considered exogeneous, and the foreign demand for the Brazilian products studied can be assumed to be perfectly elastic during the period under examination.

The best statistical results obtained can be summarized in the supply functions presented below. The first supply function involves exports of nontraditional primary products (quarterly data from 1963 to 1968).

$$\log X_1 = 7.28 + \underset{(1.93)}{0.541} \log X_2 + \underset{(7.15)}{2.12} \log X_3 - \underset{(6.36)}{4.61} D$$

$F = 30.2$

$R^2 = 0.85$

D. W. = 2.30

[7] Doellinger, et al., Exportações.

The coefficients of t and F are significant at 5 percent, and

X_1 = constant dollar value of exports of the various products;

X_2 = real exchange rate (Cr$ per US$1.00) deflated by the wholesale price of agricultural products, except coffee);

X_3 = production index of the previous period based on exported primary products; and

D = dummy variable, which assumes value 1 during the first semester of each year so as to take into account the effects of the period, between harvests, when external sales are extremely reduced.

The function denotes a high elasticity coefficient of production, 2.12, indicating that good harvests help to increase exports, and a rather low elasticity coefficient with respect to the rate of exchange, 0.54. This means that the variations that occurred in the rate of exchange during the period, generally quite large and difficult to predict, have had only a limited influence on foreign sales of nontraditional primary products.

The second function involves manufactured products (quarterly data from 1963 to 1968).

$$\log X_1 = 3.82 + \underset{(1.09)}{0.63} \log X_2 + \underset{(3.39)}{1.48} \log X_3$$

$$- \underset{(-2.91)}{2.31} \log X_4 \; \underset{(-4.70)}{-0.74} \; D$$

$R^2 = 0.91$

D. W. = 1.97

The coefficients are significant at 5 percent, except for the exchange rate, which is significant at 10 percent, and

X_1 = dollar value of exports of manufactured goods;

X_2 = real exchange rate, deflated by the wholesale price index of industrial products and inflated by the index of remuneration to exporters via fiscal incentives (following Tyler's approach and index);

X_3 = production index of exportable industrial goods;

X_4 = index of utilization of industrial capacity (based on index of variation of employment); and

D = dummy variable, which assumes value of 1 during 1963 and the first two quarters of 1964, to take into account the institutional changes that occurred after 1964.

The results show the very important influence of the index of capacity utilization. The coefficient, with a negative sign, is the highest, reflecting the tendency during this period for exporters of industrial goods to regard foreign sales more as an residual outlet available during domestic recessions rather than as a regular activity. The foreign exchange-fiscal incentive index, X_2, has an elasticity coefficient lower than one (0.63) and has little significance. As already noted, this contrasts with results obtained by Tyler, whose study included part of the period during which the minidevaluations were in effect. The production index is less relevant here than in the case of primary products.

The important conclusion of the IPEA study is that during the period 1963-1968, despite existing incentives for exports, the external commercial activities of Brazilian producers depended more on the conditions of supply (for primary products) and domestic demand (for manufactured products) than on the conscious determination of exporters to seek foreign markets. It is only after the institution of the minidevaluations in August 1968, aided by the establishment of tax credits in 1969, that exports of both manufactured goods and primary products started to boom.

Tyler's Regression Analysis of Minidevaluations

In another regression model Tyler attempted to incorporate the frequency of devaluation as a variable influencing exports of manufactured goods. The result however, was not conclusive. Using quarterly data from 1961 to 1970, he estimated the following regression equation:

$$\log X_1 = \underset{(-3.386)}{-13.577} + \underset{(2.628)}{1.415} \log X_2 + \underset{(.546)}{.005} X_3$$

$$+ \underset{(1.430)}{2.634} X_4 + \underset{(1.405)}{1.238} X_5 - \underset{(-2.184)}{.037} X_6$$

$$R^2 = .90 \qquad \text{D.W.} = .91$$

where:

X_1 = constant dollar value of Brazil's manufactured exports;

X_2 = dollar inflation adjusted real effective exchange rate for manufactured exports (Cr$ per US$1.00);

X_3 = absolute (that is, without signs) percentage variation in X_2;

X_4 = fiscal incentives for export;

X_5 = total world imports; and

X_6 = proxy variable for Brazilian industrial capacity utilization (residuals from time trend regression line for industrial production).

The results are similar to those presented previously. The independent variables X_2 and X_6, X_4 and X_5 all are statistically significant, the first two at the 5 percent level, the latter two at the 15 percent level. The exchange rate variable X_2 was significant and presented a high elasticity of 1.4, but the frequency of devaluation variable, X_3, was not significant and did not show the theoretically "correct" negative sign, although it had a very low regression coefficient of .005. Therefore, this test of the minidevaluation policy proved inconclusive.[8]

Tyler also combined the real exchange rate and fiscal incentives into the real rate of effective remuneration to Brazilian industrial exporters and represented by X_7 to estimate the alternative regression equation, with the use of quarterly data from 1961 to 1970 (see Table III-2):

---

[8]Tyler, "Exchange Rate Flexibility," pp. 19-19b.

$$\log X_1 = \underset{(3.551)}{3.857} + \underset{(2.775)}{1.616} \log X_7 + \underset{(.139)}{.001} X_3$$

$$+ \underset{(6.364)}{.008} X_5 - \underset{(-3.380)}{.035} X_6$$

$$R^2 = .88 \qquad\qquad D.W. = .90$$

where variables X_7, X_5, and X_6 are statistically significant at the 5 percent level. As before, X_3, indicating the frequency of devaluations, is insignificant.

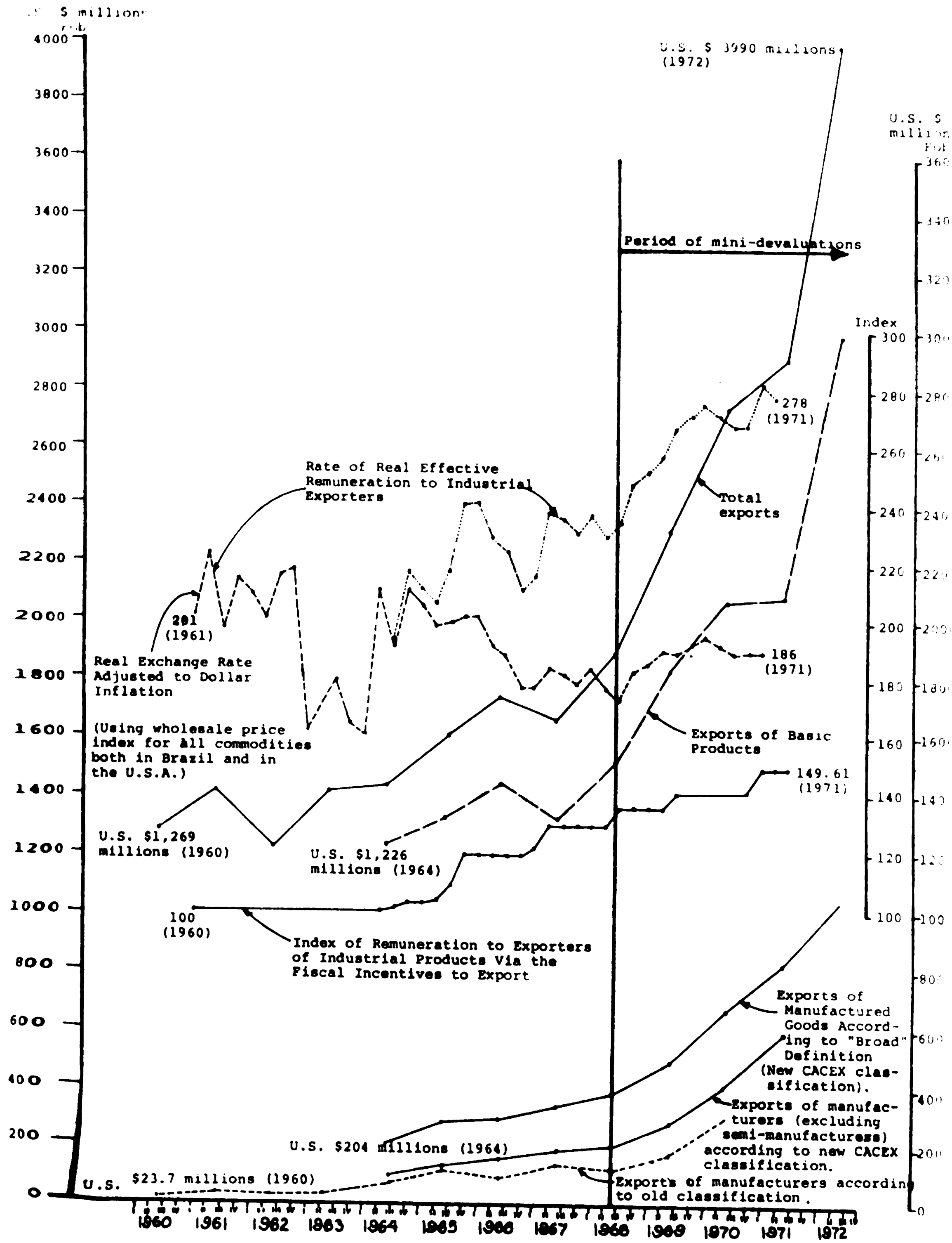
Effects of Minidevaluations on Exports of Manufactured Products: An Interpretation

There is an additional interpretation for Tyler's regression analysis not to show the importance of the fiscal incentives for the period 1961 to 1968 but, rather, to show that they were very important when the data for 1969 and 1970 were added (see pages 81-83 above). Only after the minidevaluations were initiated in August 1968 did firms have a guarantee that the level of remuneration of exports would not fluctuate widely. Therefore, minidevaluations represented a continuity in the level of fiscal incentives, and, to a certain extent, they also represented a guarantee that the remuneration for exports would remain satisfactory during the future period, when medium- and long-run contracts could be agreed upon. Figure III-1 shows the progress of exports of manufactured goods and of total exports, the index of remuneration to exporters of industrial products through fiscal incentives to export,

the index of the real effective exchange rate as adjusted to dollar inflation, and the index of the rate of real effective remuneration. The last named index is the combination of the first two indexes. It can be observed that whereas the index of remuneration through fiscal incentives becomes important after the end of 1965 and increases steadily thereafter, the real effective exchange rate as adjusted to dollar inflation fluctuates violently between 1961 and 1964, rather widely between 1964 and 1967, and only moderately from 1968 onward. The combination of these two indexes, the rate of real effective remuneration, shows upward and downward movements until August 1968, when it shows an almost steady movement upward from then on. The effect of this trend on exports is apparent.

Exports of manufactured goods which had increased from US$204 millions in 1962 to US$381 millions in 1968, according to the broad CACEX definition, already a reasonably good performance, experienced exceptional growth rates from 1968 onward, as shown in Table III-3. The compounded growth rate for the period 1969-1972 was approximately 31 percent (CACEX broad definition). The level of about US$1.1 billion dollars (CACEX broad definition) was reached in 1972, approximately the same as the value of coffee exports. Although the world trade share of Brazilian manufactures in these products is still negligible (0.1 percent in 1969), the annual increase in

Figure III-1.--The Effects of Devaluations of the Exchange Rate and of Fiscal Incentives on Brazilian Exports, 1960-1972.



U.S. $ millions
4000
3800
3600
3400
3200
3000
2800
2600
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
U.S. $ 3990 millions
(1972)
U.S. $
millions
Period of mini-devaluations
Index
300
280
260
240
220
200
180
160
140
120
100
278
(1971)
Total exports
Rate of Real Effective Remuneration to Industrial Exporters
201
(1961)
Real Exchange Rate Adjusted to Dollar Inflation
(Using wholesale price index for all commodities both in Brazil and in the U.S.A.)
186
(1971)
Exports of Basic Products
149.61
(1971)
U.S. $1,269 millions (1960)
U.S. $1,226 millions (1964)
100
(1960)
Index of Remuneration to Exporters of Industrial Products Via the Fiscal Incentives to Export
Exports of Manufactured Goods According to "Broad" Definition (New CACEX classification).
Exports of manufacturers (excluding semi-manufacturess) according to new CACEX classification.
U.S. $204 millions (1964)
U.S. $23.7 millions (1960)
Exports of manufacturers according to old classification.
1960
1961
1962
1963
1964
1965
1966
1967
1968
1969
1970
1971
1972

TABLE III-3.--Total Exports and Manufactured Product Exports of Brazil, 1953-1972.

	Total Exports (FOB)		Exports of Manufactured Products (FOB) (CACEX/NUCEX)								
			Narrow Definition			Broad Definition			SITC Classes 5-8		
Year	Millions of US$	Annual Growth Rates (%)	Millions of US$	Total Exports (%)	Annual Growth Rates (%)	Millions of US$	Total Exports (%)	Annual Growth Rates (%)	Millions of US$	Total Exports (%)	Annual Growth Rates (%)
1953	1539.3	--	8.9	0.6	--	--	--	--	--	--	--
1954	1561.8	1.5	9.4	0.6	5.6	--	--	--	11.2	0.7	--
1955	1423.2	- 9.7	15.2	1.7	61.7	--	--	--	--	--	--
1956	1482.0	4.1	13.1	0.9	-16.3	--	--	--	--	--	--
1957	1391.6	- 6.5	12.7	0.9	- 3.1	--	--	--	18.2	1.3	--
1958	1243.0	-11.9	12.2	1.0	- 4.0	--	--	--	16.5	1.3	-10.3
1959	1282.0	3.1	13.2	1.0	8.1	--	--	--	18.1	1.4	9.7
1960	1268.8	- 1.1	23.7	1.7	79.5	--	--	--	28.6	2.3	58.0
1961	1403.0	10.6	38.5	2.7	62.4	--	--	--	42.7	3.0	49.3
1962	1214.2	-15.6	33.1	2.7	-16.3	--	--	--	37.2	3.1	-14.8
1963	1406.5	15.8	37.4	2.7	13.0	--	--	--	41.7	3.0	12.1
1964	1429.8	1.6	69.9	4.9	86.9	204	-14.3	--	76.4	5.3	83.2
1965	1595.5	11.6	109.5	6.9	56.6	284	17.8	39.2	120.7	7.6	58.0
1966	1741.4	4.8	96.8	5.6	-13.1	293	16.8	3.2	124.3	7.1	3.0
1967	1654.0	- 1.0	142.7	8.6	47.4	343	20.7	17.1	163.3	10.0	31.37
1968	1881.3	13.7	130.0	6.9	- 9.8	381	20.3	11.1	153.1	8.1	- 6.7
1969	2311.2	25.8	181.6	7.9	37.5	495	21.4	29.9	224.5	9.7	46.6
1970	2738.9	18.5	306.9	11.2	69.0	665	24.3	34.3	360.0	13.2	60.35
1971	2904.0	6.0				822	28.3	23.6	--	--	
1972	3990.0	37.4				1134	28.4	38.0			

Several definitions of manufactured products are available in trade statistics and documents.

a) Based on Standard International Trade Classification (SITC):

Alternative 1: Classes 5, 6, 7, 8. The GATT statistics are based on this definition.

Alternative 2: Classes 5, 6, 7, 8, and some other products of classes 0-4. This definition is used, for example, in UNCTAD doc. TD/12/Suppl. 2.

Alternative 3: Classes 5, 6, 7, 8 without item 68 (noniron metals). Used, for example, by UNCTAD in *Commodity Survey* 1967 (New York: 1968).

b) Based on the Nomenclatura Brasileira de Mercadorias (NBM):

Alternative 4: Classes 5, 6, 7, 8, and some other products of classes 2 and 4. Used by CACEX during 1969-1970 (broad definition in Table III-3). It is a combination of the criteria adopted by INTAL (1966-1967) and UNCTAD (1965).

Alternative 5: Classes 5, 6, 7, 8. Used in official Brazilian statistics until 1968 (narrow definition in Table III-3).

Alternative 6: CACEX classification after 1971; see Table III-4.

Sources: CACEX/NUCEX, Banco do Brasil; Helmut Hesse, "Promotion of Manufactured Exports as Development Strategy of Semi-Industrialized Countries: The Brazilian Case," *Weltwirtschaftliches Archiv. Review of World Economics*, 108, No. 2 (1972): Table 6; United Nations, *Yearbook of International Trade Statistics* (New York: several years); Banco Central do Brasil, *Relatorio Anual 1971* (Brasilia: June 1972); *Conjuntura Econômica*, XXXVII (February 1973), p. 60.

world trade was only 15.2 percent (SITC classes 5 to 8) as compared to over 50 percent (SITC classes 5 to 8) for Brazil's exports during 1969-1970.

The spreading diversification of exports with regard to products and countries also has been an important achievement of the last decade. The share of manufactures in Brazil's total exports grew from 1 percent in 1958 to 11.2 percent (narrow definition) in 1970, or from 14.3 percent in 1964 to 28.4 percent (CACEX broad definition) in 1972.

That industry has become more and more export minded is evidenced in Brazil's exports of manufactures. The growth rate in this section has been about three times higher than the industrial production of the country, which had a compounded growth rate of 12.1 from 1968 to 1971. The participation of exports of manufactures in the industrial product, although low, increased from about 3 percent in 1967-1969 to an estimated 5 percent in 1970 (narrow definition).[9]

All kinds of manufactured products are being exported by Brazil, including shoes and refrigerators to the United States, clocks to Switzerland, clothes to Italy, testing and measuring instruments to Germany, photoelectric cells to the Netherlands, and cars, buses,

---

[9] See Carlos von Doellinger, "Exportacões brasileiras: diagnóstico e perspectivas," Pesquisa e Planejamento, 1 (June 1971), 83-140.

electronic products, and office machines to other Latin American countries.[10] This impressive diversification of Brazil's manufactured exports is illustrated in Table III-4, which shows the exports of semiprocessed and manufactured goods during 1971. The participation of the most important single items in the total value of exports was relatively low: 1.71 percent for soluble coffee and 1.75 percent for processed beef among the manufactured goods; 2.47 percent for sawn pinewood and 1.35 percent for castor oil among the semiprocessed goods.[11]

LAFTA countries, as shown in Table III-5, continue to be the most important buyers of Brazil's manufactures, as they were in the early 1960s. This is to be expected in view of their proximity and of the advancement of Brazil's industry in relation to that of those countries. Brazil may be in a good position to supply equipment which suits the conditions of countries at similar or less advanced stages of development. Despite the fact that exports of manufactured products to LAFTA countries has increased substantially, their share in Brazil's exports diminished from 52 percent in 1965 to 35 percent in 1970

---

[10] See Hesse, "Promotion of Manufactured Exports," pp. 252-54.

[11] It is interesting to note in Table III-4 that although the participation of industrialized goods in total dollar value of exports in 1971 was 28.3 percent, their participation in total weight (tons) was only 6.95 percent. This only confirms the generally known fact that the density value of industrialized goods is much greater than that of raw materials.

TABLE III-4.--Brazil's Total Exports and Exports of Industrial Goods in 1971 (CACEX Broad Classification).

	1971		Participation in Total Exports (%)	
	US$ Millions FOB	1,000 Tons	US$ Millions FOB	1,000 Tons
Total exports of all products (A+B+C+D+E)	2903.6	43824.5	100	100
A: Industrial goods	822.0	3043.3	28.31	6.95
a) semiprocessed goods	239.3	1271.4	8.24	2.90
1-carnauba wax	10.6	12.7	0.37	0.03
2-iron and steel for rerolling	8.7	89.0	0.30	0.20
3-pig iron	5.9	112.9	0.20	0.26
4-iron alloys	6.8	19.6	0.24	0.04
5-pinewood, sawn	71.8	583.0	2.47	1.33
6-sawn wood, other than pine	10.2	117.2	0.36	0.27
7-cocoa butter	24.3	21.1	0.83	0.05
8-peanut oil, raw	22.9	62.0	0.79	0.14
9-castor oil, raw	39.3	132.7	1.35	0.30
10-other vegetable oils (excluded items 8-9), raw	1.6	7.4	0.06	0.02
11-wood pulp	4.6	33.3	0.16	0.08
12-hides and skins, prepared or tanned	14.0	5.6	0.48	0.01

TABLE III-4.--Continued.

	1971		Participation in Total Exports (%)	
	US$ Millions FOB	1,000 Tons	US$ Millions FOB	1,000 Tons
13—semiprocessed steel mill products (excluded items 2-3-4)	.4	.4	0.00	0.00
14—other semi-processed products	18.3	79.4	0.63	0.17
b) manufactured	582.8	1771.8	20.07	4.05
15-rubber, processed	4.7	4.2	0.16	0.01
16-coffee, processed	49.7	23.3	1.71	0.05
17-footwear	29.3	7.1	1.01	0.02
18-boilers, machines, and mechanical apparatuses and instruments (excluded items 24-25-26)	38.4	19.9	1.32	0.04
19-beef, processed	50.9	34.3	1.75	0.08
20-iron, steel, or steel alloy plates, hot-rolled or cold-rolled	9.9	68.5	0.34	0.16
21-cotton yarn	6.8	6.5	0.24	0.01
22-wood veneers	18.6	32.7	0.64	0.07

TABLE III-4.--Continued.

	1971		Participation in Total Exports (%)	
	US$ Millions FOB	1,000 Tons	US$ Millions FOB	1,000 Tons
23-electrical machines, apparatuses, and other electrical appliances for technical use	28.5	6.4	0.98	0.02
24-office machines and accessories	27.1	2.3	0.93	0.01
25-earth-moving, digging, and drilling equipment	5.9	3.1	0.20	0.01
26-machine tools, parts and accessories	4.6	2.9	0.16	0.01
27-rolling stock and vehicles	25.0	13.2	0.86	0.03
28-other steel-mill products (excluded item 20)	19.6	119.6	0.68	0.27
29-molasses, edible	8.6	454.3	0.30	1.04
30-menthol	17.1	1.6	0.60	0.00
31-essential oils	10.4	4.9	0.4	0.01
32-vegetable and fruit juices	36.9	79.1	1.27	0.18
33-cotton fabrics	11.0	8.9	0.38	0.02
34-glass and glassware	14.2	22.3	0.48	0.05
35-other manufactured goods	165.6	856.8	5.70	1.96

TABLE III-4.--Continued.

	1971		Participation in Total Exports (%)	
	US$ Millions FOB	1,000 Tons	US$ Millions FOB	1,000 Tons
B: Basic products, raw materials	1987.9	40342.2	68.46	92.05
C: Ship-chandler's supplies	22.2	217.7	0.77	0.50
D: Re-exports	6.1	184.1	0.21	0.42
E: Special Transactions	65.3	37.6	2.25	0.08

Source: CACEX/NUCEX, Banco do Brasil. The classification of manufactured and semiprocessed goods is a combination of the criteria adopted by INTAL (1966-1967) and UNCTAD (1965).

(narrow definition). The U.S. percentage share of Brazil's manufactured products reached a peak of 36 percent in 1968 and then declined to 21 percent in 1970, whereas the share of EEC and several other countries increased.[12]

Effects on Exports of Non-Manufactured Products

The effects of the minidevaluations also were apparent on exports of products other than manufactured

[12]The data of this paragraph and of Table III-5 are based on the classification of manufactures used by CACEX during 1971 and published in the Boletim (Banco do Brasil), 6 (1971). In 1972, CACEX started to use another one, the broader classification of Table III-4.

TABLE III-5.--Brazil's Exports of Manufactures to Different Markets 1965-1970 (US$1,000 FOB).

	1965		1966		1967		1968		1969		1970	
Region	US$	%	US$	%	US$	%	US$	%	US$	%	US$	%
Total	155,980	100.00	154,120	100.00	209,204	100.00	204,091	100.00	287,802	100.00	452,265	100.00
U S A	35,465	22.74	53,219	34.53	15,424	36.05	71,351	34.97	79,920	27.77	93,881	20.76
Canada	1,353	0.87	3,767	2.44	2,369	1.13	4,762	2.33	5,771	2.01	12,565	2.78
LAFTA	81,971	52.56	61,584	39.96	70,541	33.72	73,764	36.14	110,416	38.36	156,302	34.56
Other American countries	1,801	1.15	2,045	1.33	3,882	1.86	2,313	1.13	3,042	1.06	8,588	1.90
E E C	22,078	14.15	19,804	12.85	25,255	12.07	29,500	14.45	55,252	19.20	92,393	20.42
E F T A	3,964	2.54	7,756	5.03	9,222	4.41	12,132	5.94	17,574	6.10	29,895	6.62
Eastern Europe	1,289	.83	921	0.60	5,158	2.46	1,296	0.64	1,894	0.65	7,341	1.62
Other European countries	453	.29	1,053	0.68	730	0.35	696	0.34	1,790	0.62	8,309	1.84
Japan	2,126	1.37	250	0.17	10,284	4.92	2,812	1.38	3,479	1.21	11,451	2.53
Other Asian countries	3,407	2.18	2,831	1.83	5,190	2.48	4,005	1.96	5,371	1.87	11,218	2.48
Africa	1,903	1.22	781	0.51	872	0.42	1,113	0.55	2,522	0.88	19,039	4.21
Oceania	160	.10	109	0.07	277	0.13	347	0.17	771	0.27	1,283	0.28

Source: Boletim Banco do Brasil, 6, No. 2 (1971); CACEX.

goods. Total Brazilian exports, mostly raw materials and food products, did not show any progress from 1960 to 1964, during which time they fluctuated around an average of US$1,412 million dollars. From 1965 to 1968, total exports began to show a positive upward trend despite a moderate setback in 1967. After 1968, however, under the policy of minidevaluations and with the accumulation of all incentives for export, total exports boomed. The relatively exceptional levels of US$2,904 millions in 1971 and US$3,990 millions in 1972 were reached. As shown in Table III-6, Brazil's share in world exports, which had slipped from almost 3 percent in 1946 to a low of 0.88 percent in 1968, began to recover the ground lost after the minidevaluations and surpassed the 1 percent mark in 1972. Brazil's share in exports of less developed countries had suffered a considerable decline from about 10 percent in 1946 to 4.3 percent in 1968, but it has shown some improvement in the past four years and reached about 5.1 percent in 1972.

Basic or nonindustrialized products also contributed substantially to this growth in export. Table III-7 shows the export value of Brazil's main basic products from 1964 to 1972 according to the classification by CACEX adopted in 1971. Table III-8 shows the export performance of the same products in index numbers (base 1964 = 100). In spite of fluctuations that occurred in the export dollar revenue of some commodities such as coffee and

TABLE III-6.--Brazil's Total Exports and Shares in World Exports and in Exports of Less Developed Countries, 1946-1972.

Year	Total Exports US$ Million	Share of World Exports (%)	Share of Total Exports of Less Developed Countries (%)
1946	985	2.90	10.04
1947	1154	2.29	8.34
1948	1185	2.20	7.38
1949	1030	2.30	7.21
1950	1355	2.46	7.74
1951	1769	2.36	7.97
1952	1418	1.96	7.27
1953	1539	2.38	8.80
1954	1562	2.04	7.51
1955	1423	1.71	6.38
1956	1482	1.60	6.31
1957	1392	1.40	5.82
1958	1243	1.31	5.31
1959	1282	1.27	5.25
1960	1269	1.13	4.86
1961	1403	1.19	5.33
1962	1214	0.98	4.34
1963	1406	1.04	4.63
1964	1430	0.94	4.29
1965	1595	0.97	4.52
1966	1741	0.96	4.53

TABLE III-6.--Continued.

Year	Total Exports US$ Million	Share of World Exports (%)	Share of Total Exports of Less Developed Countries (%)
1967	1654	0.98	4.71
1968	1881	0.88	4.37
1969	2311	0.95	4.76
1970	2739	0.98	5.06
1971	2904	0.93	4.78
1972	3990	1.1 (est.)	5.1 (est.)

Source: International Financial Statistics (IMF), various years; and CACEX, Banco do Brasil. The total world exports shown in the IMF publication exclude the Council for Mutual Economic Assistance countries, Mainland China, North Korea, North Viet-Nam, and Cuba.

cotton--due to many exogeneous factors such as weather conditions and world demand and supply movements and controls--the overall export performance of basic products during the 1968-1972 period was excellent. The index of total basic exports increased from 100 in 1964 to 122 in 1968, with one downward movement in 1967. After 1968 the index increased continuously and reached 233 in 1972. From 1964 to 1968 the compounded annual rate of growth of total basic exports was 5 percent, and from 1968 to 1972 it was about 18 percent.

The export index number of practically all main basic exports in 1971 was much higher than in 1968. The

TABLE III-7.--Export Values of Most Important Basic Exports of Brazil (FOB US$1,000,000).

	1964	1965	1966	1967	1968	1969	1970	1971	1972
Total Basic Exports	1226.0	1311.0	1448.0	1311.0	1500.0	1816.0	2074.0	2082.0	2356.0
Green coffee	759.7	706.6	764.0	704.7	774.5	813.0	939.3	772.5	
Iron ore	80.6	103.0	100.2	102.8	105.5	147.4	209.6	237.3	
Sugar	33.0	55.0	80.5	80.4	101.6	115.0	126.5	146.6	
Cotton-wool	108.3	95.7	111.0	90.8	130.8	196.0	154.4	137.1	
Cocoa	34.8	27.7	50.7	59.2	46.1	105.5	77.7	61.7	
Beef, chilled or frozen	11.6	24.4	12.9	6.7	20.2	41.6	69.6	98.7	
Corn	2.9	27.9	31.4	22.0	57.0	32.9	80.6	75.4	
Soybean cake and bran	3.0	7.7	14.6	10.2	18.9	23.4	43.6	81.5	
Other basic exports	192.1	263.0	282.7	234.2	245.4	341.2	372.7	471.2	
Total Exports	1429.8	1595.2	1741.4	1654.0	1881.3	2311.2	2738.9	2903.6	3990.0

Source: CACEX/NUCEX, Banco do Brasil.

TABLE III-8.--Performance Indexes of Brazilian Basic Exports (Base year 1946 = 100).

	1964	1965	1966	1967	1968	1969	1970	1971	1972
Total Basic Exports	100	106.9	118.1	106.9	122.3	148.1	169.2	169.8	233
Green coffee	100	93.0	100.6	92.8	101.9	107.0	123.6	101.7	
Iron ore	100	127.8	124.3	127.5	130.9	182.9	260.0	294.4	
Sugar	100	166.7	243.9	243.6	307.9	348.5	383.3	444.2	
Cotton-wool	100	88.4	102.5	83.8	120.8	181.0	142.6	126.6	
Cocoa	100	79.6	145.7	170.1	132.5	303.0	223.3	177.3	
Beef, chilled or frozen	100	210.3	111.2	57.8	174.1	358.6	600.0	850.9	
Corn	100	962.0	1182.8	758.6	1965.6	1134.5	2779.3	2600.0	
Soybean cake or bran	100	256.7	486.7	340.0	630.0	780.0	1453.3	2716.7	
Other basic exports	100	136.7	147.2	121.9	127.7	177.6	194.0	245.3	
Total Exports	100	111.6	121.8	115.7	131.6	161.6	191.6	203.1	279

Source: Brasil, Foreign Trade 1971, CACEX/NUCEX, Banco do Brasil.

only exception was coffee, but this was due to the 1969 frost. In 1972 coffee exports performed almost as well as in the high years of 1969 and 1970. Wide price fluctuations, however, due to weather conditions and other factors, always have characterized primary products trade. Table III-9 illustrates those wide fluctuations in the price indexes of some Brazilian basic export goods in the period of 1964-1971. Cocoa, in particular, has shown the most violent variations in prices from year to year.

To diminish the risk facing any country which depends on a limited number of commodities subject to great price fluctuations, Brazil has been moving in the right direction by diversifying its exports. This is most dramatically illustrated by the case of coffee. During the 1950s, coffee's contribution to Brazil's total exports amounted to an annual average of 62 percent. This share decreased to 27 percent in 1971. Table III-10 shows the export share of major basic export goods during 1964-1971. Iron ore, sugar, beef, corn, and soybeans are some of the primary products which have substantially widened their share of total Brazilian exports in recent years.

Concluding Overall Evidence Concerning Total Exports

It was shown that exports of both industrialized and basic products have improved substantially since August 1968, during which time the policy of minidevaluations was in effect. In summarizing this evidence, three types of

TABLE III-9.--Price Indexes of Some Basic Export Goods Dollar Price (Base period: 1965-1967 = 100).

	1964	1965	1966	1967	1968	1969	1970	1971
Green coffee	110	113	98.1	91.1	90.7	93.3	127	
Sugar	166	94.8	102	102	126	132	142	
Cotton	104	102	98.2	100	110	93.1	93.9	
Cocoa	108	69.8	105	120	141	204	150	123
Iron ore	108	106	101	94.0	90.6	89.7	97.5	

Source: Conjuntura Econômica, 27 (March 1973), 130.

results regarding total Brazilian exports will be described below.

First, Figure III-2 gives moving quarterly averages of the (monthly) dollar value of total Brazilian exports from 1964 to 1972. Two linear functions relating total exports and time are adjusted to the series of data for the period previous to the minidevaluation policy (from January 1964 to August 1968) and for the period of the minidevaluation policy (from August 1968 to 1972). Whereas the slope of the first function denotes moderate improvement in exports in the first period, the slope of the second function clearly indicates the exceptional rate of growth in exports that occurred in the second period.

Second, the substantial increase in diversification attained by Brazilian exports in recent years is illustrated

Figure III-2.--Total Brazilian Exports, Quarterly Moving Averages, US$ millions FOB, 1964-1972.

Note: The regressions were calculated with approximate monthly data taken from a figure published in Exportação 1947-1972, CACEX, Banco do Brasil.

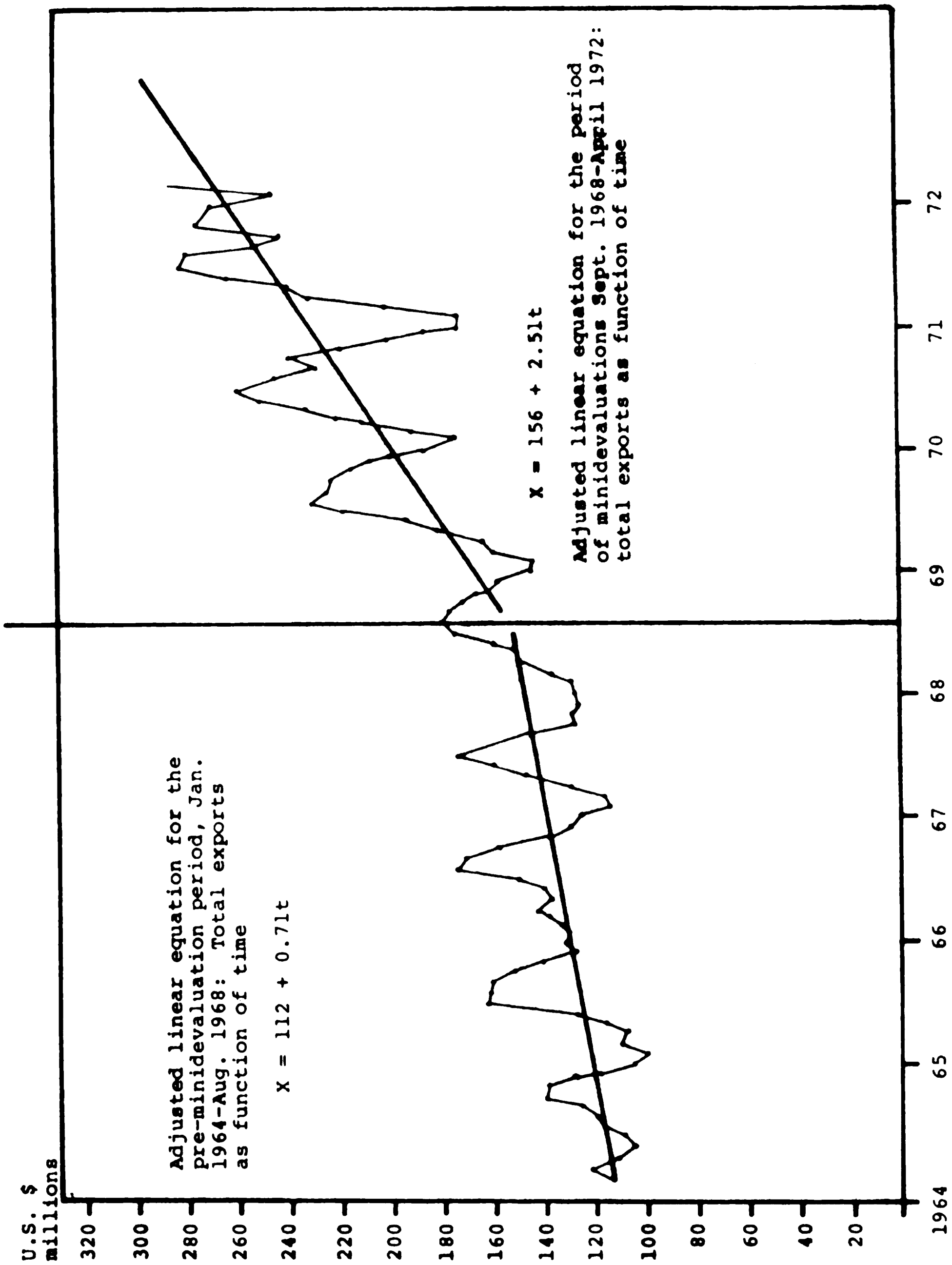

U.S. $
millions
320
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
1964
65
66
67
68
69
70
71
72
Adjusted linear equation for the
pre-minidevaluation period, Jan.
1964-Aug. 1968: Total exports
as function of time
X = 112 + 0.71t
X = 156 + 2.51t
Adjusted linear equation for the period
of minidevaluations Sept. 1968-April 1972:
total exports as function of time

TABLE III-10.--Share of Major Basic Export Goods in Total Brazilian Exports 1964-1971.

	1964	1965	1966	1967	1968	1969	1970	1971
Total Basic Exports	85.7	82.2	83.2	79.3	79.7	78.6	75.7	71.7
Green coffee	53.1	44.3	43.7	38.0	41.2	36.6	35.8	26.6
Iron ore	5.6	6.4	5.7	5.5	5.6	6.3	7.7	8.1
Sugar	2.3	3.5	4.6	4.5	5.4	5.0	4.6	5.0
Cotton	7.5	6.0	6.3	4.9	6.9	8.4	5.6	4.7
Cocoa	3.2	2.5	4.1	4.5	2.5	4.6	2.8	2.1
Beef, chilled or frozen	0.8	1.5	0.7	0.4	1.1	1.8	2.5	3.4
Corn	0.2	1.7	1.8	1.3	3.0	1.4	2.9	2.6
Soybean cake or bran	0.2	0.4	0.8	0.6	1.0	1.0	1.6	2.8
Other basic exports	13.4	11.5	16.2	14.2	13.04	14.8	13.6	16.2
Total Exports	100	100	100	100	100	100	100	100

Source: Brasil, Foreign Trade 1971, CACEX/NUCEX, Banco do Brasil.

in Tables III-11 and III-12. These tables classify all export goods according to ten different sectors. Table III-11 shows that, in terms of index numbers, all ten sectors showed remarkable growth from 1968 to 1971, in general much greater than that obtained from 1964 to 1968. As some of the sectors, such as animal products, products of chemical and allied industries, mineral products, manufactures of base metals, electrical machinery and appliances, and "other products" presented very high rates of growth, their percentage share in total exports rose to more prominent positions. As a result, the export composition in 1971 already was substantially modified with respect to that of 1968. Vegetable products, in particular, in spite of a 20 percent increase in exports in those four years, had their participation in total exports reduced from 68 percent in 1968 to 53 percent in 1971.

Third, Table III-13 gives evidence of the increasing market diversification obtained by Brazilian exports. In particular, the concentration of goods sent to the U.S. market has diminished substantially. The U.S. share of total Brazilian exports dropped from an average of 33 percent during 1964-1968 to 26 percent in 1969-1971. This is a continuation of a postwar trend which has accompanied the movement away from dependence on coffee. The average U.S. share of Brazilian exports during the 1950s was 46 percent when coffee's share in total exports was 57 percent.

TABLE III-11.--Brazilian Exports by Sectors, 1964-1972 (Index Numbers Base: 1964=100.

Sectors	1964	1965	1966	1967	1968	1969	1970	1971	1972
Total	100	111.6	121.8	115.7	131.6	161.6	191.6	203.1	279
1. Live animals and animal products	100	200.6	179.2	134.4	213.0	359.3	434.1	681.2	
2. Vegetable products	100	106.9	122.5	115.4	130.1	147.4	168.3	155.8	
3. Animal and vegetable oils, fats and waxes	100	116.1	99.9	99.9	134.9	161.8	176.3	207.6	
4. Textile and textile articles	100	85.6	98.8	78.6	101.4	144.8	127.6	127.3	
5. Products of chemical and allied industries	100	117.9	178.0	200.0	214.8	271.3	307.0	457.4	
6. Mineral products	100	134.5	133.5	123.8	134.7	179.9	262.3	293.9	
7. Base metals and articles of base metals	100	266.7	135.7	288.4	200.4	304.0	632.2	380.7	

8. Machinery and mechanical appliances, electrical equipment, parts thereof	100	199.8	260.6	318.1	344.2	493.0	760.2	970.0
9. Vehicles, aircraft, and parts thereof, vessels and certain associated transport equipment	100	97.7	68.9	124.1	52.2	91.8	199.4	334.5
10. Other products	100	90.6	84.8	117.7	114.7	189.0	307.0	865.5

Source: _Brasil, Foreign Trade 1971_, CACEX/NUCEX, Banco do Brasil.

TABLE III-12.--Brazilian Exports by Sectors, Percentage Share in Total Exports 1964-1971.

Sectors	1964	1965	1966	1967	1968	1969	1970	1971	1972
1. Live animals and animal products	2.83	5.09	4.17	3.29	4.58	6.29	6.42	9.50	
2. Vegetable products	69.10	66.18	69.47	68.92	68.30	62.99	60.71	53.01	
3. Animal and vegetable oils, fats and waxes	3.00	3.13	2.46	2.59	3.08	3.01	2.76	3.07	
4. Textile and textile articles	12.73	9.76	10.32	8.65	9.81	11.40	8.47	7.98	
5. Products of chemical and allied industries	0.60	0.64	0.88	1.04	0.98	1.01	0.96	1.35	
6. Mineral products	7.47	8.99	8.18	7.98	7.64	8.30	10.22	10.80	
7. Base metals and articles of base metals	1.24	2.97	1.38	3.10	1.89	2.34	4.10	2.33	

8. Machinery and mechanical appliances, electrical equipment, parts thereof	0.76	1.35	1.62	2.08	1.98	2.31	3.00	3.61
9. Vehicles, aircraft, and parts thereof, vessels and certain associated transport equipment	0.52	0.46	0.30	0.56	0.21	0.30	0.54	0.86
10. Other products	1.76	1.43	1.22	1.79	1.53	2.05	2.82	7.49

Source: Brasil, Foreign Trade 1971, CACEX/NUCEX, Banco do Brasil.

TABLE III-13.--Brazilian Exports to Different Economic Regions, Percentage Participation of Each Region, 1964-1971.

Regions	1964	1965	1966	1967	1968	1969	1970	1971
U S A	33.2	32.6	33.4	33.1	33.3	26.4	24.7	26.2
Canada	1.5	1.6	1.3	1.0	1.4	1.2	1.5	1.5
LAFTA	9.7	12.61	10.8	9.7	10.3	11.0	11.1	12.2
Other American countries	0.1	0.1	0.3	0.3	0.2	0.3	0.7	0.7
E E C	26.0	25.8	24.7	27.3	25.5	29.6	28.1	27.3
E F T A	12.8	13.1	13.1	12.5	11.7	12.4	12.8	10.3
Eastern Europe	6.2	6.4	7.1	7.0	7.1	6.3	5.2	4.4
Other Western European countries	4.3	2.3	2.1	2.1	3.1	3.5	4.7	5.0
Japan	1.9	1.9	2.4	3.4	3.1	4.5	5.3	5.5
Other Asian countries	2.2	1.8	3.2	1.7	2.1	3.4	3.5	3.4
Africa	1.7	1.5	1.4	1.8	2.0	1.1	2.2	2.4
Oceanic	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.2

Source: Brasil, Foreign Trade, 1971, CACEX-NUCEX, Banco do Brasil.

The movement away from coffee dependence accelerated after 1968, along with concomitant market diversification. The European Economic Community, "other European countries" (aside from the EEC and EFTA), and Japan and other Asian countries have gained most in their shares of Brazilian exports in the past four years. The share of the Latin American Free Trade Association increased moderately, from a 10.6 percent average in 1964-1968 to an 11.4 percent average in 1969-1971. In the whole group of Third World countries, however, a substantial increase is shown, from an average share of 14.7 percent during 1964-1968 to 17.3 percent during 1969-1971.

CHAPTER IV

ECONOMETRIC ANALYSIS OF THE EFFECTS OF MINIDEVALUATIONS ON INDUSTRIAL EXPORTS

As analyzed in Chapter III, there are indications that Brazilian exports have been positively affected by the policy of frequent small adjustments in the exchange rate. Theoretically, the main reason for this beneficial influence is the substantial decrease in risk which characterized exporter remuneration under the previous system of wide fluctuations in the exchange rate.

The use of econometric methods to prove this theory has not been successful to date. Tyler's attempts were inconclusive (page 88 above). The major concern of this chapter is to perform a better test of the effects of minidevaluations on the export of manufactured products.

The first section of this chapter discusses a method for testing the effect of minidevaluations. The second section presents the regression analysis of exports of manufactures.

The Method for Testing the Effects of Minidevaluations

A method for testing the equality of two regression equations--one for the pre-minidevaluation period and another for the minidevaluation period--is applied several times in this dissertation. It is explained here by using Jan Kmenta's exposition.[1] Consider a regression equation,

$$Y_i = \beta_1 + \beta_2 X_{i2} + \beta_3 X_{i3} + \text{---} + \beta_k X_{ik} + \varepsilon_i,$$

which has been estimated for a sample of n observations. Suppose now that m (>K) additional observations are obtained and that one wishes to test the hypothesis that the additional observations come from the same population as the first n observations. For example, suppose that the first n observations are from the period of wide and unexpected fluctuations in the exchange rate and that the m additional observations come from the period during which the minidevaluations were in effect. If it is expected that the parameters of, say, the export supply function during the minidevaluation period may be different from those of the pre-minidevaluation period, the null hypothesis that the parameters of the export supply function have not changed may be tested. To exemplify:

---

[1]Jan Kmenta, Elements of Econometrics (New York: The Macmillan Company, 1971), pp. 373-4.

$$Y_i = \beta_1 + \beta_2 X_{i2} + \beta_i X_{i3t} + --- + \beta_k X_{ik} + \varepsilon_i$$

$$(i = 1,2, ---, n),$$

and

$$Y_i = \lambda_1 + \lambda_2 X_{i2} + \lambda_3 X_{i3} + --- + \lambda_k X_{ik} + \varepsilon_i$$

$$(i = n + 1, n + 2, ---, n + m).$$

The null hypothesis, then, is

$$H_o: = \beta_1 = \lambda_1, \beta_2 = \lambda_2, ---, \beta_k = \lambda_k .$$

This is to be tested against the hypothesis that H_o is not true. The relevant test statistic is obtained by applying the least-squares estimation method to the first set of data ($i = 1,2, ---, n$), to the second set of data ($i = n + 1, n + 2, ---, n + m$), and to the two sets of data combined ($i = 1, 2, ---, n + m$). For the combined set of data, the regression equation is:

$$Y_i = \delta_1 + \delta_2 X_{i2} + \delta_3 X_{i3} + --- + \delta_k X_{ik} + \varepsilon_i$$

$$(i = 1, 2, ---, n + m)$$

The sum of squares of the least-squares residuals then can be denoted as:

$$SSE_1 = \sum_{i=1}^{m} (Y_i - \hat{\beta}_1 - \hat{\beta}_2 X_{i2} - \hat{\beta}_3 X_{i3} - \text{---} - \hat{\beta}_k X_{ik})^2,$$

$$SSE_2 = \sum_{i=n+1}^{n+m} (Y_i - \hat{\lambda}_1 - \hat{\lambda}_2 X_{i2} - \hat{\lambda}_3 X_{i3} - \text{---} - \hat{\lambda}_k X_{ik})^2,$$

$$SSE_c = \sum_{i=1}^{n+m} (Y_i - \hat{\delta}_1 - \hat{\delta}_2 X_{i2} - \hat{\delta}_3 X_{ie} - \text{---} - \hat{\delta}_k X_{ik})^2,$$

where the circumflexes over the coefficients indicate that these are the estimated ones. The appropriate statistic to test H_o is then

$$\frac{(SSE_c - SSE_1 + SSE_2) \ /K}{(SSE_1 + SSE_2)/(n + m - 2k)} \sim F_{k,\ n + m - 2k}.$$

This test statistic is applicable only if the number of additional observations exceeds the number of parameters to be estimated, that is, if $m > k$. If $m < k$, G. C. Chow and, alternatively, F. M. Fisher, have shown that the appropriate test is as follows.[2] To the first n observations fit the least-squares regression

$$Y_i = \beta_1 + \beta_2 X_{i2} + \beta_3 X_{i3} + \text{---} + \beta_k X_{ik} + \varepsilon_i$$

---

[2] G. C. Chow, "Tests of Equality Between Sets of Coefficients in Two Linear Regressions," Econometrica, Vol. 28, pp. 591-605, 1960; and F. M. Fisher, "Tests of Equality Between Sets of Coefficients in Two Linear Regressions: An Expository Note," Econometrica, Vol. 38, pp. 361-6, 1970. See J. Johnston, Econometric Methods, 2nd Ed. (New York: McGraw-Hill Book Company, 1972), p. 207.

and compute the sum of squares of least-squares residuals SSE_1. Then, to the pool of n + m sample observations fit the least-squares regression

$$Y_i = \delta_1 + \delta_2 X_{i2} + \delta_3 X_{i3} + --- + \delta_k X_{ik} + \varepsilon_i,$$

again computing the sum of the squares of residuals SSE_c. The test of the null hypothesis that the m additional observations obey the same relation as the first is given by

$$\frac{(SSE_c - SSE_1)/m}{(SSE_1/(n - k)} \sim F_{m,n-k} \, .$$

The formulation of the hypothesis leading to these F statistics allows for all of the regression parameters to change from one set of data to another. To test an hypothesis involving only some of the regression coefficients requires use of binary or dummy variables.

Regression Analysis of Exports of Manufactures

Inasmuch as Brazilian exports of industrial goods constitute a very small percentage of total world trade in this category, the world demand encountered by Brazilian industrial exporters may be considered as perfectly elastic. This facilitates the task of estimating an export supply function for these goods.

In Tyler's formulation,[3] the constant-dollar value of exports of industrial goods is positively related to both the level of real remuneration to exporters and to the level of world trade (proxy for world income) and negatively related to the level of capacity utilization of Brazil's industry. The index of real remuneration to exporters of manufactures is the product of two components: the index of the real exchange rate adjusted to dollar inflation and the index which denotes the level of fiscal incentives for exports of manufactures. Tyler preferred to use these two latter indexes as two separate independent variables instead of simply their product. There is an argument, however, for using the index of real remuneration to exporters. This should be the most relevant variable in affecting the decision of exporters. As the product of the other two, it is clear that a drop in one of the variables may be compensated by a rise in the other. The individual effect of either one of the two depends substantially on the behavior of the other.

There is one difficulty in interpreting the influence of industrial capacity utilization on exports of industrial goods. During 1961-1968, when Brazil was passing through great fluctuations in economic activity and exports of industrial goods were in their first and uncertain stage of development, a clear negative relation obtained between intensive use of industrial capacity--as

---

[3]See page 89 above.

a sign of a high level of domestic demand--and exports of manufactures. After 1968 the Brazilian economy entered a period of high economic activity and growth which was partly due to the expansion in exports. Thus, this expansion contributed significantly to the greater, if not full, utilization of industrial capacity. Therefore, the negative sign between the proxy for capacity utilization and exports found by Doellinger and Tyler might be reversed when the years 1968-1972 constitute a substantial portion of the period under study.[4] Moreover, if this is the case, the index of capacity utilization should lose its significance as an independent explanatory variable in the export supply function.

As a point of departure based on the above rationale, variants of two competing models of the Brazilian industrial export supply function will be tested with the use of quarterly data from 1964 to 1972:

$$\log X_{1t} = \beta_1 + \beta_2 \log X_{2t} + \beta_3 \log X_{3t} + \beta_4 \log X_{4t} + \beta_5 X_{5t} + \varepsilon_t; \qquad \text{(I)}$$

$$\log X_{1t} = \beta_1 + \beta_2 \log X_{6t} + \beta_4 \log X_{4t} + \beta_5 X_{5t} + \varepsilon_t \qquad \text{(II)}$$

---

[4]This interpretation is supported by the following: the simple correlation coefficient between log X_{1t} and X_{5t} is negative, equal to -.53, for the period 1964-1968, and positive, equal to .79, for the period 1968-1972, a dramatic change (See Table IV-1). For Doellinger's and Tyler's results see pages 81 and 85 above.

Variants of these models will allow for the deletion of variables which might show insignificance, particularly in the case of X_{5t}, and for different forms of lags in the response of exports to changes in the level of real remuneration to exporters.

The definitions of all variables and their sample means and simple correlation coefficients with the dependent variable are shown in Table IV-I. These last two items are shown for three different periods: (1) pre-minidevaluation: first quarter of 1964 to second quarter of 1968; (2) minidevaluations: second quarter of 1968 to second quarter of 1972; and (3) combined: first quarter of 1964 to second quarter of 1972. The methods, sources, and problems faced in collecting data for all variables are discussed in Appendix B.

Below, a search is made for the models which show the best fit. This includes the test of a model with a geometric lag distribution and of models with simpler lagged forms concerning the response of exports to changes in the real remuneration to exporters. The method to test the effects of minidevaluations discussed in the first section of this chapter is applied to the best fit models.

Testing of Competing Models

Equation 1 in Table IV-2 shows the estimation of Model (I) for 33 observations from the first quarter of 1964

TABLE IV-1.--Variables Used in Regression Analysis of Exports of Manufactures. Definitions, Sample Means and Correlation Coefficients.

	Mean			Simple Correlation Coefficient Between log X_t and the Variable			
Variable	1st Qr. 64- 2nd Qr. 68	3rd Qr. 68- 2nd Qr. 72	1st Qr. 64- 2nd Qr. 72	1st Qr. 64- 2nd Qr. 68	3rd Qr. 68- 2nd Qr. 72	1st Qr. 64- 2nd Qr. 72	
log X_{1t}	7.55	7.93	7.73	1.00	1.00	1.00	Logarithm of the constant dollar value of Brazil's exports of manufactures (excluding semimanufactures) according to new CACEX classification. Current dollar values were deflated by the United States wholesale-price index for all commodities.*
log X_{2t}	2.01	2.00	2.01	- .29	.69	- .13	Logarithm of the index of the real-exchange rate for industrial exports adjusted for dollar inflation. The nominal official purchase-exchange rate was deflated by the Brazilian wholesale-price index for industrial goods and the result was adjusted for dollar inflation by use of the United States wholesale-price index for all commodities.**
log X_{3t}	2.07	2.16	2.11	.80	.91	.90	Logarithm of the index which denotes the level of fiscal incentives for exports of manufactures.
log X_{4t}	11.26	11.42	11.33	.83	.94	.95	Logarithm of the real value of total world imports (proxy for world income). Current dollar values were deflated by the world-trade price index.

X_{5t}	-14.37	6.02	-4.48	- .53	.79	.67	Proxy for capacity utilization (residuals from time-trend regression of Brazilian Industrial Production).
$\log X_{6t}$	2.08	2.16	2.12	.61	.89	.89	Logarithm of index of real remuneration to exporters of manufactures, equal to log $(X_{2t} \cdot X_{3t})$.
ε_t	2.08	2.16	2.12	.61	.89	.89	Disturbance term.

*The United States wholesale-price index for all commodities reflects better the prices of tradable goods than an alternative deflator such as the consumer price index which includes many non-tradables (public services, for example).

$$^{**}X_{2t} = \frac{\text{Index of official purchase exchange rate}}{\text{Brazil's wholesale industrial price index}} \times \text{USA wholesale price index.}$$

In this form, the price that the exporter receives is adjusted to both internal and external inflation.

TABLE IV-2.--Regression Analysis to Explain the Behavior of Brazilian Exports of Manufactures (X_{1t}). Ordinary Least Squares Regressions with log X_{1t} as the Dependent Variable; 33 Quarterly Observations from 1st Quarter of 1964 to 2nd Quarter of 1972 (2nd Quarter 1964 deleted due to Unusual Political Events).

	Eq. 1	Eq. 2	Eq. 3	Eq. 4
Constant	-21.837	-17.024	-16.058	-15.590
log X_{2t}	.969 (1.610) (.119)			
log X_{3t}	.362 (.368) (.716)			
log X_{6t}		.872 (1.514) (.141)		.311 (.454) (.654)
log $X_{6(t-1)}$			1.028 (2.097) (.045)	.874 (1.450) (.158)
log X_{4t}	2.370 (3.680) (.001)	2.021 (5.887) (<0.0005)	1.908 (5.956) (<0.0005)	1.837 (5.100) (<0.0005)
X_{5t}	.0004 (.263) (.794)	.0008 (.687) (.497)	.001 (.971) (.339)	.001 (.8932) (.379)
R^2	.914	.913	.918	.919
$\bar{R}^2$	.902	.904	.910	.907
F	74.552	101.354	108.821	79.432
Sig.	<0.0005	<0.0005	<0.0005	<0.0005
D.W.	1.12	1.07	1.13	1.12

The Durbin-Watson statistic values are not conclusive as to the presence of autoregression. The definitions of the variables are in Table IV-1. The numbers in parentheses under each coefficient are the t-values and the significance levels of the estimated coefficients, respectively, in that order.

to the second quarter of 1972.[5] The overall significance (<0.0005) and the coefficient of determination ($R^2 = .91$) indicate that the sample regression line fit the observations well. All of the coefficients, except that of the proxy for capacity utilization (X_{5t}), possess theoretically correct signs. Exports of manufactures show rather low elasticity coefficients with respect to the exchange rate (X_{2t}) and fiscal incentives (X_3) and a relatively higher elasticity coefficient with respect to the proxy for world income (X_{4t}). The coefficient of log X_{2t} shows some significant (.12), but that of log X_{3t} is highly insignificant (.72); that of log X_{4t} has the highest level of significance ($<.0005$), and that of X_{5t} is highly insignificant (.79).

Similar results are obtained in Equation 2, also shown in Table IV-2, where the variable X_{6t}, the product of X_{2t} and X_{3t}, replaces these two. The coefficient of determination corrected for degrees of freedom ($\bar{R}^2 = .904$) is slightly greater than that obtained for Equation 1 ($\bar{R}^2 = .902$). The coefficient of the index of real remuneration to exporters is significant at the 14 percent level. These last two results indicate that X_{6t} should be preferred to the separate use of X_{2t} and X_{3t}. This conclusion is enhanced by the examination of results of Equations 3 and

[5]The second quarter of 1964 was deleted due to unusual political events (dock strikes and the military take over on the 31st March 1964).

4, where lagged values of X_{6t} are considered, shown in the same table.

Equation 3 shows the highest coefficient of determination corrected for degrees of freedom ($\bar{R}^2 = .91$) of all four equations in Table IV-2. The elasticity coefficient with respect to the lagged value of the index of real remuneration to exporters is close to unity and is significant at less than the 5 percent level. The proxy for world income, again, is highly significant, and the proxy for capacity utilization is highly insignificant.

The results of Table IV-2 concerning the significance of variable X_{5t}, the proxy for capacity utilization, confirm the expectation that this variable should not be considered as one that explains the behavior of industrial exports in the period under study. Accordingly, X_{5t} is deleted in the following regression models.

The Use of a Distributed Lag Model

One difficult econometric problem is the estimation of the form of lagged effects. In the case of exports of manufactures, the previous levels of real remuneration to exporters may be assumed to be quite important in forming their expectations as to the current levels of remuneration. Inasmuch as it takes time to invest, to produce, and to organize the sale of goods abroad, a lag occurs in the effects of X_6 (or alternatively of X_2 and X_3) on X_1. The stability in the level of X_6 is also expected to have an important effect on X_1.

The following distributed-lag model will be used to test both the form and influence of X_6 on X_1 before and during the period when minidevaluations were in effect:

$$\log X_{1t} = \alpha + \beta \log X_{6t} + \beta_1 \log X_{6(t-1)} + \beta_2 \log X_{6(t-2)}$$

$$\beta_3 \log X_{6(t-3)} + --- + \varepsilon_t' \qquad \text{(III)}$$

where the value of exports of manufactures is dependent on the current and past values of real level of remuneration to exports. ε_t is the disturbance term. Although X_4, the proxy for world income, was shown to be significant in the equations examined so far, it was omitted here for reasons of simplification. Suppose that the coefficient β_j decreases exponentially over time, such that[6]

$$\beta_j = \beta \lambda^j \qquad j = 1,2 ---- \qquad \text{(IV)}$$

with λ being any value in the range $0 < \lambda < 1$. Then, Model (III) becomes:

$$\log X_{1t} = \alpha + \beta \log X_{6t} + \beta \lambda \log X_{6(t-1)} + \beta \lambda^2$$

$$\log X_{6(t-2)} + --- + \varepsilon_t \qquad \text{(V)}$$

---

[6] Ronald J. Wonnacott and Thomas H. Wonnacott, Econometrics (New York: John Wiley and Sons, Inc., 1970), pp. 145-46.

For the previous t,

$$\log X_{1(t-1)} = \alpha + \beta \log X_{6(t-1)} + \beta \lambda \log X_{6(t-2)}$$
$$+ \beta \lambda^2 \log X_{6(t-3)} + --- + \varepsilon_t \qquad \text{(VI)}$$

Multiplying (V) by λ and subtracting it from (VI), most of the terms drop out (this is the so-called "Koyck transformation"[7]) and the following expression is obtained:

$$\log X_{1t} = \lambda \log X_{1(t-1)} + \alpha (1 - \lambda) + \beta \log X_{6t} + \varepsilon_t$$
$$- \lambda \varepsilon_{t-1} \qquad \text{(VII)}$$

or

$$\log X_{1t} = \alpha^* + \lambda \log X_{1(t-1)} + \beta \log X_{6t} + \varepsilon^*_t \qquad \text{(VIII)}$$

where

$$\alpha^* = \alpha (1 - \lambda) \qquad \text{(IX)}$$

and

$$\varepsilon^* = \varepsilon_t - \lambda \varepsilon_{t-1}.$$

With the simplifying assumption in (IV), Model (III) has been brought into the manageable form (VIII),

---

[7]L. M. Koyck, Distributed Lags and Investment Analysis (Amsterdam: North-Holland Publishing Co., 1954).

the number of regressors has been reduced to two, and the problem of multicollinearity that would exist in estimating (III) largely has been overcome. A problem arises, however, if the "new" disturbance ε_t^* is largely correlated with $\log X_{1(t-1)}$. This means that the ordinary least-squares estimates of the coefficients of (VIII) might be inconsistent and that other methods of estimation should be used. To avoid this problem assume that ε_t follows a first autoregressive scheme with the coefficient of autoregression being equal to λ. In this case the least-squares estimates will be consistent.[8]

Test of Minidevaluations with a Distributed-Lag Model

Following the approach explained in the first section of this chapter, the distributed lag Model (III), in its transformed expression (VIII) was fit to quarterly observations of three different periods: (A) pre-minidevaluation: 15 observations from the third quarter of 1964 to the second quarter of 1968; (B) minidevaluation: 16 observations from the third quarter of 1968 to the second quarter of 1972; and (C) combined: 31 observations from the third quarter of 1964 to the second quarter of 1972. The results are shown as Equations 5A, 5B, and 5C in Table IV-3. From the coefficients of these equations, the coefficients of the respectively equivalent Equations

[8]Kmenta, Elements of Econometrics, pp. 479 and 485.

6A, 6B, and 6C are then computed.[9] These also are shown in Table IV-3.

The comparison of results in each period (A, B, and C) is quite interesting. For the period before August 1968, when X_{6t}, the real rate of remuneration to exporters, behaved in a very unstable fashion, the regression model (5A) was quite insignificant and presented a very poor fit ($R^2 = .23$); the elasticity coefficient of X_{6t} had the "wrong" theoretical sign, was very low (-.022), and was not significant at all (.98). For period B, however, when the mini-adjustments of the exchange rate were under effect, the equation was highly significant (<0.0005), it fitted the data well ($R^2 = .84$), the elasticity coefficient of X_{6t} became positive and was quite high (2.97) and significant at the 15 percent level. The fit for the combined period, C, was even better ($R^2 = .88$); its over-all significance was very high (<0.0005), as was that of the two variables $X_{1(t-1)}$ (<0.0005) and X_{6t} (.09). Equations 6A, 6B, and 6C show the form of the lag. In B and C, it is seen that exports of industrial goods were influenced not only by the current real remuneration to exporters but also by the level of remuneration in the previous quarters, in a declining fashion. This phenomenon occurred only when the minidevaluations were in effect.

---

[9]Formulas VIII and IX above were used in this computation.

TABLE IV-3.--Test of Effects of Minidevaluations on Exports of Manufactures (X_{1t}) with a Distributed-Lag Model. Ordinary Least Squares Regressions with Log X_{1t} as the Dependent Variable.

	Equation 5A 15 Observations	Equation 5B 16 Observations	Equation 5C 31 Observations	Equation 6A (deducted from Equation 5A)	Equation 6B (deducted from Equation 5B)	Equation 6C (deducted from Equation 5C)
	3rd Qr. 1964-2nd Qr. 1968	3rd Qr. 1968-2nd Qr. 1972	3rd Qr. 1964-2nd Qr. 1972			
Constant	4.596	- 2.868	- .440	7.67	- 6.439	- 1.753
log $X_{1(t-1)}$	.401 (1.868) (.086)	.555 (2.132) (.053)	.749 (5.682) (<0.0005)			
log X_{6t}	- .022 (- .0274) (.979)	29.688 (1.546) (.146)	1.131 (1.744) (.092)	- .022	- 2.97	- 1.13
log $X_{6(t-1)}$				- .009	1.65	0.85
log $X_{6(t-2)}$				- .001	0.91	0.63
log $X_{6(t-3)}$				- .0006	0.51	0.48
log $X_{6(t-4)}$				---	0.28	0.36
log $X_{6)t-5)}$					0.16	0.27
R^2	.231	.844	.879			
$\bar{R}^2$	.103	.820	.871			
F	1.802	35.077	101.919			
Sig.	.207	<0.0005	<0.0005			
SSE	.0685	.0775	.1871			

The definitions of the variables are in Table IV-1. The numbers in parentheses under each coefficient are the t-values and the significance levels of the estimated coefficients, respectively in that order. The Durbin-Watson test is not applicable when the place of the explanatory variable is taken by the lagged value of the dependent variable. (See Kmenta, Elements of Econometrics, p. 295.)

The test of the null hypothesis that the 16 additional observations (1968-1972) obey the same relation as the first 15 (1964-1968) now can be performed.

$$F = \frac{[SSE_c - SSE_a + SSE_b)]/k}{(SSE_a + SSE_b)/(n + m-2k)} = \frac{.186676 - (.068509 + .077467)/3}{.145976/(31-6}$$

$$= \frac{.040700}{.145976} \times \frac{25}{3} = 2.323$$

whereas

$$F_{3,25,.10} = 2.32.$$

Therefore, at the 10 percent level of significance, the null hypothesis of same relationship may be rejected; it may be concluded that the policy of mini-adjustments of the exchange rate made a significant difference in making exports of manufactures more responsive to the level of real export remuneration. But the 10 percent level of significance is not satisfactory. Searching for better fit and greater significance, models with simpler lagged forms, which also include the variable X_{4t}, are tested below for the three different periods.

Test of Minidevaluations with the Best Fitted Models

The analysis of results examined so far indicate that the best explanation of exports of manufactures might be given by a variant of Model (II) above, with the deletion of the proxy of industrial capacity utilization, X_{5t}, and with the consideration of some lag in the response of exports of manufactures to changes in the level of real remuneration to exporters, X_{6t}. There are also indications of a structural shift in the behavior of exports as a result of minidevaluations. To test the existence of this shift, the following modified variants of Model (II) were estimated for the three periods (A, pre-minidevaluations; B, minidevaluations; and C, the combined one):

$$\log X_{1t} = \beta_1 + \beta_2 \log X_{6t} + \beta_3 \log X_{4t} + \varepsilon_t, \qquad \text{(X)}$$

$$\log X_{1t} = \beta_1 + \beta_2 \log X_{6(t-1)} + \beta_3 \log X_{4t} + \varepsilon_t, \qquad \text{(XI)}$$

$$\log X_{1t} = \beta_1 + \beta_2 \log X_{6t} + \beta_3 \log X_{6(t-1)}$$

$$+ \beta_4 \log X_{4t} + \varepsilon_t. \qquad \text{(XII)}$$

In Table IV-4, Equations 7A, 7B, and 7C correspond to Model (X) regressed respectively for periods A, B, and C, Equations 8A, 8B, and 8C to Model (XI), and Equations 9A, 9B, and 9C to Model (XII).

Equations 7C, 8C, and 9C fit the quarterly data from 1964 to 1972 very well. All three yield $\bar{R}^2$ approximately equal to .91 and a very high level of significance (<0.0005). The coefficients of the explanatory variables show the correct theoretical signs and high t values,

TABLE IV-4.--Test of Effects of Minidevaluations on Exports of Manufactures (X_{1t}) with the Best Fitted Models. Ordinary Least Squares Regressions with log X_{1t} as the Dependent Variable.

	Eq. 7A	Eq. 7B	Eq. 7C	Eq. 8A	Eq. 8B	Eq. 8C	Eq. 9A	Eq. 9B	Eq. 9C
Constant	-16.559	-29.494	-17.973	-15.926	-33.06	-17.611	-15.474	-30.853	-16.911
log X_{6t}	.872	1.704	.895				.455	2.004	.388
	(1.567)	(1.117)	(1.570)				(.674)	(1.074)	(.572)
	(.139)	(.284)	(.127)				(.512)	(.304)	(.572)
log $X_{6(t-1)}$				.868	.441	.989	.640	- .503	.799
				(1.825)	(.313)	(2.026)	(1.081)	(- .304)	(1.345)
log X_{4t}	1.980	2.955	2.101	1.925	3.507	2.051	1.843	3.112	1.953
	(4.285)	(13.161)	(6.551)	(4.262)	(3.792)	(7.229)	(3.867)	(3.143)	(5.829)
	(.001)	(.003)	(<0.0005)	(.001)	(.002)	(<0.0005)	(.002)	(.008)	(<0.0005)
R^2	.730	.895	.912	.744	.886	.916	.752	.896	.917
$\bar{R}^2$	.691	.879	.906	.707	.868	.910	.695	.870	.908
F	18.918	55.491	154.512	20.296	50.487	163.069	13.154	34.441	106.385
Sig.	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
D.W.	1.69	1.55	1.07	1.62	1.64	1.13	1.68	1.56	1.12

Period A: 17 observations: first quarter 1964--second quarter 1968 (second quarter of 1964 deleted due to political events).

Period B: 16 observations: third quarter 1968--second quarter 1972.

Period C: 33 observations: first quarter 1964--second quarter 1972.

The definitions of all variables are in Table IV-1. The numbers in parentheses under each coefficient are the t-values and the significance levels of the estimated coefficients, respectively in that order. The Durbin-Watson statistic indicates presence of positive autocorrelation of residuals only in the case of Equation 7C. It is not conclusive in the case of Equations 8C and 9C, and it indicates absence of autoregression in the remaining equations.

especially in Equations 7C and 8C. The coefficients of log $X_{6(t-1)}$ in Equations 8C and 9C were, respectively, more significant than that of log X_{6t} in Equations 7C and 9C. The high t values of the coefficients of Equation 8C could lead to the conclusion that this is the best model to explain the determinants of exports of manufactures. An interesting fact, however, was discovered in the investigation of whether a structural shift had taken place in the model from period A to period B as a result of the minidevaluations. Not only exports became more elastic with respect to both the current real remuneration to exporters (X_{6t}) and world income (X_{4t}), but also X_6 had a more rapid effect on X_1 during the period under which the minidevaluations were in effect. This is clearly seen in the equations of periods A and B.

All of the six equations pertaining to periods A and B present very high over-all significance (<0.0005) and coefficients of determination (R^2) above .73. The first interesting fact to be noticed is that whereas Equation 8A provides the best fit ($\bar{R}^2 = .707$) among the three alternatives for period A, Equation 7B ($\bar{R}^2 = .879$) does the same for period B. Before the minidevaluations, exports of manufactures are relatively inelastic (elasticity close to .87) with respect to the real remuneration to exporters lagged by one quarter. In the period during which the minidevaluations become effective, exports of manufactures become elastic (elasticity close to 1.70) with respect to the current real remuneration to exporters. The comparison of coefficients of Equations 9A and 9B also confirms this analysis. Another interesting fact shown by the three equations in each period is the substantial increase in the elasticity of exports of manufactures with respect to world income from period A (around 2) to period B (around 3). The individual coefficients of log X_4 are always highly significant.

The F test statistic is then applied to the three models to check the existence of a structural shift from one period to another. The results are as follows.

For Equations 7A, 7B, and 7C:

$$F = \frac{[SSE - SSE_a + SSE_b)]/k}{(SSE_a + SSE_b)/(n+m-2k)} = \frac{.1769 - (.0703 + .0520)/3}{.1223/(17 + 16 - 6)},$$

$$F = \frac{.0546}{.1223} \times \frac{27}{3} = 4.02 > F_{3,27,.05} = 2.96.$$

For Equations 8A, 8B, and 8C:

$$F = \frac{.1684 - (.0667 + .0565)/3}{.1237/27} = \frac{.0452}{.1232} \times \frac{27}{3},$$

$$F = .3669 \times 9 = 3.30 > F_{3,27,.05} = 2.96.$$

For Equations 9A, 9B, and 9C:

$$F = \frac{.1665 - (.0645 + .0516)/3}{.1161/27} = \frac{.0504}{.1161} \times \frac{27}{3},$$

$$F = .4341 \times 2 = 3.91 > F_{3,27,.05} = 2.96.$$

The F test applied to all three models indicates that, at the 5 percent level of significance, the null hypothesis of same relationship for the two different periods may be rejected. Therefore, it may be concluded that the policy of minidevaluations made a significant difference in making exports of manufactures more responsive both to the level of real export remuneration and to the level of world income.

Conclusion

The regression analysis with quarterly data shows that minidevaluations had a positive effect on exports of manufactures. The most significant effect was to make these exports more responsive to changes in the level of real remuneration to exporters. The regression analysis with annual data, presented in Appendix C, fell short of supporting this hypothesis with strong conclusive evidence. Nevertheless, it also gave indications that exports of manufactures became more responsive to changes in the level of remuneration to exporters, both through changes in the real exchange rate and through changes in the level of fiscal incentives.

CHAPTER V

ECONOMETRIC ANALYSIS OF THE EFFECTS OF MINIDEVALUATIONS ON EXPORTS OF BASIC PRODUCTS

The data presented in Chapter III indicated that exports of most primary products performed relatively well during the period when the mini-adjustments of the exchange rate were in effect. The econometric analysis of these exports was limited because for most basic products only annual observations on both prices and values were available, and these were confined to the period 1964-1971. An aggregate export supply function for 28 basic products was estimated. For most of these products, Brazil's participation in world trade is relatively small, so that the international market price could be considered to be affected only mildly by Brazil's supply, and the foreign demand for them could be considered approximately as perfectly elastic.

Because it is far from meeting this condition, coffee was excluded from these 28 basic products. Brazil produces about one-third of the world consumption of coffee. Coffee trade is also subject to unique peculiarities, such as the Brazilian government's contribution quota (US$23.96 per exported bag of 60kg in 1972) and the regulations of the International Coffee Agreement. Furthermore, since the production cycle of coffee lasts about five years, it is too early to study properly the effects of the new exchange rate policy on coffee exports. For some of the 28 products included in the following analysis--mainly cotton, cocoa, sugar, and iron ore--Brazil is a major, but not a dominant world supplier.[1]

The Model

The following models were used to estimate the export supply of basic exports:

$$\log X_{1t} = \beta_1 + \beta_2 \log X_{2t} + \beta_3 \log X_{3t} + \beta_4 \log X_{4t} + \beta_7 X_{7t} + \varepsilon_t; \qquad \text{(I)}$$

$$\log X_{1t} = \beta_1 + \beta_6 \log X_{6t} + \beta_4 \log X_{4t} + \beta_7 X_{7t} + \varepsilon_t, \qquad \text{(II)}$$

where

X_{1t} = exports of basic products other than coffee deflated by the world-trade price index;

x_{2t} = index of real exchange rate for exports of basic products other than coffee (nominal purchase exchange rate deflated by the Brazilian wholesale price index);

---

[1]Brazil's share in international trade ranges about 5 percent for cotton, 9 percent for cocoa, 6 percent for sugar and less for other primary products. The country does not act as a large individual seller, however, for most primary commodities. There are many export agents who have a position which approximates that of perfect competitor in world trade.

X_{3t} = price index for Brazil's exports of basic products other than coffee;

X_{4t} = proxy for world income; world imports deflated by the price index for world imports;

X_{7t} = annual average of the monthly percentage variation (without sign) in the real exchange rate for exports (X_{2t}). (The number 7 was used because this variable is similar to X_{7t} used in annual regressions for industrial exports); and

X_{6t} = index of real remuneration to exporters of basic products other than coffee. It is the product of X_{2t} times X_{3t}.

The supply of basic exports is considered as a function of the real remuneration to exporters, of the proxy for world income, and of the index of fluctuations in the real exchange rate. The greater the real remuneration to exporters (X_{6t}), the greater should be the supply of exports (X_{1t}). Two factors affect the real remuneration to exporters: the index of real exchange rate for exports (X_{2t}) and the price index for exports (X_{3t}). Model (I) tests the response of exporters to the separate behavior of these two indexes. Model (II) tests the response of exporters to the product of the two indexes. Both models are similar since

$$\log X_{6t} = \log (X_{2t} \cdot X_{3t}) = \log X_{2t} + \log X_{3t}$$

Model (II) may be considered a superior formulation, however, because it is the final product, X_{6t}, that really affects the profitability of exporters, not just its separate components X_{2t} and X_{3t}. Testing the competing formulations will permit the comparison of the significance, signs, and values of the coefficients of log X_{2t} and log X_{3t} with those of log X_{6t}. The proxy for world income, X_{4t}, is also expected to have a positive effect on exports. The variable X_{7t}, the index of fluctuations in the real exchange rate, enters the function as a qualitative variable. Appendix E illustrates how this variable depicts the effects of minidevaluations. Small fluctuations in the real exchange rate mean a low degree of exchange risk to the exporter. Therefore, the smaller the value of X_{7t}, the greater should be the incentive to export.

Models (I) or (II) differ from that used by Doellinger from nontraditional basic products (see Chapter III, page 84) with respect to some variables. He had included an index of production of ten primary products and found that good harvests tend to have a significant positive effect on exports. As a price variable, Doellinger had included only the real exchange rate, not the price index, of exports. No appropriate index or production for the 28 primary products could be found. An available index based on ten main products would take into account only about one-third of the value of exports of the 28 products. On the other hand, one may assume that the production index of agricultural goods is a function mainly of their price and of weather conditions.

It was not possible to use weather conditions as a variable, but the price of all 28 basic products, which included not only agricultural but also mineral and animal products, were available and were used in a weighted form. Further discussion of each variable and the data and measurement problems are presented in Appendix D.

The Regression Results

In view of the small number of observations available one cannot expect high levels of significance for all individual coefficients. Their estimated values should not be seen as accurate elasticity values.

First, Model (I) was run to test the separate effects of changes in the real exchange rate and in the export prices during the period 1964-1971. The result is Equation 1.

$$\log X_{1t} = 6.5755 + \underset{\substack{(.8187)\\(.473)}}{.5464} \log X_{2t} + \underset{\substack{(.6900)\\(.540)}}{.5674} \log X_{3t}$$

$$+ \underset{\substack{(2.2583)\\(.109)}}{1.1716} \log X_{4t} - \underset{\substack{(-1.5756)\\(.213)}}{.0083} X_{7t}. \qquad \text{(I)}$$

8 Observations, F = 22.661 Significance .014

$R^2 = .9680$ $\bar{R}^2 = .9250$

D.W. = 2.31, does not indicate presence of autoregression.

The t values, and under them the significance values, are shown in parentheses under the respective coefficients.

The regression was significant at the 1.0 percent level and presented an excellent fit ($\bar{R}^2$ =.925). All the coefficients had the correct theoretical signs. Interestingly, the elasticity of exports of basic products with respect to the real exchange rate, X_{2t}, was exactly the same as that found by Doellinger for nontraditional basic products (see Chapter III, page 84, .054).[2] The elasticity with respect to the price of exports was also low and approximately the same, 0.57. Both were not very significant, however. Greater significance was shown by the elasticity coefficient of the proxy for world income. Its value was slightly higher than unity. Wide fluctuations in the real exchange rate had a negative impact on the growth of exports, as indicated by the sign of X_{7t}, but the significance of the coefficient, although greater than that of log X_{2t} and log X_{3t}, did not permit permit a definite conclusion.

The best fit was obtained with Model (II):

$$\log X_{1t} = -5.571 + \underset{\substack{(1.4514)\\(\ .220\ )}}{.5485} \log X_{6t} + \underset{\substack{(6.4229)\\(\ .003\ )}}{1.1828} \log X_{4t}$$

$$- \underset{\substack{(-1.9238)\\(\ \ .127\ )}}{.0082}\ X_{7t} \qquad \text{(II)}$$

[1]Doellinger's regression, however, was on quarterly data.

8 Observations, $F = 40.4975$ Significance .002

$R^2 = .9681$ $\bar{R}^2 = .9442$

D.W. = 2.31, no autoregression.

Equation (II), in spite of the small sample size, presented an excellent fit and a higher coefficient of determination ($R^2 = .9681$) than that obtained by Doellinger's best fit model ($R^2 = .85$) for nontraditional exports. Exports of basic products proved to be inelastic--the coefficient was 0.55--with respect to changes in the level of real remuneration to exporters. The elasticity coefficient of the proxy for world income was highly significant (.003), and its value was 1.2. Finally, at the 12 percent level of significance the coefficient of X_{7t} indicated that the greater the level of fluctuations in the real exchange rate, the smaller the rate of growth in exports of basic products. The simple correlation coefficient between X_{7t} and log X_{1t} during 1964-1971 was -.78. The size of the coefficient of X_{7t} is not so important and was expected to be small because it related a log value which had small range, from 8.66 to 9.02, with a nonlog value, which had a much greater range, from 0.85 to

14.1.[2] Its negative sign and its significance--quite reasonable for only 8 observations--confirmed one main hypothesis tested in this dissertation: The policy of mini-adjustments in the exchange rate had a positive effect on the Brazilian exports of basic products.

Conclusion

The very small number of observations available has limited the quality of the above econometric analysis. Nevertheless, it may be concluded that the policy of mini-adjustments in the exchange rate has had a positive impact on exports of primary products.

---

[2]The following coefficients were found when X_1 was run against the same variables in a nonlog form for the same period 1964-1971:

$$X_{1t} = 9{,}299{,}037.1953 + \underset{\substack{(1.2992)\\(\ .264)}}{4{,}253{,}861.1628}\, X_{6t} + \underset{\substack{(7.0502)\\(\ .002\ )}}{.0044}\, X_{4t}$$

$$- \underset{\substack{(-1.3410)\\(\ \ .251\ )}}{9{,}873{,}345.71}\, X_7$$

Overall F = 38.0522 Significance .002

$R^2 = .9661$ $\bar{R}^2 = .9408$

D.W. = 2.24

In this nonlog form the variable X_7 has a large coefficient, but it becomes less significant than in the log form.

CHAPTER VI

THE EFFECTS OF MINIDEVALUATIONS ON BRAZILIAN IMPORTS

Since Brazil's demand for imports constitutes only about 1 percent of world exports, it may be assumed that the country faces an infinitely elastic export supply curve. The exchange risk that is inherent in a system of sharp and unpredictable adjustments in the exchange rate may have a negative influence on the volume of imports. Importers are always ready to take advantage of profitable opportunities provided by an occasional overvalued domestic currency. The risks of devaluation, however, may jeopardize the normal development of imports. For example, in case of products which need to be ordered well in advance of the shipment time, so that they can be produced according to specific requirements, the instability of the exchange rate constitutes a nuisance that might discourage trade.

The objective of this chapter is to find out to what extent imports were affected by the policy of miniadjustments in the exchange rate. The demand for imports is a function mainly of the relation between internal and external prices, of national income, and of import barriers. Important modifications occurred with respect to trade barriers just prior to the institution of the minidevaluations. In the beginning of 1965 the cost for import credits (compulsory deposits) was significantly reduced. In March 1967 a general tariff reform lowered effective protection of manufacturing industry from 98 percent to 52 percent on the average for all sectors, and from a range of 10-333 percent to a range of 10-139 percent. The aims of the reform were to intensify price competition from abroad, to force import-substituting industries to economize on costs, and to facilitate an export drive by these industries.[1] Although at the end of 1968 tariffs were increased again, they were still lower than the ones that existed prior to 1967. The price and income elasticities of import demand are expected to be greater after the lowering of tariffs because the prior tariff levels practically prohibited imports of several goods. This makes the task of identifying the effects of the minidevaluations more difficult. As shown below, the import liberalization policy has made import demand expand considerably more than production or income in the past five years. After a brief analysis of imports during the period

[1]See Donges, Brazil's Trotting Peg.

1968-1972, econometric models will be used to examine to what extent they were affected by new exchange policy.

Brazilian Imports Since 1968

From 1968 to 1972 Brazilian imports of merchandise had an average growth rate of about 23 percent per year, much greater than that of the Gross Domestic Product (about 10 percent). This growth was exceptional compared to the previous two decades. The proportion of imports over GDP (in current cruzeiros), which had reached the record low of 5 percent in 1965, surpassed the 8 percent level in 1971. Machinery and equipment, and chemical, mineral, and metal products were the main commodity categories that led this growth. Imports have had a key role in the process of fixed capital formation in Brazil. In the past years machinery and equipment constituted about 35 percent of total imports. (See Tables F-1 to F-5 in Appendix F.)

Since 1968 Brazil has not experienced a shortage in its capacity to pay for imports, despite trade deficits in 1971 and 1972. This was mainly due to the concommitant expansion in exports and the increase in the net inflow of capital at the exceptional average yearly growth of 57 percent (1968-1971). (See Table F-7 in Appendix F.)

Econometric Analysis of Import Behavior

The Model

The following model was used to describe Brazilian import behavior:

$$\log X_1 = \beta_1 + \beta_2 \log X_2 + \beta_3 \log X_3 + \varepsilon_t, \qquad \text{(I)}$$

where:

X_1 = total Brazilian imports of merchandise in constant cruzeiros of 1949;

X_2 = Gross Domestic Product in constant cruzeiros of 1949;

X_3 = index of real import exchange rate (nominal import index deflated by the ratio of the Brazilian wholesale price index over the U.S. wholesale price index) adjusted for import barriers, such as tariffs, auction fees, and so forth; and

ε_t = disturbance term.

Observations of variables X_1 and X_2 were available only on an annual basis. Therefore, the sample size to test the period of minidevaluations was very small. The index of real import exchange rate, which was adjusted both for dollar inflation and for import barriers, was taken from the work of Joel Bergsman.[2] Eighteen annual observations, from 1954 to 1971, were available.

---

[2] Bergsman, "Foreign Trade Policy in Brazil." Bergsman had calculated 17 annual indexes. This author estimated the 1971 index following his method. Bergsman's adjustment for tariffs considers the nominal rather than the effective rate of protection. This has an important implication discussed at the end of this chapter.

The demand for imports is expected to respond positively to changes in real national income and negatively to changes in the index of real exchange rate adjusted for tariffs, and so forth. Since the policy of the government in certain periods seemed to be one of facilitating imports whenever the capacity to pay for them was growing, and since the net inflow of capital has been particularly associated with imports, the capacity to import also should be considered as a variable that might determine changes in imports. By capacity to import goods, X_4, is meant:[3]

$$X_4 = CFP - S, \text{ where } \quad CFP = PPX - A + NIC$$

$$X_4 = PPX - A + NIC - S, \text{ where } \quad PPX = X\ (MPI/XPI)$$

$$X_4 = X(MPI/XPI) - A + NIC - S$$

where:

CFP = capacity of foreign payments.

S = service (commercial and noncommercial) receipts-service payments

PPX = purchasing power of exports

A = amortizations

NIC = net inflow of capital

MPI = import price index

XPI = export price index.

[3]This is the definition of capacity to import goods currently used by the Brazilian monetary authorites (see Table F-7, Appendix F).

In view of this expectation the following model was tested:

$$\log X_1 = \beta_1 + \beta_2 \log X_2 + \beta_3 \log X_3 + \beta_4 \log X_4 + \varepsilon_t, \qquad \text{(II)}$$

where X_1, X_2, X_3, and ε_t have the same meaning as is in Model (I), and X_4 is the capacity to import. Here, however, total imports (X_1) and real GDP (X_2) were measured in constant dollars since the capacity to import was measured more accurately in dollars than in cruzeiros. A consistent series of observations for the capacity to import, as defined above, was available only for 13 years, from 1959 to 1971. (See Table F-7 in Appendix F.)

To examine the effects of minidevaluations on imports, different approaches were followed. First, both Models (I) and (II) were tested for period A, 1954 to 1968 for (I) and 1959-1968 for (II), and for period B, which includes the three years 1969-1971, during which the minidevaluations were in effect.[4] Alternatively, a dummy variable, D, representing the policy of minidevaluations, was included in modified versions of Models (I) and (II). The problems involved in the different tests will be discussed with the presentation of results.

The data used in the estimation Model (I) is shown in Table VI-1 and Figure VI-1, whereas that used to estimate Model (II) is shown in Table VI-2 and Figure VI-2.

---

[4] About one-third of 1968 also should be excluded from period A but this was not possible with annual data.

TABLE VI-1.--Data for Estimation of Brazil's Import Function (Model I).

Year	Total Imports In Constant Cruzeiros of 1949 X_1	Gross Domestic Produce in Constant Cruzeiros of 1949 X_2	Index of Real Import Exchange Rate (nominal import index deflated by Brazilian W.P.I./ U.S. W.P.I.) Adjusted for Tariffs, Auction Fees, etc. X_3
1954	24.5	318.2	154
1955	23.7	340.0	194
1956	23.6	350.8	211
1957	25.4	379.1	270
1958	27.0	408.3	249
1959	30.7	431.1	290
1960	29.2	472.9	243
1961	31.4	521.6	321
1962	35.0	549.0	364
1963	30.8	557.5	329
1964	25.6	573.8	329
1965	26.3	589.5	288
1966	32.3	619.6	203
1967	34.1	649.2	165
1968	43.8	709.7	169
1969	47.8	773.6	190
1970	56.3	847.2	187
1971	69.6	942.9	183

Sources: X_1: Relatório 1971, CACEX, Banco do Brasil.

X_2: Conjuntura Econômica, 26 (November 1972).

X_3: Joel Bergsman, "Foreign Trade Policy in Brazil," U.S. AID (unpublished study, February 1971).

TABLE VI-2.--Data for Estimation of Brazil's Import Function (Model II).

Year	Brazil's Imports at 1965/67 Prices	Real Gross Domestic Product at 1965/67 Prices	Index of Real Import Exchange Rate (nominal import index deflated by Brazilian W.P.I./ U.S. W.P.I.) Adjusted for Tariffs, Auction Fees, etc.	Brazil's Capacity to Import at 1965/67 Prices
	X_1	X_2	X_3	X_4
1959	1,245	16,737.8	290	1,121
1960	1,364	18,360.7	243	917
1961	1,340	20,251.5	321	1,399
1962	1,342	21,315.3	364	1,087
1963	1,301	21,645.3	329	1,087
1964	1,127	22,278.2	329	1,299
1965	963	22,887.7	288	1,257
1966	1,306	24,056.4	203	1,405
1967	1,413	25,205.6	165	1,132
1968	1,767	27,554.6	169	1,777
1969	1,935	30,035.6	190	2,477
1970	2,388	32,893.1	187	2,798
1971	3,090	36,608.7	183	4,130

Sources:

X_1 and X_2: *Conjuntura Econômica*, 26 (November 1972).

X_3: Joel Bergsman, "Foreign Trade Policy in Brazil," U.S. AID (unpublished study, February 1971).

X_4: See Table F-7.

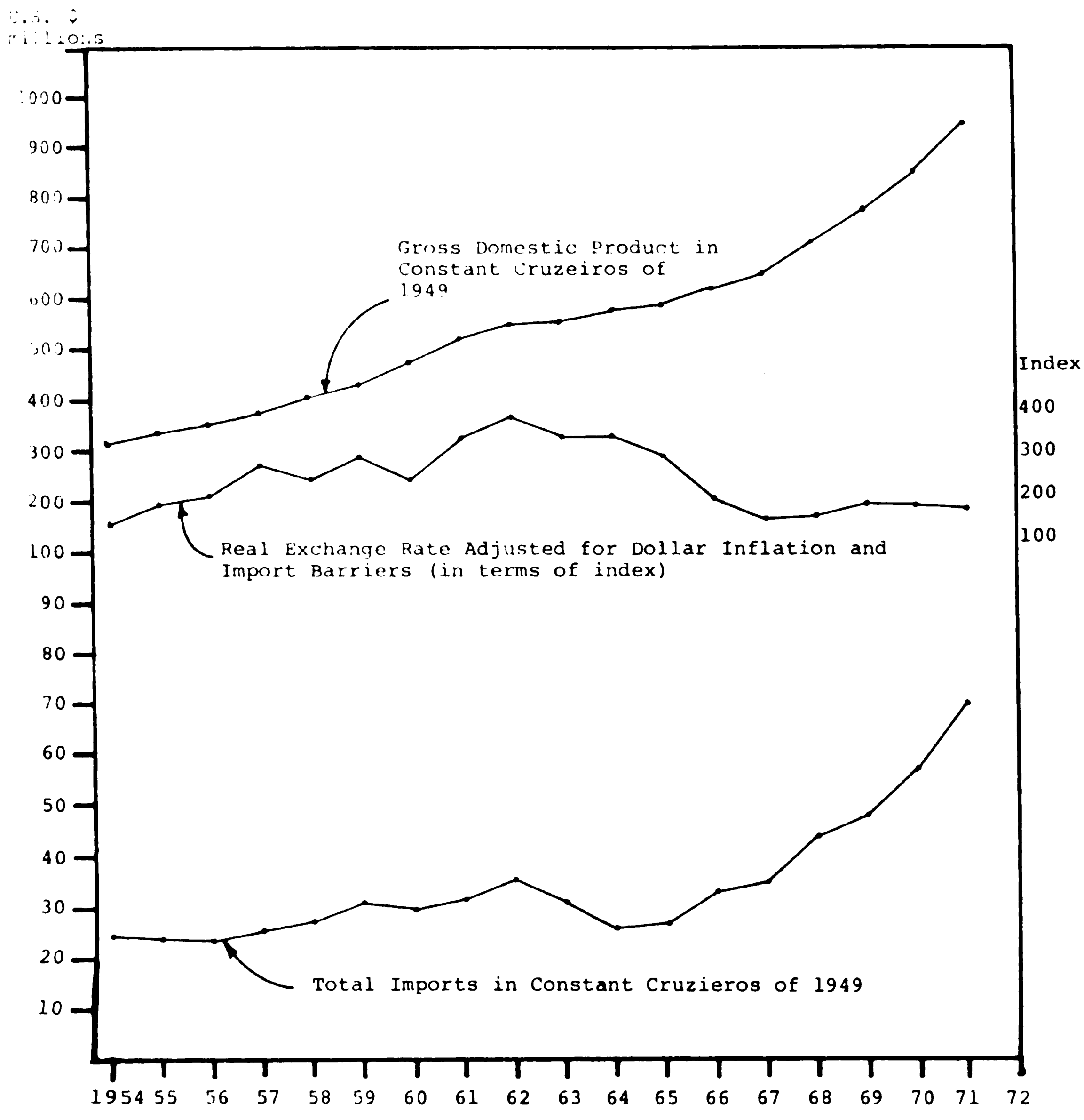


Figure VI-1.--Brazil's Imports in Constant Cruzeiros of 1949, GDP in Constant Cruzeiros of 1949, and the Real Exchange Rate Adjusted for Dollar Inflation and Import Barriers.

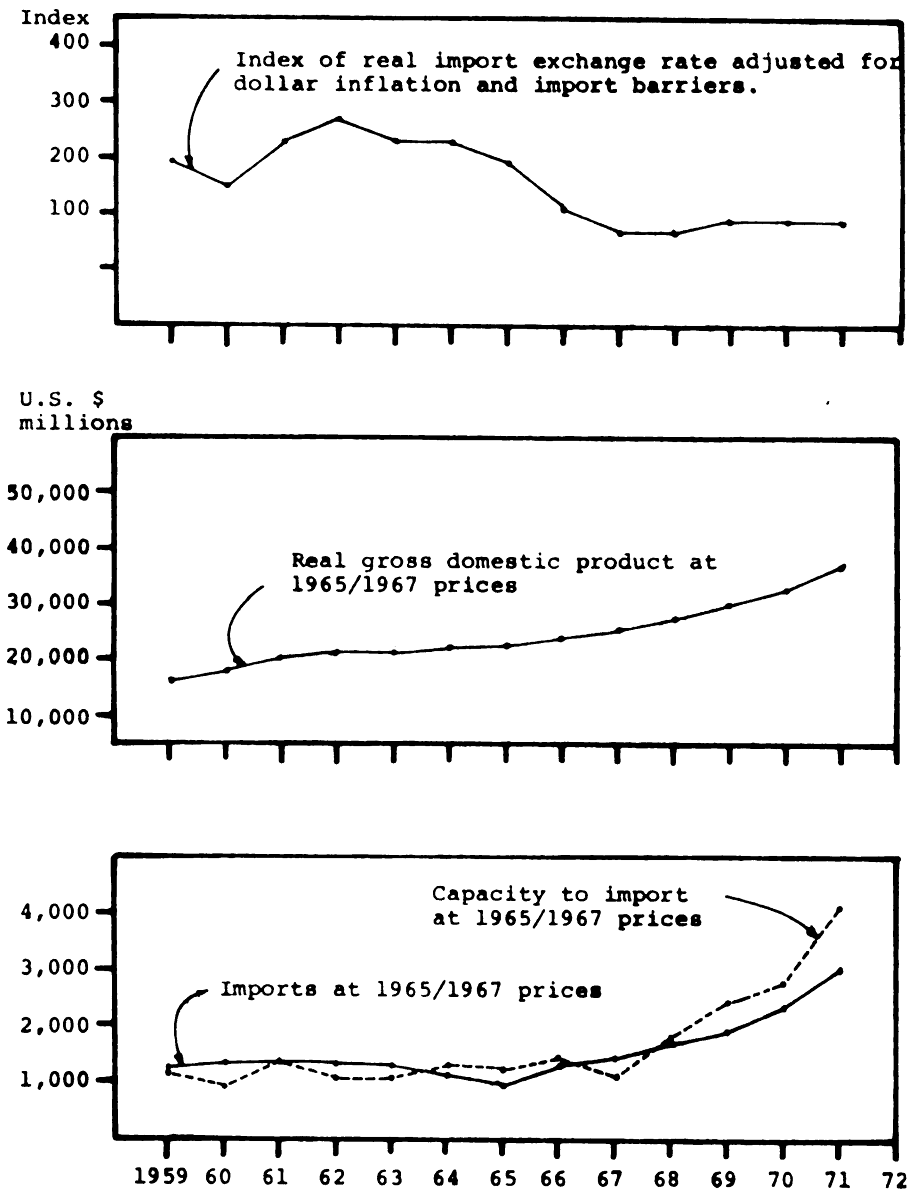


Figure VI-2.--Brazil's Imports, GDP, Capacity to Import and Real Exchange Rate Adjusted for Dollar Inflation and Import Barriers.

Regression Results

Model (I) regressed for periods A and B gave the following results:

A. 15 Observations, from 1954 to 1968:

$$\log X_1 = .2608 + \underset{\substack{(4.4921)\\(\ .001\ )}}{.5427} \log X_2 - \underset{\substack{(-.9608)\\(\ .356\ )}}{.1061} \log X_3 \qquad (1a)$$

The numbers in parentheses under each coefficient are the t-values and the significance levels of the estimated coefficients, respectively.

$F = 10.1101$ Significance .003

$R^2 = .6276$ $\bar{R}^2 = .5655$

D.W. = 1.09, not conclusive as to presence of autoregression

$SSE_a = .0292.$

B. 18 Observations, from 1954 to 1971:

$$\log X_1 = .1466 + \underset{\substack{(7.4574)\\(<0.0005)}}{.8190} \log X_2 - \underset{\substack{(-1.8818)\\(\ .079)}}{.2418} \log X_3 \qquad (1b)$$

$F = 32.2164$ Significance <0.0005

$R^2 = .8112$ $\bar{R}^2 = .7860$

$D.W. = .65 \qquad\qquad d_{L,2,18,.01} = 0.80$

$d_{U,2,18,.01} = 1.26$

indicates the presence of autoregression.[5]

$SSE_b = .0579.$

Both the level of overall significance and the degree of fit substantially improved with the addition of the three observations. The elasticity coefficients of imports (X_1), both with respect to GDP (X_2) and to the real exchange rate adjusted for tariffs, and so forth, (X_3) more than doubled when the years 1969-1971 were added to the regression. Still, their values in both equations indicate very low elasticities. Changes in X_3 were not even significant in determining the level of exports in period A. This is an indication that the level of tariffs were so high and prohibitive that changes in relative prices did not affect imports significantly. The low, but still very significant, GDP elasticity coefficient indicates that the import-substituting policies pursued by the government, especially from 1954 until the tariff reform of 1967, substantially limited the response of imports to

[5]When the disturbances are autoregressive, the least-square estimators are unbiased and consistent, but they are not efficient or assymtotically efficient. The respective variances are biased, and as a result, the tests of significance to the regression coefficients might lead to incorrect statements. Kmenta, Elements of Econometrics, pp. 278-81.

increases in real national income.[6] With the application of the Chow or Fisher test at the 5 percent level of significance, it may be affirmed that a structural shift has taken place in the regression equation after 1968:

$$F = \frac{SSE_b - SSE_a/m}{SSE_a/n - k} = \frac{.0579 - .0292/3}{.0292/15 - 3} =$$

$$3.93 > F_{3,12,.05} = 3.49.$$

In addition to the lowering of tariffs, the policy of minidevaluation also might have contributed to the increase in the elasticity coefficients which have characterized this structural shift. This test, however, does not permit a distinction between the two possible causes.

Minidevaluations Represented By a Dummy Variable

A significant result was obtained with the following modified version of Model (I):

$$\log X_1 = \beta_1 + \alpha D + \beta_2 \log X_2 + \beta_3 \log X_3$$

$$+ \alpha_3 D \log X_3 + \varepsilon_t \qquad \text{(I)}$$

---

[6] The low elasticity values which were found contrast sharply with the U.S. income elasticity for import demand for manufactures of +2.35 and with the relative price elasticity of -4.7, as found by Kreinin for 43 quarterly observations from 1954 to 1964. Mordechai E. Kreinin, Alternative Commercial Policies--Their Effect on the American Economy (East Lansing: Michigan State University, 1967), p. 46.

In this formulation the dummy variable D is used to allow both for a differential intercept and for a differential elasticity coefficient for X_3, the real exchange rate adjusted for tariffs and so forth. The dummy variable represents the policy of minidevaluations. It takes the values of zero from 1954 to 1967, of 0.34 in 1968, and of one from 1969 to 1971. The result, for 18 observations, was:

$$\log X_1 = .3167 + \underset{\substack{(1.8266) \\ (.091)}}{9.5954\,D} + \underset{\substack{(3.2845) \\ (.006)}}{.4030} \log X_2$$

$$+ \underset{\substack{(1.2182) \\ (.831)}}{.0237} \log X_3 - \underset{\substack{(-1.7924) \\ (.096)}}{4.1362\,D} \log X_3 \qquad \text{(II)}$$

$F = 38.53$ Significance <0.0005

$R^2 = .9222$ $\bar{R}^2 = .8983$

D.W. $= 1.24$ $d_{L,3,18,.01} = 0.71$

$d_{U,3,18,.01} = 1.42$

not conclusive as to presence of autoregression.

Equation (II) was highly significant and showed a goodness of fit much greater than that of Equation (1b)-- $\bar{R}^2 = .92$ for Equation (I) compared to .79 for Equation

(1b). The coefficient of log X_2 was again significant but low, indicating an inelastic income demand for imports. The dummy coefficient for the intercept was significant at the 9 percent level and showed a substantial differential in the function for the minidevaluation period. Changes in the real exchange rate adjusted for tariffs, and so forth, were not significant before 1968--the coefficient of log X_3 was low and had the incorrect theoretical sign. But a substantial change occurred during the period of minidevaluations. The coefficient of D log X_3 was -4.14, had the correct sign, and was significant at the 10 percent level. One must be cautious, however, in interpreting the dummy variable. It represents, indeed, the period of minidevaluations, but this period almost coincided with the one during which lower and less prohibitive taxes came into effect. Therefore, the only possible conclusion is that a shift has taken place in the basic import function since 1968. Whether or not the minidevaluations contributed to it cannot yet be affirmed.

The Inclusion of the Capacity to Import as an Independent Variable

Model (II) regressed for periods A and B[7] gave the following results:

A. 10 Observations, from 1959 to 1968:

$$\log X_1 = 7.130 + \underset{\substack{(8.9896)\\(.024)}}{.1399} \log X_2 - \underset{\substack{(-1.531)\\(.177)}}{.1920} \log X_3 + \underset{\substack{(.5844)\\(.580)}}{.1118} \log X_4 \tag{2a}$$

$F = 5.455$ Significance .038

$R^2 = .7317$ $\bar{R}^2 = .5976$

D.W. = 1.69, no autoregression.

$SSE_a = .0110$

B. 13 Observations, from 1959 to 1971:

$$\text{lob } X_1 = 3.4286 + \underset{\substack{(2.7911)\\(.021)}}{.1503} \log X_2 - \underset{\substack{(-.9408)\\(.371)}}{.1343} \log X_3 + \underset{\substack{(5.248)\\(.001)}}{.4924} \log X_4 \tag{2b}$$

---

[7]Note that periods A and B have a smaller number of observations in this case compared to the regressions with Model (I). Another difference is that here the values of X_1, X_2, and X_4 were in constant dollar figures instead of constant cruzeiros.

$F = 27.9924$ Significance <0.0005

$R^2 = .903$ $\bar{R}^2 = .8707$

D.W. = 2.06, no autoregression.

$SSE_b = .0223$

The equation gained substantially in significance and in goodness of fit when the three additional observations were added. Imports in both periods A and B had a low but highly significant elasticity coefficient with respect to GDP (X_2). The elasticity coefficient with respect to the real exchange rate adjusted for tariffs, and so forth, (X_3), was not significant in A and even less so in B, where it presented a lower value. The elasticity coefficient with respect to the capacity to import was only significant when the period 1969-1971 was added to the first ten observations. Its value increased from .11 to .49. Imports also were inelastic with respect to the capacity to import. In the case of Equations (2a) and (2b) the application of the Chow or Fisher test did not indicate that a structural shift took place in the parameters after 1968:

$$F = \frac{(SSE_b - SSE_a)/m}{SSE_a/n - k} = \frac{(.0223 - .0110)/3}{.0110/10 - 4}$$

$$F = 2.05 < F_{3,6,.05} = 4.76$$

Care, however, must be used in interpreting the results of Equations (2a) and (2b). The estimated coefficients, especially that of log X_3, might be unreliable due to the fact that several components of the capacity to import are dependent upon the level of the real exchange rate and also were affected, in different degrees, by the policy of minidevaluations.[8] This is particularly true of exports, as examined in previous chapters, and of capital inflows and services, as will be seen below (see Table F-7 in Appendix F).

Dummy Variable Used Again

In an attempt to isolate the effect of the minidevaluations and the effect of changes in the real exchange rate adjusted for tariffs, and so forth, on changes in imports, a dummy variable was introduced to allow both for a differential intercept and for a differential coefficient of log X_3. The dummy takes again the values of zero from 1954 to 1967, of .034 in 1968, and of one from 1969 to 1971. The result for 13 observations from 1959 to 1971 was:

$$\log X_1 = 7.228 + \underset{\substack{(6.986)\\(\ .111)}}{12.7332}\ D + \underset{\substack{(2.7685)\\(\ .028\ )}}{.1317}\ \log X_2 - \underset{\substack{(-.1948)\\(\ .851\ )}}{.0260}\ \log X_3$$

$$- \underset{\substack{(-1.806)\\(\ \ .114)}}{5.5091}\ D \log X_3 + \underset{\substack{(.2960)\\(.776\ )}}{.0645}\ \log X_4 \qquad \text{(III)}$$

---

[8]This is a problem caused by a certain degree of multicollinearity. See Kmenta, Elements of Econometrics, p. 389.

$F = 23.2036$ Significance <0.0005

$R^2 = .9431$ $\bar{R}^2 = .9025$

D.W. = 1.63, no autoregression.

Equation (III) was highly significant and its goodness of fit was the best among all equations used to test the behavior of imports. In this formulation the coefficient of log X_2 (changes in GDP) was again low, but significant at the 2 percent level. The coefficient of log X_4 (changes in import capacity) became very low and insignificant. A significant differential at the 11 percent level occurred both with the intercept and with the elasticity coefficient of the real exchange rate adjusted for tarrifs, and so forth. Indeed, log X_3, which did not have a coefficient significantly different from zero prior to the minidevaluations, showed a highly elastic coefficient of -5.5 for the period after 1968. The fact that the capacity to import is dependent upon the real exchange rate might make these coefficients unreliable. But there is no doubt that there has been an important shift in import behavior since 1968. It is difficult to conclude whether its main cause was the lowering of tariffs to less prohibitive levels of whether minidevaluations also contributed to it, or both.

However, if the effective, rather than the nominal, protection is considered, one might reach different conclusions. The effective rate of protection is the percentage increase in domestic value added made possible by the tariff structure compared to a situation under free trade. Joel Bergsman's calculations, as shown in Table VI-3, indicates that although product protection since January 1969 has been much lower than before March 1967, the current levels of effective protection are not so much lower. Especially for manufactured goods, which constituted more than two-thirds of Brazilian imports in the past five years, effective protection since January 1969 has been only a few points below the pre-March 1967 level. Therefore, the lower nominal tariffs on the post-January 1969 period may have had only a minor impact on their "prohibitive" character.[9] Accordingly, the shift in the Brazilian import function that occurred after 1968 must also be attributed to the minidevaluations.

Conclusion

The regression analysis showed that a significant shift in the parameters of the Brazilian import function took place with the advent of the minidevaluation policy. Imports became more responsive to income change and, especially, to changes in the real exchange rate adjusted

---

[9] It must be noted, however, that consumer demand is affected by nominal rather than by effective protection. Thus the change in the "prohibitive" character of the tariffs might have been quite relevant as the product protection for all goods changed from .46 before March 1967 to 0.22 after January 1969 (see Table VI-3).

for dollar inflation, tariffs, auction fees, and other trade barriers. This shift in the parameters of the import function had two direct causes: the lowering of the import tariffs and the policy minidevaluations. The first made some imports nonprohibitive and therefore more responsive to income and relative price changes. The second diminished the exchange rask caused by wide and unpredictable changes in the official exchange rate, and, because of this, also contributed to making imports more responsive to relative price changes. It was not possible, statistically, to distinguish the weight of these two causes.

TABLE VI-3.--Net Product Protection and Effective Protection, 1966-1971. Joel Bergsman's Estimation.

Groups of Sectors	Product Protection 1966-Feb 1967	Product Protection April 1967-Dec 1968	Product Protection Jan 1969-Present	Effective Protection 1966-Feb 1967	Effective Protection April 1967-Dec 1968	Effective Protection Jan 1969-1971
Agriculture and fishing	.19	-0.00	0.00	.18	-0.05	-0.01
Mining	- .06	-0.05	-0.10	- .34	-0.24	-0.31
Low-level intermediates	.35	0.12	0.09	.02	-0.23	0.04
High-level intermediates	.65	0.38	0.39	1.29	1.06	1.34
Machinery	.14	0.08	0.03	.11	0.07	0.11
Transport equipment	.06	0.01	-0.02	- .11	-0.10	-0.02
Consumer durables	1.11	0.61	0.92	3.24	1.83	3.01
Food products	.57	0.20	0.25	1.85	1.09	1.58
Beverages and tobacco	1.31	0.57	1.29	3.20	1.44	3.42
Other consumer non-durables	1.04	0.42	0.80	1.93	0.85	1.93
All primary	.16	-0.01	-0.01	.21	-0.08	-0.06
All manufacturing	.61	0.29	0.36	1.25	0.72	1.21
All primary and manufacturing	.46	0.17	0.22	.74	0.33	0.59

Source: Joel Bergsman, "Foreign Trade Policy in Brazil," U.S. AID (unpublished study, February 1971).

Net Protection: percentage of free trade exchange rate. The free trade exchange rate is defined as that rate which would maintain the balance of trade unchanged in the absence of protection, export taxes, or subsidies.

Effective protection is calculated as: $Z_j = \dfrac{t_j - \sum a_{ij} t_i}{1 - \sum a_{ij} (1 + t_{Di})}$,

where t_j = tariff on product j,

t_i = tariff on input i,

a_{ij} = value of input i needed to produce one unit of product j, free trade prices, and

t_{Di} = excise taxes on input i.

CHAPTER VII

EFFECTS OF THE SYSTEM OF MINIDEVALUATIONS ON SERVICES, CAPITAL MOVEMENTS, AND FOREIGN INDEBTEDNESS

This chapter will examine the nature of capital movements and the foreign indebtedness position of Brazil in recent years. It will attempt to identify the influence of the system of frequent small exchange rate adjustments on those items. To complete the analysis of the country's foreign sector, it also will briefly describe the major trends that have characterized the behavior of services in the past 25 years, especially during the period of minidevaluations.

Effects of Minidevaluations on Capital Movements

The policy of minidevaluations has had two major impacts on capital movements. First, it has substantially diminished destabilizing short-term capital movements which previously had been harmful to the value of the cruzeiro. Second, along with other measures, it has constituted a necessary condition for an open economy and for the exceptional recent influx of foreign capital.[1]

Under the old system of occasional large devaluations at fairly long intervals, huge financial speculative movements were made whenever a sharp change was expected in the foreign exchange rate. With running inflation, the longer the interval between devaluations, the greater would be the problem around the time of expected devaluation. Financiers, and people in general, anticipating the change would convert overvalued cruzeiros into foreign currencies. They would wait out the devaluation and then buy back the cruzeiros at the new rate, thus realizing a windfall gain in the amount of the devaluation. Just after a large devaluation people could be reasonably assured that no other change in the pegged exchange rate would occur, in, say, the next six months. They could then buy bills of exchange and gain the nominal interest prevailing in Brazil (20 percent per semester was common during 1960-1967). When people expected a new devaluation they again could convert their money into foreign currencies. This speculation-devaluation cycle led to periodic intense pressures on the credit market. Funds which normally would serve to finance productive activities would be temporarily diverted to buy foreign currencies.

---

[1]This section profited from the analyses of Lira, "Cruzeiro, O Preço Exato da Moeda"; Tyler, "Exchange Rate Flexibility"; Donges, Brazil's Trotting Peg; and Bracher, "Sistema Cambial de Taxa Flexivel."

Several types of exchange controls were imposed from time to time to prevent such speculative operations. The pressure continued to exist, however, as evidenced by the large differential between the official and black market value of the exchange rate which prevailed throughout the sixties until the beginning of the minidevaluations in August 1968. The differential varied from 15-20 percent from 1960 to 1968, to 60 to 100 percent in 1963 and 1964. Although no published data on black market rates during the period of minidevaluations are available, interviews disclosed that these rates, in general, have varied less than 10 percent from the official rate since August 1968.

The new exchange rate procedure, coupled with the interest rate policy pursued by the government, has made the purchase of foreign exchange for the sole purpose of gaining from devaluation unprofitable. The monetary authorities have been careful to keep the average rate of devaluation below the differential between internal and foreign interest rates. This differential has been about two percentage points per month and the rate of devaluation slightly over one percent per month. Since the internal rate of interest has exceeded the external level by more than the devaluation rate, there has been no incentive for

---

[2]See Conjuntura Econômica, 26 (November 1972), supplement, p. 34. The series of data on the black market rates is not complete, and it does not cover the period of minidevaluations.

Brazilians to invest abroad. The risk element involved in the adjustment interval, which has varied from 14 to 80 days, has made short-run speculative operations even less desirable.

Table VII-1 shows that the differential annual yields between some selected domestic and foreign securities has, in general, been greater than the annual cruzeiro devaluation during the period of minidevaluations. This has been true for the differential return between a Brazilian bill of exchange--an almost riskless security--and the London Euro-Dollar interest rate.

Unfortunately, no data are available on a monthly basis to evaluate the effects of the minidevaluation policy on short-run speculative flows. The annual reports of the Banco Central do Brazil have stated, however, that speculative short-run movements against the cruzeiro have substantially diminished since August 1968. On the other hand, the minidevaluations, along with other important economic and political measures, have created the conditions for an exceptional influx of capital into Brazil in the past five years.

Factors Which Have Influenced the Influx of Capital

An examination of the several financial reforms and political and economic events which have affected the net movement of capital into Brazil is necessary in order

TABLE VII-1.--Differential Yields on Internal and External Securities Compared to Devaluation Rates.

	Annual Percentage Rates				
	1968	1969	1970	1971	1972
Adjustable Brazilian Treasury Bill (ORTN)[1]	43.3	22.8	24.0	27.1	23.7
Bill of Exchange[2] (letra de câmbio)	31.8	30.3	30.5	30.3	29.2
US Treasury Bill[3]	5.3	6.7	6.4	4.3	3.7
Euro Dollar London Interest Rate[4]	6.4	9.8	8.5	6.6	5.2
ORTN minus US Treasury Bill	38.0	16.1	17.6	22.8	20.0
ORTN minus Euro Dollar Rate	36.9	13.0	15.5	20.5	18.5
Bill of Exchange minus US Treasury Bill	26.5	20.5	24.1	26.0	25.5
Bill of Exchange minus Euro Dollar Rate	25.4	20.5	22.0	23.7	24.0
Cruzeiro Devaluation[5]	40.9	13.7	13.8	13.8	10.4

Source: _Boletim_, Banco Central do Brasil, and _International Financial Statistics_, IMF.

[1]ORTN carry a 12-month maturity. Return shown is from December to December.

[2]Bill of Exchange of 6-month maturity, taken in a yearly rate After 1971 maturity considered is 360 days.

[3]Average tender rate for 3-month U.S. Treasury Bill.

[4]Average of daily quotations for 3-month deposits.

[5]Cruzeiro devaluation from December of the previous year to December of the stated year. The high rate for 1968 is due to two large devaluations decreed in January and August of that year, just before the beginning of the mini-devaluations.

to properly evaluate the specific influence of the mini-devaluation policy.

First, important changes have occurred in the interest rate policy and capital markets. Real interest rates, due to legal restrictions, had become increasingly negative from 1960 to 1964 as the rate of inflation accelerated. Beginning in 1965 monetary correction to adjust for price changes was instituted and was extended to main financial instruments as part of the gradual approach to curb inflation. As a result, real interest rates became increasingly positive after 1966.[3]

Second, numerous measures were undertaken to bolster the development of the Brazilian stock market. Income tax deduction for stock purposes, the exemption of capital gains from taxation, the participation of the government in various ways, and the resurgence of Brazil's economic growth resulted in an unprecedented stock market boom from 1967 to 1971. The BV index of price for stocks listed on the Rio de Janeiro exchange increased by over 16 times from December 1967 to December 1971. The increase was exceptionally accelerated in the first semester of 1971, during which the index rose by 212 percent.

---

[3]See Leif Christoffersen, "Taxas de Juro e a Estrutura de um Sistema de Bancos Comerciais em Condições Inflacionárias," Revista Brasileira de Economia, 23 (June 1969); and Tyler, "Exchange Rate Flexibility."

Third, the monetary authorities have promulgated several regulations to provide mechanisms to channel short-term and medium-term foreign credit to Brazilian firms through the commercial banking system.[4] Both national and foreign firms have increasingly acquired short- and medium-term loans abroad. Foreign firms have taken the lead in this practice, and many of the loans have been from parent company to subsidiary. As a result of some administrative regulations and of the favorable foreign investment climate, many foreign subsidiaries have brought money into Brazil as loans rather than having it registered as foreign investment.

Fourth, the political regime since 31 March 1964 has played a major role in providing the most favorable climate for foreign investment. The importance of this factor is particularly notable when it is realized that few countries in Latin America, Africa, and Asia have had stable political and economic conditions in recent years. This, of course, has limited the opportunities for profitable investments by those who have surplus capital

---

[4]The main regulations are: (1) Resolution 63 of the Central Bank (August 1967) for loans granted for a term determined at the time of application (12 to 36 months); (2) Law 1431, which provides financing for a minimum of six months with no established maximum term, but which is dependent upon Central Bank approval; and (3) SUMOC Instruction 289, which allowed loans for periods of 180 to 360 days and which could be extended under Law 1431 at the discretion of the Central Bank. Instruction 289 was revoked in October 1972.

available in the developed countries. Brazil, since 1964, has been ruled by officers of the armed forces, who with the help of skilled civilian technicians, have been attempting to promote the fastest possible development under a mixed capitalist system. Political democracy has been kept at a very low level, and dissent has been firmly repressed. The government, with firm control of the media, has been successful in maintaining a tranquil business environment, which, coupled with the formidable economic opportunities in Brazil, has attracted foreign investors.

Finally, the minidevaluation policy has substantially diminished the exchange rate risk for those involved in international financial operations. The initiation and expansion of large investment projects by foreign companies have become less dependent on changes in the level of the exchange rate. Also, there has been less risk of being suddenly subject to strict foreign exchange controls as a result of worsening disequilibrium in the balance of payments, a common situation in the early sixties.

These factors have resulted in an exceptional upsurge of capital flow into Brazil, as shown in Table VII-2. Since 1968 the total influx has been increasing at a compounded rate of more than 38 percent per year. Estimates for 1972 show that the influx in that year was twice that of 1971 and more than seven times that of 1967.

Direct private investment from abroad increased at a compounded rate of over 20 percent from 1968 to 1972. The sum of direct investments in the period 1968-1972 was two-and-a-half times greater than that of the period 1963-1967. The most dramatic rise, however, has been in loans and financing. From 1968 to 1971 about 25 percent of these funds came from the Interamerican Development Bank, USAID, World Bank, Eximbank, and International Financial Corporation, organizations which, since 1964, have been particularly supportive of the Brazilian development effort.[5] The remaining 75 percent of loans and financing, a proportion that has been increasing in recent years, is from private operations. Unfortunately, capital influx data are not available in any greater detail than that presented in Table VII-2.

Analyzing Capital Flows: Tyler's Linear Regression Equation

To analyze the determinants of capital influx into the Brazilian balance of payments William G. Tyler has estimated the following linear regression equation:[6]

$$F - 334.19 + \underset{(1.83)}{9.50}\ i + \underset{(4.23)}{553.11}\ D \qquad \text{(t values)}$$

$$R^2 = .90 \qquad\qquad D.W. = 2.06,$$

---

[5]See Relatórios 1970 and 1971 (Rio de Janeiro: Banco Central do Brasil).

[6]Tyler, "Exchange Rate Flexibility," p. 32.

TABLE VII-2.--Autonomous Capital Movements 1963-1972, US$ millions.

	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972 (est)
I.--Inflows	374	307	517	667	645	786	1291	1762	2312	4755
1) Investments	30	28	70	74	76	81	139	128	146	200
In equipments	18	6	5	12	5	7	5	2	2	
In currency	12	22	65	62	71	74	134	126	144	
2) Loans and financing	287	221	363	508	530	553	1053	1440	2042	4555
In equipment	188	115	91	159	170	246	328	434	630	
In currency	68	106	272	349	360	307	725	1006	1412	
3) Other	32					152	99	194	124	
4) Reinvestments (1963/67)	57	58	84	85	39					
II.--Outflows	- 364	- 277	- 304	- 350	- 444	- 646	- 622	- 824	- 947	-1100
1) Investments	--	--	--	--	--	--	- 12	- 20	- 22	
2) Amortizations	- 364	- 277	- 304	- 350	- 444	- 484	- 533	- 673	- 874	-1100
Of compensatory loans	- 145	- 92	- 90	- 124	- 107	- 113	- 96	- 80	- 71	
Of other loans and financing	- 219	- 185	- 214	- 226	- 337	- 371	- 437	- 593	- 803	
3) Other						162	77	131	51	
III.--Other Capital (Net 1963/67)	3	110	- 134	- 112	- 138					155
Balance	13	140	79	205	63	140	669	938	1365	3810

Sources: Relatórios 1967-1971, Banco Central do Brasil; and Conjuntura Economica, 27 (February 1973).

where F represents private medium- and long-term capital influx, i equals the real rate of interest paid to holders of bills of exchange (commercial paper) and D represents a dummy variable for the minidevaluation policy. Tyler utilized annual data from 1964 to 1970. The expected signs were found, with D statistically significant at the 1 percent level and i at a little over the 10 percent level. The significance of D, however, cannot be attributed solely to the minidevaluation policy. The other factors mentioned above, such as the nature of the political regime and the numerous financial reforms which have rationalized Brazilian money markets, also have played their part. These cannot be distinguished in the regression analysis, however.

Regression Analysis of Direct Foreign Investments

The flow of direct foreign investments may be separated from that of loans and financing for the purpose of analysis. The major determinants of direct private investment are the expected rate of profit and the risk associated with it. A good proxy for profit opportunities available to foreign investors is the rate of growth of the economy. A major component of risk is that related to fluctuations in the level of the foreign exchange rate. To analyze the determinants of direct foreign investments in Brazil the following ordinary least-squares regression was estimated for 10 annual observations from 1963 to 1972:

$$I = 76.799 + \underset{\substack{(1.921) \\ (\ .096)}}{5.240}\ \dot{y}_t - \underset{\substack{(-2.107) \\ (\ .073)}}{10.198}\ f_t \qquad \begin{array}{l}(t\ \text{values}) \\ (\text{significance})\end{array}$$

$R^2 = .825$ $\bar{R}^2 = .774$

$F = 16.449$ Significance .002,

D.W. = 2.11, no autoregression,

where I represents constant dollar value of direct foreign investments in Brazil, $\dot{y}_t$ equals the real rate of growth of the country's gross domestic product, and f_t the annual average of the monthly percentage variation (with no signs) in the real official exchange rate. The lower the level of f_t, the lower the level of fluctuations (and of exchange risk) in the real exchange rate (see discussion of this variable in Appendix E). Table G-1 in Appendix G shows the data used in estimating the above regression. It can be seen that the value of f_t is much lower after 1968, during the minidevaluations, than before. The regression shows high overall significance and a good fit. The coefficients of both $\dot{y}_t$ and f_t show the expected signs. That of $\dot{y}_t$ is statistically significant at the 10 percent level and that of f_t at the 7 percent level. Therefore, this result indicates that the minidevaluations, by diminishing the exchange rate risk associated with the returns to foreign investors, had a positive influence on direct foreign investments. Other factors which affect the expectations of foreign investors, such as political events, were not taken into account. The portfolio approach in the next section will consider them.

Analyzing Capital Flows: The Portfolio Approach

The portfolio approach to analyzing short-term capital movements also can provide insights to the recent upsurge of foreign capital in Brazil. The portfolio theory views each financier as holding a portfolio of financial assets, the composition of which is designed to maximize his return subject to minimum risk. A major determinant of the portfolio distribution between domestic and foreign assets is the constellation of interest rates prevailing in the domestic and foreign money markets. In the case of an English investor, for example, the composition of his portfolio can be represented by

$$\frac{V_t^f}{V_t} = g\ (i_t^f,\ i_t^d,\ s_t), \qquad (1)$$

where V_t^f is the fraction of net worth, V_t, held in foreign securities, i_t^f the foreign interest rate, i_t^d the domestic rate, and s_t includes variables such as evaluation of risk and exchange rate expectations.

The equilibrium holdings of foreign assets can be represented by

$$V_t^f = V_t\ g\ (i_t^f,\ i_t^d,\ s_t). \qquad (2)$$

For the English investor considering Brazilian securities, the policy of minidevaluations coupled with the stability of the Brazilian government would represent an important favorable change in the variable s, which can be represented by

$$\frac{dV^f}{d\ s} = V_0\ \frac{\partial g}{\partial s}. \tag{3}$$

The decrease in risk would encourage the financier to include more Brazilian securities in his portfolio. Similarly, a variation in the interest rate can be represented by[7]

$$\frac{dV^f}{di^f} = V_0\,\frac{\partial g}{\partial i^f} \tag{4}$$

An increase in the return on Brazilian securities would cause the financier to include more of them in his portfolio. These stock shift effects are one-time changes in portfolio distribution. As the portfolio grows over time, the higher return on the foreign (Brazilian) asset should raise the fraction of portfolio growth that contributes to accumulation of foreign assets. With a given vector of interest rates, the growth in foreign (Brazilian) assets is given by

---

[7]See T. H. Branson and T. D. Willet, "Policy Toward Short-Term Capital Movements, Some Implications of the Portfolio Approach," paper presented at the Conference on International Mobility and Movement of Capital sponsored by The National Bureau of Economic Research, January, 1970; Kreinin, International Economics, pp. 75-76.

$$\frac{dV^f}{dt} = \dot{V}^f = \dot{V}_g\ (i^f,\ i^d,\ s). \tag{5}$$

An increase in the foreign interest rate (or a decrease in the exchange rate risk) will increase $\dot{V}^f$, the equilibrium flow into foreign assets, by

$$\frac{d\dot{V}^f}{di^f} = \dot{V}\ \frac{\partial g}{\partial i^f}. \tag{6}$$

This is a continuing flow effect. The very general model of portfolio distribution given by Eq. (1) implies a fairly rigid relationship between the continuing flow and stock shift effects. Dividing Eq. (6) by Eq. (4), one obtains:

$$\frac{\text{Flow effect}}{\text{Stock effect}} = \frac{d\dot{V}^f/di}{dV_t^f/di} = \frac{\dot{V}_t}{V_t}\ .$$

The ratio of the flow effect to the stock effect is equal to the rate of growth of the "scale variable." Thus, if the portfolio is growing at, say, 10 percent per year, then an increase in the foreign rate of 1 percent would cause a stock shift of, say, \$500 thousand, and the effect on the continuing annual outflow initially would be \$50 million per year. This effect itself also would grow at a 10 percent annual rate.

The portfolio approach indicates that the flow effect is small relative to the stock shift effect. It is changing interest rates that produce large continuing flows in the balance of payments; high rates primarily affect reserves. In the light of this theory, how could one explain the continuous capital upsurge into Brazil, especially since 1968? Table VII-3 shows the differential between the real return on two selected securities, the Brazilian bill of exchange, an almost riskless commercial paper, and the London Euro-Dollar three-month deposits. This differential has been continuously increasing since 1968. Therefore, according to the portfolio theory, this increase should result in both stock shift and flow effects, which then would produce a substantial capital influx into Brazil. Another good proxy to indicate the rentability of investments in Brazil is the rate of growth of the economy. This rate also has increased substantially and almost continuously since 1968. It constitutes a sign that Brazilian assets have become increasingly interesting to foreigners in recent years.

Unfortunately, the flow and stock effects cannot be separated empirically. The portfolio theory also does not say much about lags in the response of investors to changes in expected returns of different assets. In addition, the analysis of capital flows should take into account political events, such as coup-d'états, elections,

TABLE VII-3.--Differential Between the Real Return on a Bill of Exchange in Brazil and the Real Euro Dollar London Interest Rate.

	1967	1968	1969	1970	1971	1972
Nominal Return Paid to Holder of Bill of Exchange[1] in Brazil	33.2	31.8	30.3	30.5	30.3	29.2
Annual Percentage Change in the General Price Index in Brazil[3]	25.0	25.5	20.1	19.3	19.5	16.4
Return on Bill of Exchange Deflated by General Price Index in Brazil	6.6	5.0	8.5	9.4	9.0	11.0
Annual Percentage Change in Consumer Price Index in the United Kingdom[2]	2.4	4.7	5.4	6.4	9.5	7.1
Euro Dollar Rate Deflated by Consumer Price Index in United Kingdom[2]	3.0	1.6	4.2	2.0	-2.6	-1.6
Deflated Return on Bill of Exchange minus Deflated Return on Euro Dollar Rate	3.6	3.4	4.3	7.4	11.6	12.6

[1]Bills of Exchange (letras de cambio) are almost riskless commercial papers. Rates shown are for 6-month maturity up to 1971 and 360 days after 1971, Boletim, Banco Central do Brasil (December 1972).

[2]Average of daily quotations for 3-month deposits. International Financial Statistics, IMF, April 1973.

[3]Conjuntura Economica, 26 (November 1972).

nationalizations, revolutionary movements, regression, and so forth, to which they are sensitive. Thinking in terms of Eq. (1) above, these qualitative events can be represented by changes in the variable s, which denotes evaluation of risk.

The annual growth in the flow of direct private investment and in loans and financing into Brazil may be compared to the differential between the real return on a Brazilian bill of exchange and on a Euro-Dollar deposit and also with the rate of growth of Brazil's GDP. (See Table VII-4.) The low rates of growth (proxy for investment rentability) and the highly unstable political situation during 1963 and 1964 had a substantial negative impact on both direct investment and loans and financing flows. The military take-over and the government's policy favoring foreign investment caused important "stock" and "flow" effects on capital influx. Direct private investment, especially, increased 150 percent in 1965. The period 1966-1968 presented moderate growth. In August 1968 the initiation of the minidevaluation policy represented an important step in diminishing the risk involved in the fluctuations of the exchange rate. The year 1968 was also the beginning of a long period of high growth for the Brazilian economy. As a result, 1969 presented a 72 percent increase in a direct private investment and a 90 percent increase in loans and financing funds, an indication that substantial positive "stock" and "flow" effects occurred in that year. Since 1969 the return differential

TABLE VII-4.--Differential Return on Domestic and Foreign Securities, the Rate of Growth of the Economy and the Inflow of Capital.

	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
Real Return on Bill of Exchange minus Real Return on Euro Dollar Deposit--%	---	---	---	---	3.6	3.4	4.3	7.4	11.6	12.6
Rate of Growth of Brazilian Real Gross Domestic Product--%	1.5	2.9	2.7	5.1	4.8	9.3	9.0	9.5	11.3	10.4
Inflows of Direct Private Investments (excludes reinvestments)--US$ millions	30	28	70	74	76	81	139	128	146	200
Annual Growth in Direct Private Investment Inflows--%	---	-6.6	150.0	5.7	5.6	6.6	71.6	- 7.9	14.1	37.0
Total Loans and Financing Inflows--US$ millions	287	221	363	508	530	553	1053	1440	2042	4555
Annual Growth in Loans and Financing Inflows--%	---	23.0	64.3	39.9	4.3	4.3	90.4	36.8	41.8	123.1

Source: Tables VII-3 and VII-4 above. Conjuntura Economica, 26 (November, 1973); Boletim, Banco Central do Brasil (December 1972); International Financial Statistics, IMF (April 1973).

between a Brazilian security and a Euro-Dollar deposit has grown continuously, and this has resulted in a continuous rise in loans and financing. The increasing high rates of growth in loans and financing from 1970 to 1972 again indicate the concomitant "stock" and "flow" effects.

Direct private investments decreased a small 7.9 percent in 1970. This can be attributed to the uncertainty created by the following events: the incapacitation of President Costa e Silva in August 1969; the election of General Emilio Garrastazu Médici--until then not generally known by the people--by the Congress after his selection by the high command of the armed forces in October 1969; and the appearance, heretofore very unusual in Brazil, of a leftist terrorist movement which, in its most daring act, kidnapped the U. S. Ambassador to Brazil in September 1969. By the end of 1970 the new government was proving itself administratively successful, efficient in curbing both terrorism and other forms of political dissent, and very friendly to foreign investors. The economy was showing increasing rates of growth. As a result, the flow of direct private investment increased by 14.1 percent in 1971 and by 37 percent in 1972. Although many factors contributed to the exceptional increase in capital influx into Brazil after 1968, it seems clear that the minidevaluation policy was a key, and probably a necessary, factor.

On the side of outflows (see Table VII-2), the increase in the amortizations of loans and financing, which have occurred with a lag in relation to the respective inflows, is to be expected. The net inflow-outflow balance has shown an accelerated growth since 1968. The large surplus in the capital account has financed the balance in the current account and also has resulted in an unprecedented increase in foreign indebtedness and accumulation of foreign exchange reserves.

In fact, this increasing net influx of capital may have tempted the authorities to diminish the rate of exchange depreciation. A decline in the real exchange rate, _ceteris paribus_, tends to make local currency, short-term debt instruments still more attractive to foreigners, thus increasing the short-term capital influx. As noted in Chapter II, the real exchange rate adjusted for dollar inflation has declined a little since 1968.[8] The following example serves to explain why rates of devaluation smaller than the difference between the domestic and external inflation rates might make local debt instruments more attractive to foreigners.

Suppose the exchange rate at the beginning of the year is Cr$1.00 = US$1.00. In addition, suppose that: (1) the nominal interest rate paid on a riskless Brazilian Treasury Bill in Brazil is 25 percent per year, whereas it

---

[8]This decline is based on a comparison of either the wholesale price index for all commodities or the consumer (cost of living) price index in both Brazil and the United States. There is no decline when the wholesale industrial price index in Brazil is considered. For capital flows, however, the price index for all goods, not simply for industrial goods, is more relevant.

is 8 percent on a riskless U.S. Treasury Bill; (2) the annual rate of inflation in Brazil is 18 percent, in the United States, 3 percent; (3) the Brazilian authorities devalue the cruzeiro several times during the year by a total of 13 percent, that is, 2 points less than the difference (15 percent) between inflation rates in the two countries; (4) there is no fee for exchange rate transactions or income tax on returns in both countries; and (5) the U.S. authorities do not change the official par value of the dollar. Assume now that a U.S. resident invests US$100.00 in Brazilian Treasury Bills and the same in U.S. Treasury Bills at the beginning of the year. At the end of the year his Brazilian Treasury Bill will be worth US$110.62 (CR$125.00 divided by CR$1.13), whereas his U.S. Treasury Bill will be worth US$108.00, both in nominal dollar terms.[9] Therefore, the investment in the Brazilian security is more attractive, and conditions for a substantial net capital influx into Brazil, other things being equal, are created. Had the total annual devaluation of the cruzeiro been 15 percent, the Brazilian Treasury Bill would be worth US$108.70 (CR$125 divided by CR$1.15), and the return differential would be negligible.

The advantage given to the foreign investor in the former case is really not so secure because he does not know whether the government will continue to devalue the

---

[9]In terms of constant dollar value (considering the 3 percent annual rate of inflation in the United States) at the end of the year the Brazilian Treasury Bill will be worth US$107.40 and the U.S. Treasury Bill US$104.85.

cruzeiro by less than the differential in inflation rates during the next year. The expectation of foreign investors, however, following the second year of experience with the minidevaluations, has been that the monetary authorities have tended to devalue the currency by little less than the difference in inflation between the Brazilian and U.S. general (for all commodities) price indexes. As a result, they may have been expecting the advantage provided by the system in loan operations, which might by an additional reason for the increase in the net influx of capital into Brazil since 1968.

The Effects of Minidevaluations on Foreign Indebtedness and Accumulation of Foreign Reserves

Since the initiation of the minidevaluations, important changes have occurred in foreign indebtedness and in the accumulation of foreign exchange reserves as a result of trade performance and of the movements in capital flows. As shown in Table VII-5, the external debt of Brazil, which had oscillated between US\$3.0 billion and US\$3.7 billion from 1960 to 1967, increased dramatically after 1968 and attained the level of US\$10.2 billion in December 1972. Concomitantly, the foreign exchange reserves which were at the very low level of about US\$200 million in 1967, rose by an even larger rate, to US\$3,952.6, in December 1972. The concept of net foreign indebtedness is obtained by subtracting foreign reserves from external

TABLE VII-5.--Brazil's Foreign Indebtedness and Foreign Reserves on December 31, 1960-1972.

	External Debt (1)		Reserves (2)		Net Indebtedness (3) = (1 - 2)	
Year	Value	Index	Value	Index	Value	Index
1960	3,071.0	100.0	345.0	100.0	2,726.0	100.0
1961	3,080.0	100.3	470.0	136.2	2,610.0	95.7
1962	3,183.1	103.7	285.0	82.6	2,898.1	106.3
1963	3,185.5	103.7	219.0	63.5	2,966.5	108.8
1964	3,101.1	101.0	245.0	71.0	2,856.1	104.8
1965	3,478.4	113.3	484.0	140.3	2,994.4	109.8
1966	3,702.4	120.6	425.0	123.2	3,277.4	120.2
1967	3,372.0	109.8	199.0	57.7	3,173.0	116.4
1968	3,917.0	127.5	257.0	74.5	3,660.0	134.3
1969	4,403.3	143.4	657.0	190.4	3,746.3	137.4
1970	5,295.2	172.4	1,187.0	344.1	4,108.2	150.7
1971	6,621.6	215.6	1,642.0	476.0	4,979.6	182.7
1972	1,170.0	331.2	3,952.6	1,145.7	6,217.4	228.1

Source: Conjuntura Economica, 26 (April 1972) and 27 (March 1973).

debt. Column (3) of Table VII-6 indicates that Brazil's net foreign indebtedness has almost doubled during the period of minidevaluations, from US$3.2 billion at the end of 1967 to US$6.2 billion at the end of 1972.

Increases in both foreign indebtedness and foreign exchange reserves have been the result of deliberate government policy aimed at two objectives:[10] First there was a desire to increase the absorption of foreign savings to supplement the domestic saving effort. This would permit higher rates of investment and, consequently, economic growth. Second, the government wishes to direct the growth in foreign indebtedness, which results from the pursuit of the first objective toward medium- and long-term feasibility. Whereas the net influx of capital has financed the deficit in the balance of goods and services, the accumulation of foreign exchange reserves has bolstered foreign investors' confidence in the capacity of the Brazilian economy to meet its obligations and has become a reserve to be used in any short-run crisis that might eventually affect the foreign exchange earnings of the country.

The minidevaluations have facilitated the implementation of the foreign indebtedness policy.

---

[10] Stated by the Director of Exchange of Banco Central do Brasil, Paulo H. Pereira Lira, in "Politica de Endividamento Externo" (unpublished conference paper delivered to the Superior War College, July 1972), and also discussed by him in an interview with this author in August 1972.

They have established the conditions for reasonable economic calculations in foreign exchange operations, with the result that these operations have been normalized. Using computer simulation methods, monetary authorities have been able to forecast with reasonable accuracy Brazil's future foreign indebtedness behavior, its payment obligations, and its capacity to pay. The authorities have been closely following the level and term structure of foreign indebtedness, and they have taken the necessary steps to prevent undesirable developments. Since 1969 they have improved the information system. All foreign exchange operations, with specified payment terms, have been required to be registered at the Central Bank. Indirect type of controls, that is, controls which do not interfere with individual contracting parties, have limited the volume of short-term borrowing to levels considered safe by the authorities.

Table VII-6 shows that, despite a substantial increase, net foreign indebtedness averaged only 1.6 times the value of merchandise exports from 1969 to 1972,[11] compared to an average of 1.9 from 1965 to 1968 and 2.1 from 1960 to 1964. The term structure of foreign indebtedness also has had a salutary change. Short-term (up to one year) borrowing as a proportion of total debt declined

---

[11]This means that the level of net foreign indebtedness (foreign indebtedness less foreign exchange reserves) could be paid by the foreign exchange earnings generated by the exports of approximately one year and seven months.

TABLE VII-6.--Brazil's Net Indebtedness and Exports, 1960-1972, US$ millions.

	Net Indebtedness (1)		Exports of Merchandise (2)		
Year	Value	Index	Value	Index	1/2
1960	2,726.0	100.0	1,270.0	100.0	2.1
1961	2,610.0	95.7	1,405.0	110.6	1.9
1962	2,898.1	106.3	1,215.0	95.7	2.4
1963	2,966.5	108.8	1,406.0	110.7	2.1
1964	2.856.1	104.8	1,430.0	112.6	2.0
1965	2,994.4	109.8	1,595.5	125.6	1.9
1966	3,277.4	120.2	1,741.4	137.1	1.9
1967	3,173.0	116.4	1,654.0	130.2	1.9
1968	3,660.0	134.3	1,881.3	148.1	1.9
1969	3,746.3	137.4	2,311.2	182.0	1.6
1970	4,108.2	150.7	2,738.9	215.7	1.5
1971	4,976.6	182.7	2,903.6	228.7	1.7
1972	6,217.4	228.1	3,990.0	314.2	1.6

Source: Conjuntura Economica, 26 (April 1972), and 27 (March 1973).

from 1969 to 1970, whereas medium- and long-term debt increased. Table VII-7 indicates that this trend was slightly reversed in 1971.

During 1972 there was a relatively large surplus of disposable funds in the main world money markets; in addition, Brazil's political and economic outlook was considered excellent by foreign investors, especially in relation to other areas in Latin America, Africa, or Asia. This situation was reflected in the so-called "Brazil risk rate," the additional rate over the London interbank offering rate, LIBO, which is normally charged by foreign investors. During 1969-1971, the Brazil risk rate was 2.5 to 3.5 percent per year over the LIBO rate (which ranged from 5 to 6 percent per year) for three-year loans; during 1972 it decreased to 1.5 percent over the LIBO rate for five-year loans.[12] As a result, the foreign indebtedness of Brazil accelerated. In October 1972 the government decided to require that borrowers deposit 25 percent of the value of their foreign loans with the Central Bank. This made foreign loans more expensive to borrowers, but the net capital influx continued at a high level afterward. The authorities might have used an alternative desincentive for the foreign suppliers of funds: devaluation of the Brazilian currency by slightly

---

[12]From interviews by the author with Paulo H. Pereira Lira, Director, Banco Central do Brasil; Fernão C. Botelho Bracher, Director, Banco da Bahia; and Roberto C. de Barros Barreto, Director, Banco de Investimentos do Brasil, August 1972.

TABLE VII-7.--Term Structure of Brazil's Foreign Indebtedness, US$ millions.

Term	December 31, 1969		December 31, 1970		December 31, 1972	
	Value	% over Total	Value	% over Total	Value	% over Total
Up to 1 year	1,154.1	26.2	1,235.3	23.3	1,632.5	24.7
Up to 3 years	1,980.3	45.0	2,344.9	44.3	3,289.2	49.7
Up to 5 years	2,432.1	55.2	2,897.2	54.7	4,030.6	60.9
Up to 10 years	3,027.4	68.7	3,640.9	68.8	4,958.1	74.9

Sources: Relatórios and Boletins of Banco Central do Brasil, and Conjuntura Economica, 26 (April 1972).

Note: The data do not include operations with terms to be specified: 1969, US$361.6 millions, and 1970, US$597.3 millions.

higher rates or by the full differential between internal and external inflation. The influx of capital as well as imports probably would have diminished, whereas exports probably would have increased. Import tariffs could have been reduced if the government wanted to maintain the same level of imports that would occur at lower exchange rates.

The Behavior of Services

As shown in Figures VII-1, VII-2, and VII-3, from 1947 to 1972 the Brazilian balance on service items always has shown a deficit. This has been due to many reasons. First, until recently, because of the lack of an adequate shipping industry, Brazil depended almost entirely on foreign shippers. Second, unlike Mexico, Greece or Egypt--which have ancient cultural heritages constituting major tourist attraction--Brazil, despite its natural beauty and surging modern civilization, has not yet been selected as one of the world's major tourist attractions. In the past 26 years, Brazilians have traveled abroad much more than foreigners have traveled to Brazil. Third, as a net borrower and as a capital-importing country, Brazil has had a continuous deficit in its capital income account. Fourth, interest, profits, and dividends have constituted major service payment items. Insurance (except since 1971), government transactions, and other services such as management fees, technical assistance, patents and royalties, film rentals, and underwriters, commissions, and agents' fees complete the list of service items which

Figure VII-1.--Brazil's Balance of Services, 1947-1971, Current Dollar Value.

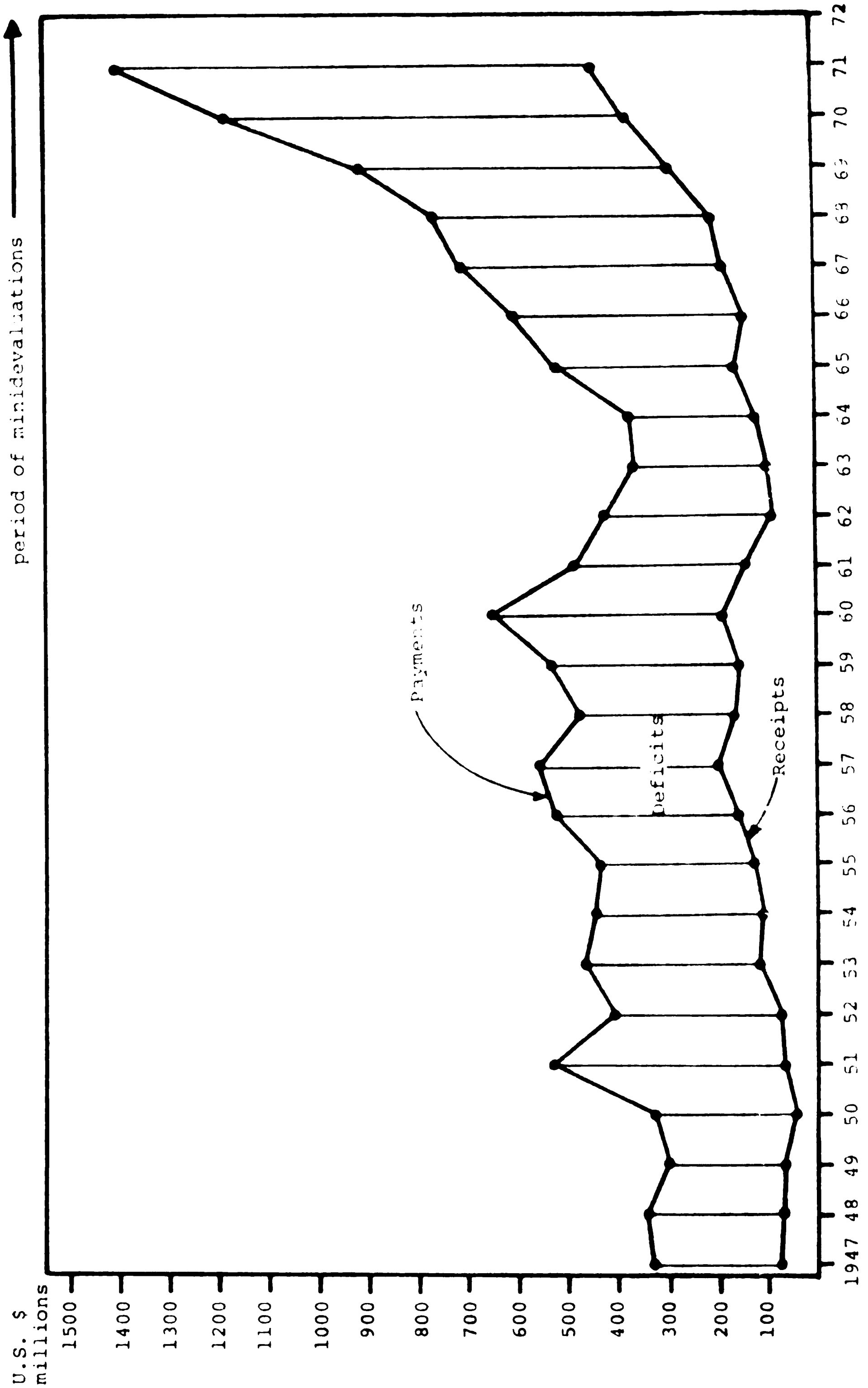

period of minidevaluations
Payments
Deficits
Receipts
U.S. $
millions
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
1947
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
70
71
72

Figure VII-2.--Service Payments, 1947-1971, Current Dollar Value.

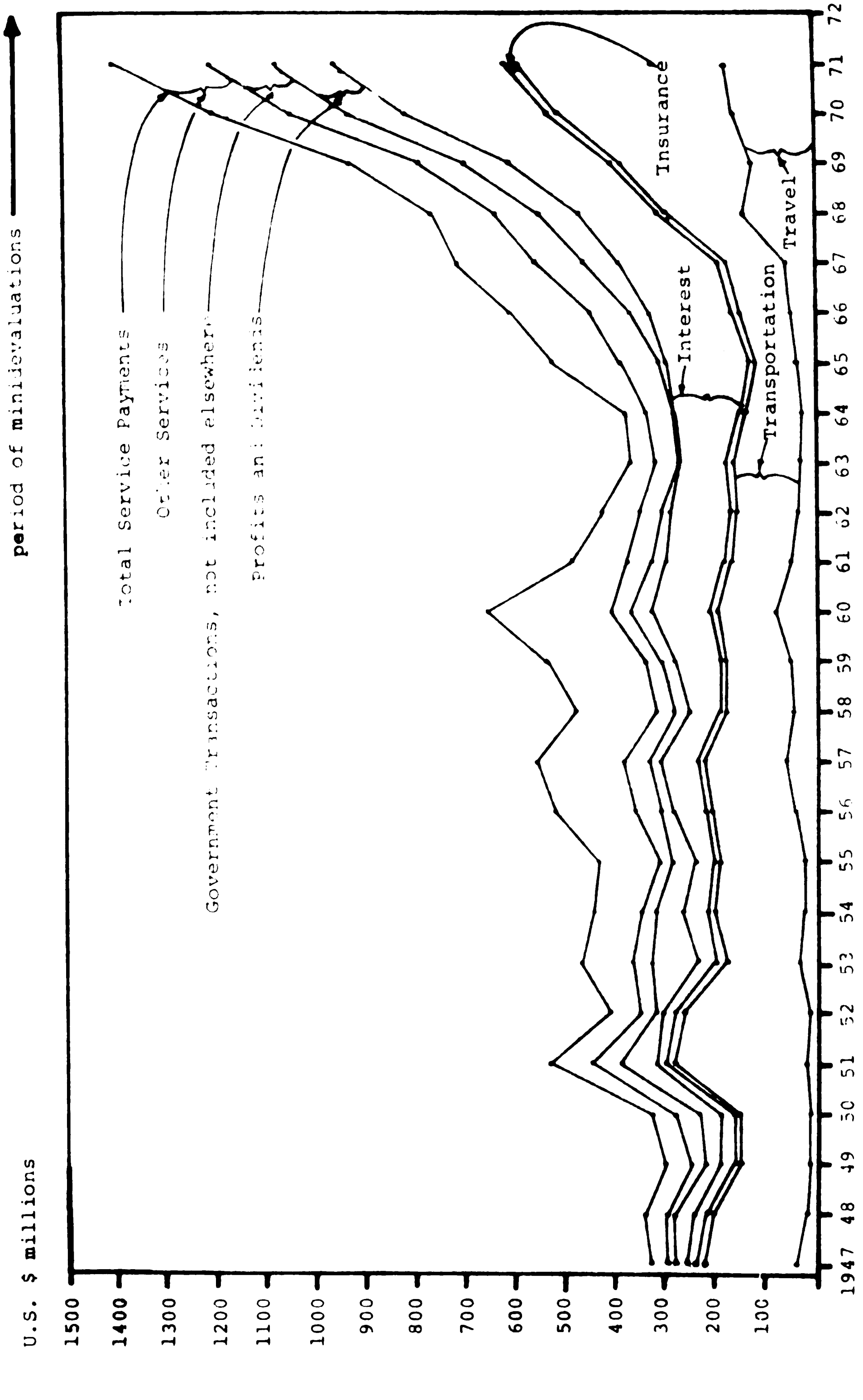
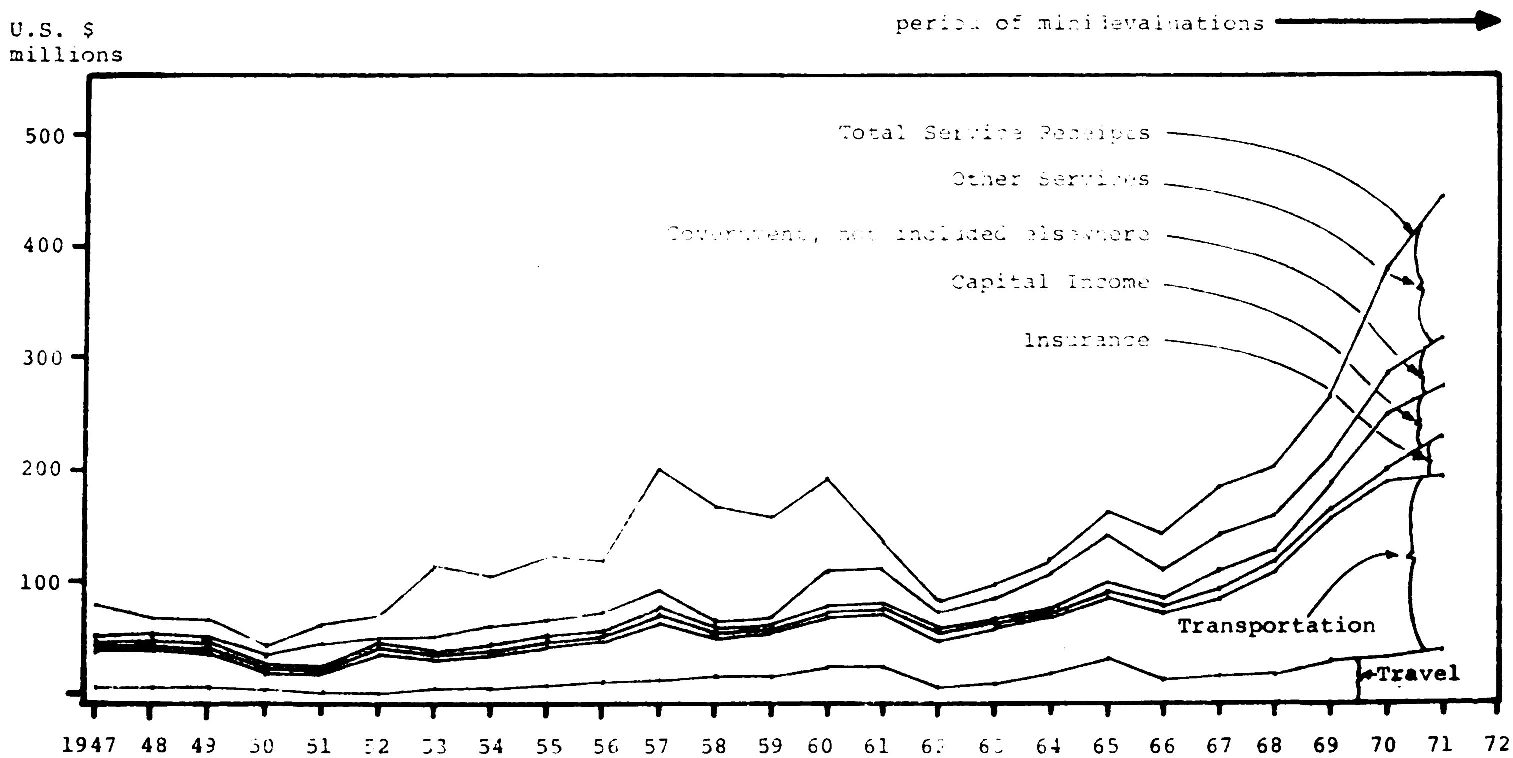

U.S. $ millions
period of minidevaluations
Total Service Payments
Other Services
Government Transactions, not included elsewhere
Profits and Dividends
Insurance
Interest
Transportation
Travel
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
1947
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72

Figure VII-3.--Service Receipts, 1947-1971, Current Dollar Value.


U.S. $ millions
500
400
300
200
100
Total Service Receipts
Other Services
Capital Income
Insurance
Transportation
Travel
1947
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72

have contributed continuously to the deficits in the Brazilian service account.

The importance of the service account to the Brazilian balance of payments can be illustrated by the following observation: Although the Brazilian balance of trade (exports minus imports in fob value) had only five deficit years between 1947 and 1972,[13] the balance of goods and services presented deficits in 19 out of the 26 years of the same period. Each of the service items has been influenced by important government measures. Only the major changes in the service accounts during the period under which the minidevaluations were in effect will be noted here.

Travel

Table VII-8 shows the Brazilian balance of services for the period 1960-1971. Since 1968 travel payments have increased sharply and much more than travel receipts. In 1971 travel expenses were 375 percent higher, in current dollar value, than the annual average for 1964-1967, whereas travel receipts were 89 percent higher than the annual average for 1964-1967. This has occurred despite strict regulation of currency sales for travel purposes. Since January 1968 each Brazilian who travels abroad has been allowed to purchase a maximum of US$1,000.00 in foreign exchange. He also has been allowed to receive a

---

[13] 1952, 1960, 1962, 1971, 1972.

TABLE VII-8.--Brazil's Balance of Services, 1960-1971, US$ millions.

	1960/63*		1964/67*		1968		1969		1970		1971	
	R[1]	P[2]	R	P	R	P	R	P	R	P	R	P
Total	127	481	151	554	205	761	290	920	378	1193	444	1422
1. Travel	15	42	19	36	17	138	28	117	30	160	36	171
2. Transportation	47	127	59	106	92	155	126	261	159	344	161	431
Freight	13	105	16	92	40	124	61	110	87	135	88	155
Other	34	22	43	15	152	31	65	151	72	209	73	276
3. Insurance	5	12	4	11	7	16	8	19	10	23	34	30
4. Capital Income	3	134	9	199	10	238	22	285	50	403	44	464
Interest	3	111	9	166	10	154	22	204	50	284	42	343
Profits and dividends	0	23	0	33	0	84	0	81	0	119	2	121
5. Government Transactions not included elsewhere	24	47	33	78	26	89	28	92	36	105	42	128
6. Other Services	33	119	27	124	53	125	78	146	93	158	127	198
Management and technical assistance					12	63	19	84	24	96	37	122
Patents, royalties and leases					2	7	3	9	3	8	3	10
Other					39	55	56	53	76	54	87	66
Balance	---	354	---	403	---	556	---	630	---	815	---	978

[1]Receipts. [2]Payments. *Annual average.

Source: Boletim, Banco Central do Brasil, several issues.

maximum of US$300.00 per month while abroad.[14] This high increase in travel expenses is due to the sharp rise in income of people in the top income brackets over the past five years. On the other hand, the steady increase in travel receipts since 1968 may be attributed to the improved tourist organization encouraged by the government and to the huge influx of foreign capital which has meant that many businessmen travel continuously in and out of the country. It is difficult to fathom whether or not the exchange rate policy of the government has had an important effect on travel. Brazil in recent years has not been a place for tourists to find many bargains. Indeed, the cost of living in big cities such as Rio de Janeiro, which receives the largest number of foreign travelers, has been quite high compared to other large cities in the world.

Transportation

An important development has occurred with respect to transportation. The exceptional growth of Brazilian exports and imports since 1968 has been accompanied by corresponding increases in expenditures for freight. Until the mid-sixties, almost all Brazilian exports and imports were shipped by foreign transportation. Beginning in 1966, but mainly since 1968, the government has been

[14] A person may apply for larger sums to the Central Bank in case of special need, such as business representation expenses, university tuition, and so forth.

fostering the development of a national shipbuilding industry and the expansion of a national commercial fleet. Minimum target levels of participation of the national flag in the transportation of merchandise overseas have been established. Furthermore, the system of minidevaluations of the exchange rate has eliminated the large exchange risk to which Brazilian shippers were exposed under the old system of sharp and unpredicted devaluations. Since 1968 Brazilian transport companies have been able to make more reliable revenue budgets, which, of course, has helped them in their investment plans.

The Brazilian government's policy has caused a substantial expansion of transportation firms, and, as a result, freight receipts have increased much more than freight payments.[3] In 1970 and 1971 freight receipts were, respectively, 444 percent and 450 percent higher than the annual average of the 1964-1967 period, whereas freight payments were, respectively, only 47 and 68 percent higher

---

[15]One must note that freights of imports paid to Brazilian shippers are not computed in the balance of payments. This is a transaction between importers and shippers who are residents of the same country. Therefore, only values paid to foreign shippers are registered in the item "freight expenses." Freight receipts are payments made by foreign importers to Brazilian shippers. In 1971 the Brazilian flag had a 62 percent participation in the transportation of Brazilian imports, as opposed to 57 percent in 1970 and 50 percent in 1969. The participation in the transportation of exports was 22 percent in 1970, as opposed to 20 percent in 1969. Relatório 1971 (Rio de Janeiro: Banco Central do Brasil).

than the corresponding annual averages of the same base period. This has prevented the development of an even worse deficit in the service account in the past five years.

Capital Income

The service account with the greatest net expenditure is income on capital, which is subdivided into interest, profits, and dividends. Such payments abroad had a compounded annual growth rate of 25 percent from 1968 to 1971. This exceptional growth rate has been due to the great influx of foreign capital into Brazil in the form of loans and direct investments since 1968.

The substantial growth in interest payments is partly due to the financing of equipment imports and partly to other kinds of loans, such as those financing working capital. In 1970 and 1971 the value of interest payments was respectively 71 percent and 107 percent higher than the annual average of the 1964-1967 period. Although starting from a lower base, the proportional growth in profits and dividends was even higher. In 1970 and 1971 the value of profits and dividends paid was, respectively, 261 percent and 267 percent higher than the annual average of the 1964-1967 period.

On the receipts side, capital income was negligible until 1968. Brazil receives interest on the investment abroad of official foreign reserves and on the import financing of Brazilian merchandise. Although still relatively modest interest receipts have had an impressive growth rate. In 1970 and 1971 their value was, respectively, 455 and 366 percent higher than the annual average of the 1964-1967 period. Profits and dividends were practically null up to 1970. In 1971, for the first time, a small amount, US$2 million, appeared as received in this account.

Conclusion

Many factors contributed to the expansion of services and the influx of capital and foreign indebtedness into Brazil since 1968. The policy of minidevaluations, however, has played a crucial role in this development. It has eliminated most of the exchange risk involved in foreign exchange operations, normalized the expectations of economic units, and helped the government in forecasting future developments with respect to the foreign indebtedness and reserve position of the country.

CHAPTER VIII

THE EFFECTS OF MINIDEVALUATIONS ON INFLATION AND ECONOMIC GROWTH

Having considered the effect of minidevaluations on the balance of payments items, this study now turns to their effect on the domestic economy. The gradual stabilization of prices and the acceleration of economic growth in the past decade have been the major objectives of economic policy common to all administrations. Econometric models that explain price behavior and growth will be used to test the extent to which the policy of minidevaluations has affected the pursuit of those goals.

The Effects of Minidevaluations on Inflation

The system of minidevaluations should have done no harm and even may have facilitated the government's pursuit of a gradual stabilization of prices in the Brazilian economy. Following are four arguments in support of this position.[1]

---

[1] For the first two arguments see Donges, Brazil's Trotting Peg, pp. 17-19.

First, under the conditions of chronic inflation such as prevailed in Brazil during the sixties, sharp devaluations in the exchange rate tended to produce inflationary shocks in the economy. Substantial rises in import prices for raw materials, intermediate products, and capital goods would drive costs upward. The rise in prices of oil and wheat, two of Brazil's most important import items, and of other food items would generate increases in cost of living and wage demands. Extrepreneurs would try to pass on the increased costs to consumers. Within a sufficiently elastic monetary system, these higher prices normally would not cause a substantial decline in sales. Under the oligopolistic situation, which has characterized a substantial part of Brazilian industry these price hikes would give new impetus to the price-wage spiral.[2] The system of minidevaluations has minimized the risk of spiraling price-wage developments. The small devaluations have permitted smoother price adjustments and have not caused defensive reactions on a wide front. Most firms, whether or not directly affected by the devaluations, also have been less inclined to use them as a pretext for price increases.

Second, as noted in the previous chapter, with the minidevaluations the difference between the official

---

[2]For a theoretical exposition of the price-wage spiral see Eduardo Matarazzo Suplicy, "Graphic Presentation of a Macroeconomic Model; The Inflationary Spiral," Revista Brasileira de Economia, 24 (October-December 1970).

and black market exchange rates has been much smaller than under the old system of large devaluations at relatively long intervals. In the past when that divergence was substantial it was expected that the official rate could not be defended for long and that an abrupt devaluation, followed by an inflationary push, was in the offing. This process was a major factor affecting price expectations, but under the new system it has lost much of its significance.

Third, the greater efficiency and productivity of the economy permitted by the minidevaluations has been an additional factor in the fight against inflation. The significant expansion of the foreign sector, analyzed previously, is evidence of this efficiency and productivity. Further evidence will be examined in the following section on economic growth.

Finally, the system of small and frequent adjustments in the exchange rate has greatly facilitated the control of macroeconomic developments, in particular the administration of monetary aggregates by the government. Since 1969, therefore, almost concomitantly with the introduction of the minidevaluations, the monetary authorities also have made increased use of open-market operations. Both instruments have played a key role in the short-run tuning of the economy. In particular, they have enabled the authorities to prevent undesirable rates of expansion in the money supply that otherwise would occur as a result of foreign exchange operations.[3]

The next section presents the results of econometric tests which were performed to check whether the system of minidevaluations has had a negative or positive effect on the Brazilian government's fight against inflation.

Models Explaining Price Behavior and the Regression Results

One way of obtaining information regarding the behavior of prices is to try to explain statistically the rate of change of prices as a function of variables that may be considered direct or indirect causes of the inflation. Two such variables are the rate of change of the money supply and of wage rates. This approach was first developed by Arnold C. Harberger to study inflation in Chile. It later was used with some variations by Carlos F. Diaz Alejandro and Adolfo C. Diz to study the case of Argentina and by Antonio Delfim Netto *et al*. to study the case of Brazil.[4]

---

[3]Before 1968 the monetary authorities were not always able to offset at the desired time the expansion in the means of payments that resulted from the eventual surplus in the balance of payments. See Mario Henrique Simonsen, *Inflação, Gradualismo X Tratamento de Choque* (Rio: APEC, 1970), chapter 2.

[4]Harberger, "The Dynamics of Inflation in Chile," in *Measurement in Economics: Studies in Mathematical Economics and Econometrics in Memory of Yehuda Grunfeld*, ed. by Carl Christ *et al*. (Stanford: Stanford University Press, 1963; Díaz Alejandro, *Exchange Rate Devaluation*,

Harberger's basic approach consists of a slight departure from two traditional theories: the quantity theory of money and the liquidity-preference theory. Based on the first theory, the price level may be expressed as a function of the quantity of money and the level of real income; based on the second, the cost of holding cash also enters as an independent variable. Taking first differences, the rate of change of prices, $\dot{p}_t$, can be expressed as a function of the rate of change of the quantity of money, $\dot{m}_t$, the rate of change of real income, $\dot{y}_t$, and, in the liquidity-preference case, the rate of change of the expected cost of holding cash. Changes in prices are positively related to changes in money supply and negatively related to changes in real income. A high expected cost of holding cash does not in itself induce prices to rise in a particular period if people already have adjusted their cash balances to the levels dictated by this fact. But when the expected cost of holding cash is rising, people try to lower their real cash balances, thereby tending to increase the upward pressure on prices.

---

chapter 5, and "Stop-Go Cycles and Inflation during the Postwar Period," in Essays on the Economic History of the Argentine Republic (New Haven and London: Yale University Press, 1970), pp. 367-89; Adolfo C. Diz, "Money and Prices in Argentina, 1935-1962" (Ph.D. dissertation, University of Chicago, 1966); Antonio Delfim Netto, Alfonso Celso Pastore, Pedro Cipollari, and Eduardo Pereira de Carvalho, Alguns Aspectos da Inflação Brasileira (São Paulo: ANPES, 1965).

To represent the rate of change in the expected cost of holding cash, Harberger used the difference between the rate of inflation in the past year and the rate of inflation in the year before ($a_t = \dot{p}_{t-1} - \dot{p}_{t-2}$). This variable was called the expected rate of acceleration in inflation. Harberger recognized that the variable a_t was bound to be a poor representation of the rate of change in the expected cost of holding cash. One limitation, not discussed by him, is that inflationary expectations are continuously being formed by people in the economy. The difference between the rates of inflation in the past two years might be too remote if the current rate of inflation--which is immediately recognized by the people--is following a very different path. Therefore, a better measure of expectations might be given by the difference between the current and the past year's rates of inflation ($a_t^* = \dot{p}_t - \dot{p}_{t-1}$). A problem with this formulation, however, is that the dependent variable, $\dot{p}_t$, becomes part of the explanatory variable. Thus, one cannot be enthusiastic about the high significance this expectation variable, a_t^*, probably will show in regression results. Its adoption as an alternative, nevertheless, might be useful, as will be seen below.

The departure from the two basic theories involves the consideration of further "policy" variables which also may affect the behavior of prices. Accordingly, Harberger allowed for the effects of minimum wage changes, $\dot{w}_t$, on the rate of inflation. Autonomous wage rises could lead to price rises even in the absence of increases in the quantity of money.

> A neo-orthodox position would hold that if the monetary authorities failed to allow the money supply to increase sufficiently to 'finance' a wage rise, unemployment would grow and activity slacken even in the face of a rising price level. In this sort of situation, wages would be able to add somewhat to the explanation given by monetary factors movements in the rate of inflation. On the other hand, if the monetary authorities always increased the money supply by enough (or more than enough) to assure full employment at the new wage level, there would be no strong reason to expect that wages would add significantly to a monetary explanation of inflation. Even though the wage rises were an autonomous force producing the inflation, they would in this case have their effects on prices by way of monetary expansion.[5]

Diaz Alejandro, Diz, and Delfim Netto et al. also considered exchange rate devaluation, $\dot{e}_t$, as an autonomous policy variable that could add explanatory power to price behavior. If, as a result of a rapid increase in real national income, the demand for imports increases at a much faster pace than exports, the authorities might feel the need for devaluations to prevent growing deficits in the balance of payments. The devaluations will tend to make imports and exports more expensive, therefore adding pressure to domestic prices.[6]

---

[5] Harberger, "The Dynamics of Inflation," p. 228.

[6] For the analysis of the effects of exchange rate adjustments on income and prices see Kreinin, International Economics, chapters 4 and 5.

All the above variables were considered in this study. In addition, three other policy variables were tested following the same basic approach.

One new one was the national treasury deficit, that is, government revenues minus expenditures as a proportion of Gross Domestic Product, d_t. The justification for its use is based on the Keynesian argument that fiscal policy is an important autonomous determinant of income and prices. In fact, although new issuance of paper money has been used to finance government deficits in Brazil, the relationship between both has varied greatly in the past two decades. Since 1965, in particular, a growing proportion of the government deficit has been financed by the sale of Treasury Bills to the public.

The second new variable to be considered was the average of the monthly percentage change in the level of the real official exchange rate during each year, f_t. It denotes the level of fluctuations in the real exchange rate, and it is used to test whether minidevaluations have had a positive or negative effect on the government's fight against inflation. (Appendix E illustrates the way the variable f_t depicts the effects of minidevaluations).

Finally, a dummy variable, c_t, was used to test whether or not the enforcement of price controls, applied since 1967 to the industrial sector of the economy, has had a significant effect on curbing inflation. It takes the value of zero before 1966 and of one from 1967 onward.

The annual percentage change in the general price index, $\dot{p}_t$, is the dependent variable in all models tested in this section. The general price index, widely followed in Brazil, is the weighted average of the wholesale price index (weight 6), the cost of living (weight 3), and the construction price index (weight 1), the last two in the State of Guanabara.[7] Changes in the 12-month average of each year were considered.

The several models were tested using ordinary least-squares regressions on 19 annual observations made from 1954 to 1972. Table VIII-1 presents the definitions of all variables, their sample means, and the simple correlation coefficients between each variable and the dependent variable. Table VIII-2 presents the values of all variables during the period studied.

Four models were tested. The first was the "naive" quantity theory model that links the relative rate of change in prices during a given period to the contemporaneous and past rates of change in the quantity of money. The assumption is that the latter two affect the level of prices through a process of adjustment that involves time. Assuming a constant velocity of money one should obtain:

---

[7]There are no equivalent national indexes for the last two indexes.

TABLE VIII-1.--Definitions, Sample Means, and Correlation Coefficients.

Variable	Mean	Simple Correlation Coefficient Between $\dot{p}_t$ and the Variable	Definition
$\dot{p}_t$	33.64	1.000	Annual percentage change in the general price index (average of 12 months). The general price index is the weighted average of the wholesale price index (weight 6), the cost of living (weight 3), and the construction price index (weight 1).
$\dot{m}_t$	33.59	.775	Annual percentage change in the average money supply (currency in the hands of the public plus demand deposits in commercial banks)
$\dot{m}_t^*$	39.39	.801	$0.7\ \dot{m}_t + 0.3\ \dot{m}_{t-1}$
$\dot{m}_t^{**}$		.800	$0.8\ \dot{m}_t + 0.2\ \dot{m}_{t-1}$
$\dot{m}_t^{***}$		.791	$0.6\ \dot{m}_t + 0.4\ \dot{m}_{t-1}$
$\dot{y}_t$	7.02	- .676	Annual percentage change in real income (Gross Domestic Product)
$\dot{w}_t$	34.11	.812	Annual percentage change in minimum wage (average of 12 months)
a_t	.42	.445	Proxy for expected rate of acceleration in inflation, equal to $\dot{p}_{t-1} - \dot{p}_{t-2}$
a_t^*	.14	.329	Alternative proxy for expected rate of acceleration in inflation, equal to $\dot{p}_t - \dot{p}_{t-1}$
f_t	4.89	.061	Annual average of the monthly percentage change in the real exchange rate for imports; it denotes the degree of instability in the real exchange rate
d_t	1.90	.558	National Treasury deficit (government expenditures minus government revenues) as a proportion of Gross Domestic Product
$\dot{e}_t$	32.66	.550	Annual percentage change in the official import exchange rate (average of 12 months)
c_t	.32	- .380	Dummy variable to indicate enforcement of controls of prices of industrial goods. It takes the value of zero from 1954 to 1966 and 1 from 1967 to 1972.

TABLE VIII-2.--Values of Variables Used in Models to Explain Price Behavior in Brazil.

Year	Annual Percentage Variation in: General price index (average of the year)	Money supply (average of 12 months)	Official import exchange rate (average of 12 months)	Minimum wage (average of 12 months)	Real income (GDP)	National Treasury deficit as a proportion of GDP	Average of the monthly percentage change in the real exchange rate for imports*	Dummy variable for enforcement of price controls in the industrial sector
1952	11.8	12.80						
1953	14.8	18.28						
1954	27.0	21.49	45.45	46.22	10.1	0.6	11.5	0
1955	16.4	19.08	58.01	32.18	6.9	0.7	6.31	0
1956	19.9	20.63	13.59	25.22	3.2	2.4	11.07	0
1957	14.2	23.77	-22.32	28.47	8.1	3.4	4.77	0
1958	13.0	33.14	90.80	0.00	7.7	2.1	9.54	0
1959	37.8	27.12	33.13	59.46	5.6	2.0	9.26	0
1960	29.2	66.30	3.62	10.00	9.7	2.8	3.55	0
1961	37.0	20.00	21.83	55.16	10.3	3.4	4.55	0
1962	51.6	53.46	38.71	31.24	5.3	4.3	4.85	0
1963	75.4	58.21	59.43	58.90	1.5	4.2	4.14	0
1964	90.5	86.51	100.00	83.33	2.9	3.2	7.42	0
1965	56.8	83.65	53.40	61.04	2.7	1.6	3.24	0
1966	37.9	37.10	17.29	30.65	5.1	1.1	2.47	0
1967	28.4	36.09	19.95	25.31	4.8	1.7	2.87	1
1968	24.2	42.21	28.01	21.63	9.3	1.2	3.34	1
1969	20.8	32.40	19.57	19.24	9.0	0.6	1.52	1
1970	21.9	29.14	12.73	20.11	9.5	0.4	1.27	1
1971	19.7	30.95	15.06	20.36	11.3	0.3	0.52	1
1972	17.5	31.00	12.24	19.55	10.4	0.2	0.63	1

Source: Conjuntura Econômica, 26 (November 1972), and 27 (March 1973).

*See Appendix E.

$$\dot{p}_t = \alpha + \beta_o \dot{m}_t + \beta_1 \dot{m}_{t-1} + \beta_2 \dot{m}_{t-2} + \ldots,$$

where α represents the exogenously given long-run rate of increase in real output.[8]

Adolfo C. Diz wrote some interesting comments about this relationship. On theoretical grounds, one should expect that, other things being equal, an upward and sustained shift in the rate of monetary expansion would, after a while, result in a similar increase in the rate of price changes. It follows that the sum of the β coefficients should add up to unity when all the relevant lags are taken into consideration. Then, according to the quantity theory of money, a lower level of real cash balances should be consistent with the new and higher rate of change in prices after the above shift has fully worked its effects in the economy. This, in turn, could cause some overshooting in the path of the rate of change in prices during the adjustment period in order for real cash balances to decline to their level. Because of this, Diz argues that one may observe some partial sum of the β coefficients to be greater than unity and some of them to be negative, while the total sum approaches unity as the whole adjustment process comes to an end.

---

[8]See Diaz Alejandro, "Stop-Go Cycles," p. 367.

Empirically, however, some difficult problems arise, particularly with the choice of the appropriate number of lagged changes in money. As Diz notes, "the stepwise inclusion of lagged values of the independent variable cannot be terminated on the basis of a sum of coefficients equal to one, or the significance of the last estimated coefficient, because the overshooting of prices might produce both effects before all relevant lags are included." In addition, multicollinearity will almost certainly occur when many values of the same variable at successive points in time are included in an estimation procedure, if the adjustment is not a rapid one.[9] In spite of this limitation this model was estimated to give some indication of the lagged response in prices to changes in the money supply.

The estimation result is shown as Equation (1) in Table VIII-3. The constant term appears as negative, equal to -1.2, and this cannot be considered the exogeneously given long-run rate of increase in real output. The sum of the three coefficients of the independent variables is close to unity, as expected. The coefficient of determination, however, is relatively low, and the coefficient of the second lagged value of rates of change in money supply, $\hat{m}_{t-2}$, is highly insignificant. Based on this result the decision was made to consider only the

[9] Diz, "Money and Prices," pp. 63-64.

TABLE VIII-3.--Application of the Quantity Theory of Money to Explain Price Behavior in Brazil and Examination of the Appropriate Lag in the Influence of Changes in Money Supply on Changes in the General Price Index. Ordinary Least Squares Regressions with $\dot{p}_t$ as the Dependent Variable, 19 Annual Observations: 1954-1972.

	Eq. 1	Eq. 2	Eq. 3	Eq. 4	Eq. 5
Constant	-1.194	23.013	22.684	23.608	23.298
$\dot{m}_t$	.702 (3.819) (.002)	.529 (3.084) (.008)			
$\dot{m}_{t-1}$	.280 (1.467) (.163)	.172 (1.100) (.289)			
$\dot{m}_{t-2}$	- .101 (- .5737) (.575)				
$\dot{m}_t^*$			.711 (4.008) (.001)		
$\dot{m}_t^{**}$				.689 (4.014) (.001)	
$\dot{m}_t^{***}$					.707 (3.860) (.001)
$\dot{y}_t$		-2.426 (-2.210) (.043)	-2.426 (-2.277) (.037)	-2.443 (-2.300) (.035)	-2.489 (-2.299) (.035)
R^2	.650	.731	.729	.729	.719
$\bar{R}^2$	.581	.677	.695	.696	.684
F	9.306	13.557	21.539	21.590	20.472
Sig	.001	0.0005	0.0005	0.0005	0.0005

The definition of the variables are in Table VIII-1. The numbers in parentheses under each coefficient are the t-values and the significance levels of the estimated coefficients, respectively.

current and previous values of this variable in the models examined below.

The second model tested was the quantity theory model, discussed above, which can be expressed as:

$$\dot{p}_t = \beta_0 + \beta_1\dot{m}_t + \beta_2\dot{m}_{t-1} + \beta_3\dot{y}_t,$$

or, alternatively,

$$\dot{p}_t = \beta_0 + \beta_1\dot{m}_t^* + \beta_2\dot{y}_t,$$

where $\dot{m}_t^*$ is a weighted average of $\dot{m}_t$ and $\dot{m}_{t-1}$. Equation (2) in Table VIII-3 shows the estimation of the first alternative of this model, whereas Equations (3) to (5) show the estimation of the second alternative assuming different weights for m_t and m_{t-1}. The best results (highest $\bar{R}^2$) with practically the same level of overall significance and coefficient of determination were shown by equations (3) and (4), which use as weights, respectively,

$$\dot{m}_t^* = 0.7\ m_t + 0.3\ m_{t-1}$$

and

$$\dot{m}_t^{**} = 0.8\ m_t + 0.2\ m_{t-1}$$ (m_t^{**} takes the place of m_t^* in the model).

The most significant weights might be found in the interval between the values given by these two alternatives. Since the difference is very small, and since the simple correlation coefficient between $\dot{m}_t^*$ and $\dot{p}_t$ (see Table VIII-1) is slightly higher than that between $\dot{m}_t^{**}$ and p_t, the decision was made to use $\dot{m}_t^*$ in the models considered below.

In Equation (3) the coefficients of $\dot{m}_t^*$ and $\dot{y}_t$ have the expected signs and are significant, respectively, at less than 1 percent and at 4 percent levels. The coefficient of determination, however, around .73, is not satisfying. Better results can be obtained following Harberger's procedure.

The third model considered, Harberger's, can be written as:

$$\dot{p}_t = \beta_0 + \beta_1\dot{m}_t^* + \beta_2\dot{y}_t + \beta_3\dot{w}_t + \beta_4 a_t.$$

Adding the variable f_t to denote the effect of minidevaluations, the model becomes

$$\dot{p}_t = \beta_0 + \beta_1\dot{m}_t^* + \beta_2\dot{y}_t + \beta_3\dot{w}_t + \beta_4 a_t + \beta_5 f_t.$$

During the period of minidevaluations, after 1968, as shown in Table VIII-2, the value of f_t is relatively small, denoting small fluctuations in the real exchange rate for imports. Before 1968 the value of f_t was much higher. Therefore, if minidevaluations have constituted an inflationary factor, the coefficient of f_t should be positive and significant.

Equations (6) and (7) in Table VIII-4 are the regression results of estimating these two models. Both equations are highly significant and have coefficients of determination adjusted for degrees of freedom around .84, much higher than those shown in Table VIII-3 for the quantity theory equations. The coefficients of $\dot{m}^*_t$, $\dot{y}_t$, $\dot{w}_t$, and a_t show the expected signs. Those of m^*_t and $\dot{w}_t$ are highly significant, that of $\dot{y}_t$ is significant only at the 12 percent and 15 percent levels, respectively, in Equations (6) and (7), and that of a_t is highly insignificant.

The addition of f_t as an explanatory variable does not improve the coefficient of determination R^2, and it slightly decreases the value of $\bar{R}^2$. The coefficient of f_t is negative and highly insignificant, indicating that minidevaluations have not constituted an inflationary factor.

In Equations (8) and (9) the variable $a^*_t = \dot{p}_t - \dot{p}_{t-1}$ took the place of $a_t = p_{t-1} - p_{t-2}$ to estimate the same Harberger model with and without the minidevaluation variable f_t. Since $\dot{p}_t$ is included as part of a^*_t, this formulation is not useful for prediction; also, the exceptionally high significance shown by the coefficients of a^*_t are not very meaningful. But it is interesting to note that the coefficient of a^*_t in Equations (8) and (9) is much higher than that of a_t in Equations (6) and (7).

TABLE VIII-4.--Test of the Effect of the Minidevaluations on Price Behavior in Brazil. Application of the Haberger Model with Modifications. Ordinary Least Squares Regressions with $\dot{p}_t$ as the Dependent Variable; 19 Annual Observations: 1954-1972.

	Eq. 6	Eq. 7	Eq. 8	Eq. 9	Eq. 10	Eq. 11	Eq. 12
Constant	7.767	10.415	2.193	7.649	11.349	6.925	1.913
$\dot{m}^*_t$	.494	.465	.773	.722	.619	.618	.336
	(3.536)	(2.574)	(10.163)	(8.776)	(5.761)	(5.886)	(2.262)
	(.003)	(.023)	(<0.0005)	(<0.0005)	(<0.0005)	(<0.0005)	(< .043)
$\dot{y}_t$	-1.348	- 1.464	- 1.101	- 1.342	- 1.230	- 1.173	- .708
	(-1.649)	(-1.545)	(-2.718)	(3.135)	(-2.647)	(-2.622)	(- .954)
	(.121)	(.146)	(.017)	(.008)	(.024)	(.024)	(.359)
$\dot{w}_t$	.464	.474	.254	.274	.281	.299	.469
	(3.895)	(3.685)	(3.719)	(4.054)	(3.747)	(4.340)	(4.657)
	(.002)	(.003)	(.002)	(.001)	(.004)	(.001)	(.001)
a_t	.121	.134					
	(.787)	(.806)					
	(.445)	(.435)					
a^*_t			.556	.578	.537	.494	
			(6.592)	(6.956)	(4.458)	(4.860)	
			(<0.0005)	(<0.0005)	(.001)	(.001)	
f_t		- .209		- .498	- 1.117	- .855	- 1.120
		(- .271)		(-1.400	(-1.962)	(-2.012)	(-1.566)
		(.790)		(.185)	(.078)	(.069)	(.143)
$\dot{e}_t$					.067	.068	.158
					(1.354)	(1.409)	(2.092)
					(.205)	(.186)	(.058)

d_t					.576 (.418) (.685)	1.202 (1.158) (.271)	4.074 (2.809) (.016)
d_t^*							
c_t					- 2.957 (- .713) (.492)		
R^2	.883	.883	.970	.974	.980	.978	.933
$\bar{R}^2$	.849	.839	.962	.964	.963	.965	.899
F Sig.	26.343 <0.0005	19.694 <0.0005	113.785 <0.0005	97.663 <0.0005	60.393 <0.0005	72.173 <0.0005	27.826 <0.0005
D.W.	1.64	1.76	1.49	1.69			

The definitions of the variables are given in Table VIII-1. The numbers in parentheses under each coefficient are the t-values and the significance levels of the estimated coefficients, respectively. The Durbin-Watson statistic values are inconclusive as to the presence of autoregression.

Also, the significance of all other individual coefficients is substantially increased. The coefficient of f_t in Equation (9), in particular, more than doubles (in absolute value) with respect to its value in Equation (7) and is significant at the 19 percent level. Its negative sign indicates again that minidevaluations have not been an inflationary factor.

The fourth model considered is a modified version of Harberger's basic approach. Additional policy variables were considered as follows:

$$\dot{p}_t = \beta_0 + \beta_1\dot{m}_t^* + \beta_2\dot{y}_t + \beta_3\dot{w}_t + \beta_4 a_t^* + \beta_5 f_t + \beta_6\dot{e}_t + \beta_7 d_t + \beta_8 c_t$$

$$\dot{p}_t = \beta_0 + \beta_1\dot{m}_t^* + \beta_3\dot{y}_t + \beta_3\dot{w}_t + \beta_4 a_t^* + \beta_5 f_t + \beta_6\dot{e}_t + \beta_7 d_t$$

Equations (10) and (11) in Table VIII-4 are the regression results of estimating these models. The coefficient of determination corrected for the number of degrees of freedom, $\overline{R}^2$, is almost the same in both Equations (10) and (11) as that obtained in Equation (9) with a smaller number of variables. The coefficients of the added policy variables, d_t, $\dot{e}_t$, and c_t show the expected signs but are insignificant. It is interesting to note, however, that the coefficient of the minidevaluation variable, f_t, substantially increases (in absolute value) with respect to the corresponding one in Equation (9). It is negative, and it becomes significant at the 8 and 7 percent levels, respectively, in Equations (10) and (11). This result implies that minidevaluations have helped the government in curbing inflation.

Equation (12) is similar to (11), except for the deletion of the expectation variable a_t^*. Here the coefficients of the variables $\dot{e}_t$, the percentage change in the real exchange rate for imports, and d_t, the National Treasury deficit as a proportion of Gross Domestic Product, become significant, respectively, at the 6 and 2 percent levels. The coefficient of the minidevaluation variable, f_t, has about the same value as in Equation (10), but its significance drops to the 14 percent level.

Conclusion

The results presented in this section indicate that the policy of minidevaluations have not constituted an inflationary factor, and that, on the contrary, may have aided the government in its pursuit of gradual stabilization of prices in Brazil.

The Effects of Minidevaluations on Economic Growth

After obtaining increasingly high rates of growth during the postwar years, averaging 6.4 percent between 1948 and 1956 and 8.3 percent during 1957-1961, the Brazilian economy presented a poor growth performance from 1962 to 1967. The average annual increase in real product was only 3.7 percent in this period, quite low in comparison with the annual population growth rate of 2.89 percent during the sixties. From 1968 through 1972, however, the period during which the minidevaluations were in effect, Brazil's economic growth was the highest in the country's history. During these four years, the real Gross Domestic Product grew at an annual average of 9.9 percent and in 1971 and 1972 it reached 11.3 and 10.4 percent, respectively, among the highest in the world. This section presents the results of econometric tests of the possible influence on this growth performance of minidevaluations, which might have helped the economy in attaining greater efficiency and higher rates of growth for several reasons.[10]

First, since divergences in cost and price trends between the domestic and foreign markets have been largely eliminated, the pull and fall in imports and exports that

---

[10] See Donges, Brazil's Trotting Peg.

otherwise would occur due to internal inflation have been avoided. The miniadjustments in the exchange rate have constituted an important instrument in making a gradual stabilization policy feasible, as opposed to a shock treatment policy to counteract difficulties in the balance of payments. As a result, disturbances which cause production losses have been avoided, and chances for a steadier and faster growth rate have increased.

Second, the substantial decrease in the exchange rate risk due to minidevaluations has reduced the incentives for firms which produce, sell, or buy exportables and importables to speculate with their stocks of merchandise. Under the old system of sharp changes in the exchange rate separated by long intervals, importers would try to buy large amounts of imported goods whenever they felt a sharp devaluation was going to occur. Concomitantly, sales of goods competing with imports would decline sharply. The reverse would occur just after the sharp devaluations. Exporters, on the other hand, during inflationary and pegged exchange rate periods, would pile up goods, await a new devaluation, and then sell merchandise for the maximum cruzeiro sales revenue. The decrease in such speculative stock fluctuations also has allowed for greater efficiency and steadier rates of growth. In addition, the removal of the exchange rate risk has facilitated investment planning for all firms directly or indirectly involved with foreign exchange operations.

Two very simple growth models and two slightly more sophisticated ones were applied to test the effects of minidevaluations on growth. Unavailability of appropriate data, however, has all but prevented the study from obtaining very meaningful results in the application of the more sophisticated growth models.

A Simple Growth Model

The equilibrium condition of a simple macroeconomic model which assumes fixed prices and no government requires that the total income (output), Y, equal the total expenditure, E, where

$Y = C + S$,

$E = C + I + X - M$, and

C = consumption,

S = saving,

I = investment,

X = exports of goods and services, and

M = imports of goods and services.

Both X and M do not include payments of services for the use of foreign capital received in previous periods in the form of interest, profits, and dividends.

In equilibrium,

$$Y = C + I + X - M,$$

or

$$I = (Y - C) + (M - X),$$

where

$Y - C = S_d$ = domestic saving, and

$M - X = S_e$ = foreign saving.

Rewriting the equilibrium condition,

$$I = S_d + S_e \qquad \text{(I)}$$

At any time t, the conditions for long-run equilibrium on the product market also require that the capital stock K be utilized at full capacity. This may be expressed as[11]

$$K = vY \text{ for all } t,$$

or

$$Y = \alpha K,$$

where $\alpha = \frac{1}{v}$ = output-capital ratio.

---

[11]See R. G. D. Allen, Macro-Economic Theory, A Mathematical Treatment (New York: MacMillan and St. Martin's Press, 1968), chapter 10.

The relation between the change in output and change in capital stock may be written as

$$dY = \alpha dK \tag{II}$$

but, by definition, $I = dK$. Then, from expressions (I) and (II),

$$dY = \alpha(S_d + S_e).$$

Dividing by Y,

$$\frac{dY}{Y} = \alpha \frac{(S_d + S_e)}{Y}.$$

This expression indicates that the rate of growth in real output is a function of the output-capital ratio and of the sum of the domestic saving rate and the foreign saving rate. In an alternative notation, it may be written

$$\dot{y}_t = \alpha\ (s_t + b_t), \tag{III}$$

where

$\dot{y}_t$ = annual rate of growth in Gross Domestic Product (GDP),

s_t = domestic saving as a proportion of GDP, and

b_t = deficit in the balance of goods and non-monetary services as a proportion of GDP (M - X).

Growth Model (III) has been used by officials to rationalize the foreign indebtedness and growth policies pursued by the government.[12] Thus, the increases obtained in both the domestic saving rate and foreign saving rate in the years 1968-1971, which have resulted in very high growth rates, constituted the accomplishment of a conscious policy.[13]

Taking α as a parameter to be estimated, Model (III) can be tested. But since the objective of the study was to test the effects of the minidevaluations, the variable f_t, the annual average rate of change in the real official exchange rate (the same that was used in the inflation models), was added to the model to obtain[14]

$$\dot{y}_t = \alpha \, (s_t + b_t) + \beta f_t. \qquad \text{(IV)}$$

In Model (IV) f_t enters as a qualitative variable. Because of the reasons discussed above, the smaller the fluctuations in the real exchange rate, the

---

[12] See Lira, "Politica de Endividamento," Appendix.

[13] The domestic and foreign saving rates for 1970 and 1971 used in this chapter are unpublished preliminary estimates cited in Carlos Von Doellinger, "Capitais Externos, Balanço de Pagamentos e Crescimento Econômico," Internal Document, IPEA, Ministry of Planning.

[14] A similar model using a dummy variable, D, to represent the minidevaluations in the place of f_t, where D took the value of zero before 1968, 0.34 in 1968, and 1 from 1969 to 1971 was tested and yielded results somewhat less significant than those obtained in estimating Model (IV).

greater the rate of economic growth should be (see Appendix E).

The Increase in the Labor Force as a Variable

An alternative simple growth model starts from a general aggregate production function in which output is a function of capital and labor:[15]

$$Y = F(K,L),$$

$$dY = \frac{\partial F}{\partial K}\, dK + \frac{\partial F}{\partial L}\, dL.$$

Dividing by Y, and multiplying the second term in the right hand side by $\frac{L}{L}$

$$\frac{dY}{Y} = \frac{\partial F}{\partial K}\frac{\partial K}{\partial Y} + \frac{\partial F}{\partial L}\frac{L}{Y}\frac{\partial L}{L}$$

or, in terms of coefficients to be estimated,

$$\dot{y} = \beta_1 \frac{dK}{Y} + \beta_2\, \dot{i},$$

where the investment rate $\frac{dK}{Y} = s_t + b_t$, in equilibrium conditions,[16] and $\dot{i}_t$ = annual percentage change in the labor force.

Adding a constant term and the variable f_t to denote the effects of minidevaluations, the following model is obtained:

---

[15] See Sherman Robinson, "Sources of Growth in Less Developed Countries," Quarterly Journal of Economics 85, no. 3 (August 1971), 391-408.

[16] In terms of ex-post data, the investment rate (gross investment over GDP) is also equal to the sum of domestic and foreign savings (with negligible differences) in the Brazilian national accounts.

$$\dot{y}_t = \beta_0 + \beta_1 (s_t + b_t) + \beta_2 \dot{i}_t + \beta_3 f_t \qquad \text{(V)}$$

Allowing for improvement in the quality of the labor force, an additional term may be added:[17]

$$\dot{y}_t = \beta_0 + \beta_1 (s_t + b_t) + \beta_2 \dot{i}_t + \beta_3 \dot{e}_t + \beta_3 f_t \qquad \text{(VI)}$$

where $\dot{e}_t$ is a proxy for the annual percentage increase in the number of students that complete their education at a certain level and join the labor force. (See the discussion of this variable in estimation problems below.)

Following Sherman Robinson's procedure, the growth model also can take into account the rate of factor transfers from the "backward" or agricultural sector to the "advanced" or urban sector of the economy. The rate of transfer of labor can be estimated by p_t, the average annual absolute change in the percentage share of the population living in the cities. The rate of transfer of capital is measured indirectly. Assuming that the capital-output ratios are the same in the two sectors, the change in the share of the advanced sector in total output measures the rate of capital transfer. The variable a_t

[17] Except for the inclusion of f_t and the exclusion of interaction terms, a similar model is developed by Carlos Geraldo Langoni, "As Fontes de Crescimento Economico Brasileiro," Estudos Economicos, 2, no. 4 (1972), 3-34. The interaction terms also are excluded by Langoni in empirical applications. See also Marcelo Selowski, "On the Measurement of Education's Contribution to Growth," Quarterly Journal of Economics, 83 (August 1969), 449-63.

is the average annual absolute change in the share of the agricultural sector in Gross Domestic Product. (A negative change in a_t means a positive transfer of capital from agriculture to the advanced sector of the economy.)[18] The growth model then may be written as

$$\dot{y}_t = \beta_0 + \beta_1 (s_t + b_t) + \beta_2 \dot{i}_t + \beta_3 \dot{e}_t$$

$$+ \beta_4 a_t + \beta_5 p_t + \beta_6 f_t, \qquad \text{(VII)}$$

where the growth rate of real product is positively related to $(s_t + b_t)$, $\dot{i}_t$, $\dot{e}_t$, and p_t and is negatively related to a_t and f_t.

Estimation Problems and Regression Results

The use of the above growth models in time series regression analysis is confronted with some data limitations. First, the only available information on the size of the labor force derives from the censuses taken each ten years. Therefore, it is only known that the labor force grew at 2.9 percent per year during the fifties and at 2.7 percent during the sixties. As a result, meaningful results cannot be obtained for the coefficient

---

[18]See Robinson, "Sources of Growth." In his cross-section study, Robinson uses $(s_t + b_t)$ and $(-b_t)$ as two separate variables, the first as the ratio of gross investment to GNP and the second as the ratio of net foreign balances (balance on current account) to GNP. The regression results of Robinson's model applied to 12 annual observations from 1960 to 1971 yielded very insignificant results, which may be due partly to data limitations.

of $\dot{i}_t$. Second, it is difficult to have a good measure for the improvement in the quality of the labor force. An accurate indicator should take into account the number of persons of different degrees of education (such as, primary, secondary, secondary technical, university) that join the labor force each year. On-the-job training also should be considered. But complete time series information for a long period was not available for these items. As a proxy for the rate of change in the number of students that complete secondary education and also as an indicator of the change in the capacity of society to absorb technological progress, the variable $\dot{e}_t$, the annual percentage increase in the number of students enrolled in higher education, was used. Third, estimates of the annual absolute change in the share of population living in urban areas were available only from 1960 to 1971 and were based on the censuses of two years, 1960 and 1970. The coefficient of the year-to-year variations, p_t, therefore, is not very meaningful. There were no difficulties in finding data on s_t, b_t, a_t, and f_t.

Table VIII-5 presents the definitions of all variables, their sample means, and their simple correlation coefficient with the dependent variable $\dot{y}_t$, Table VIII-6 offers the data used in the estimation, and Table VIII-7 indicates the regression results for twelve annual observations from 1960 to 1971.

TABLE VIII-5.--Variables Used in Growth Models, Definitions, Sample Means, and Simple Correlation Coefficients; 12 Annual Observations: 1960-1971.

Variable	Simple Correlation Coefficient Between the Variable and $\dot{y}_t$	Sample Mean	Definition
$\dot{y}_t$	1.00	6.78	Annual percentage change in real Gross Domestic Product.
s_t	- .20	16.89	Ratio of domestic savings to Gross Domestic Product.
b_t	.64	1.14	Ratio of foreign savings to Gross Domestic Product.
$s_t + b_t$	.27	18.03	Ratio of total savings (equal to gross investment in the national accounts) to Gross Domestic Product.
$\dot{l}_t$	.27	2.72	Annual percentage increase in the labor force.
$\dot{e}_t$	.23	15.68	Annual percentage change in the number of students enrolled in higher education (serve as proxy both for the percentage increase in number of students who have finished intermediate education and for the increase in the capacity of the economy to absorb technological change).
a_t	- .19	- .78	Annual absolute change in the share of agricultural sector in GDP.
p_t	- .27	1.08	Annual absolute change in share of population living in the cities.
f_t	- .53	3.31	Annual average of the monthly percentage change in the monthly real official exchange rate. It denotes the level of fluctuations in the real exchange rate.

TABLE VIII-6.--Data Used in Estimation of Growth Models to Test the Effect of the Minidevaluations.

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
Annual percentage change in real GDP $\dot{y}_t$	9.7	10.3	5.3	1.5	2.9	2.7	5.1	4.8	9.3	9.0	9.5	11.3
Annual percentage change in labor force $\dot{l}_t$	2.9	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Ratio of domestic savings to GDP s_t	16.3	18.1	17.8	17.7	19.0	18.8	15.1	14.0	15.8	15.6	16.5	18.0
Ratio of foreign savings to GDP b_t	2.1	1.1	2.6	1.0	- 0.4	- 1.4	0.1	1.2	1.6	0.9	1.6	3.3
Ratio of total savings (equal gross investment including changes in inventories) to GDP $s_t + b_t$	18.4	19.2	20.4	18.7	18.6	17.4	15.2	15.2	17.4	16.5	18.1	21.3
Annual percentage changes in total number of students enrolled in higher education $\dot{e}_t$	4.0	9.0	5.6	15.8	14.6	9.4	15.6	18.2	30.7	23.2	24.1	18.0
Annual absolute change in share of agricultural sector in GDP a_t	- .06	- .59	1.77	- 2.84	1.17	- .50	- 2.04	.36	- 1.71	- .54	- 2.60	- 1.82
Annual absolute change in share of population living in urban areas p_t	1.26	1.23	1.19	1.16	1.13	1.09	1.07	1.03	1.01	.98	.95	.92
Annual average of the monthly variation in the real official exchange rate for imports f_t	3.55	4.55	4.85	4.14	7.42	3.24	2.47	2.87	3.34	1.52	1.27	0.52

Sources: For $\dot{y}_t$, $\dot{l}_t$, s_t, b_t, and a_t, Conjuntura Econômica, 26 (November 1972). The data for s_t and b_t for 1969 to 1971 are unpublished preliminary estimates by IPEA, Ministry of Planning. For f_t see Appendix E, Table E-4.

For p_t, estimates are based on the national census of 1960 and 1970 by João Lyra Madeira and Celso Cardoso da Silva Simões, "Estimativas Preliminares da População Urbana e Rural segundo as Unidades da Federação, de 1960/1980 por uma Nova Metodologia," Revista Brasileira de Estatística, 33 (January-March 1972), 3-11.

TABLE VIII-7.--Test of the Effect of the Minidevaluations on the Brazilian Economic Growth. Ordinary Least Squares Regressions with $\mathring{y}_t$ as the Dependent Variable; 12 Annual Observations: 1960-1971.

	Equation 1	Equation 2	Equation 3	Equation 4
Constant	--	-44.47	-78.55	-77.49
$s_t + b_t$	.57	.62	.80	.97
	(5.80)	(1.30)	(1.62)	(1.95)
	(<0.0005)	(.23)	(.15)	(.11)
$\dot{i}_t$		16.09	26.15	13.85
		(1.06)	(1.53)	(.69)
		(.32)	(.17)	(.52)
$\dot{e}_t$			.17	.44
			(1.17)	(1.83)
			(.28)	(.13)
a_t				1.21
				(1.36)
				(.23)
p_t				27.58
				(1.21)
				(.28)
f_t	- 1.07	- 1.09	- .82	- 2.05
	(- 2.25)	(- 2.29)	(- 1.58)	(- 2.03)
	(.04)	(.05)	(.16)	(.09)
R^2	.40	.48	.56	.69
$\bar{R}^2$	.34	.28	.31	.33
F	--	2.44	2.26	1.92
Sig.	--	.14	.16	.24
D.W.	1.44	1.93	1.90	--

The definitions of the variables are given in Table VIII-5. The numbers in parentheses under each coefficient are the t-values and the significance levels of the estimated coefficients, respectively. The Durbin-Watson statistic values do not indicate the presence of autoregression.

Equation (1) in Table VIII-7 corresponds to the model (IV), the simplest. It shows a low coefficient of determination, $R^2 = .40$. The coefficient of determination corrected for degrees of freedom, although low, $\bar{R}^2 = .34$, is the highest of the four tested models. The coefficient of $(s_t + b_t)$ shows the expected sign and is highly significant. The negative sign on the coefficient of f_t and its significance at the 4 percent level indicate that minidevaluations had a positive impact on the growth rate of the economy.

In Equation (2), which corresponds to model (V), the coefficients of $(s_t + b_t)$ and $\dot{i}_t$ have the correct signs but are not significant. That of f_t, however, shows the same sign and about the same value as in Equation (1) and is significant at the 5 percent value. The positive effect of minidevaluations is then confirmed.

In Equation (3) the inclusion of $\dot{e}_t$ as an explanatory variable causes the value of $\bar{R}^2$ to increase with respect to that of Equation (2), although not with that of Equation (1). All coefficients have the expected signs, but none is significant at the 5 percent level.

Equation (4) corresponds to model (IV). It has the highest coefficient of determination, $R^2 = .69$, but when corrected for degrees of freedom ($\bar{R}^2 = .33$) it becomes slightly lower than that obtained by Equation (1) ($\bar{R}^2 = .34$). The coefficient of a_t unexpectedly shows a positive sign, but it is insignificant. The coefficients of the other explanatory variables show the expected signs, but only that of f_t is significant at less than the 10 percent level. The positive effect of the minidevaluations is again confirmed, although the result must be qualified in view of the low overall significance of this equation.

Evidence of Greater Efficiency After Minidevaluations

An examination of the residual factor in economic growth can indicate the higher efficiency of the Brazilian economy after the minidevaluations. The productivity residual is the growth of output that cannot be accounted for by the growth of labor and capital. It is shown in Appendix H that the average residual for the years 1962 to 1967 was only 0.80 percent as compared to about 5.0 percent for the years 1968 to 1972, a dramatic change. Therefore, it may be asserted that the economy became substantially more efficient after the introduction of minidevaluations.

Conclusion

Measurement problems have limited the application of time series regression analysis. However, the results have shown that the system of minidevaluations of the exchange rate has had a positive impact on the growth performance of the economy. Examination of the residual factor in the growth of the economy have indicated that much greater efficiency was obtained after the initiation of minidevaluations.

CHAPTER IX

CONCLUSION

The main findings of this study were the following: The system of minidevaluations of the exchange rate at short intervals proved to have several advantages over the system of sharp devaluations at long intervals for the Brazilian economy. The main advantage was the greater stability in the relation between internal and external prices for those involved in the foreign sector of the economy. Thus, the exchange rate risk involved in export, import, direct foreign investments, and international loan operations was practically eliminated.

It was shown that Brazilian exports were positively affected by the policy of minidevaluations. The regression analysis showed that this policy made exports of manufactures more responsive to changes in the level of real income and significantly more responsive to changes in the level of real remuneration to exporters. This latter occurred both through changes in the real exchange rate and changes in the level of fiscal incentives. Exports of primary products also were shown to be positively affected by the smaller fluctuations in the real exchange rate under the minidevaluations.

The econometric analysis of imports indicated that a significant shift in the parameters of the import function took place as a result of two causes: the lowering of import tariffs and the policy of minidevaluations. Imports became more responsive to income changes and especially responsive to changes in the real exchange rate adjusted for dollar inflation, tariffs, auction fees, and other trade barriers.

Minidevaluations have had two major impacts on capital movements. First, they substantially diminished destabilizing short-term capital movements which previously had been harmful to the value of the cruzeiro. Second, along with other measures, they constituted a necessary condition for the exceptional influx of foreign capital into Brazil that has occurred since 1968. The regression analysis of direct foreign investments indicated that they were responsive to profit opportunities--which were represented by the rate of growth of the economy--and to the decrease in the exchange rate risk caused by the minidevaluations. It was seen that the differential between domestic and foreign levels of real interest rates played an important role in attracting foreign loans and financing into Brazil. The portfolio approach to analyzing capital flows showed that interest differentials and the evaluation of risk, as determined by the exchange rate policy, political factors, and other events, were all important in determining the influx of foreign capital. By normalizing the expectations of economic units and by establishing the conditions for reasonable economic calculations in foreign exchange operations, minidevaluations have helped the government in forecasting and managing future developments with respect to the foreign indebtedness and reserve position of the country. Under minidevaluations, the exceptional growth in exports, imports, and capital flows was accompanied by a similar increase in service payments and receipts. Among service payments the items which registered larger increases were capital income (interest, profits, and dividends), transportation, and travel. Among service receipts, transportation and capital income increased most.

The econometric analysis of price behavior indicated that minidevaluations have not constituted an inflationary factor. On the contrary, they may have aided the government in its pursuit of gradual stabilization of prices in Brazil.

Finally, evidence was presented that minidevaluations had a positive impact on the growth performance of the economy. The growth of the Brazilian economy, however, must be qualified. Although this dissertation has not dealt with the subjects of income distribution and the political and economic regime, these dimensions must be considered in the larger context of general development strategy.

According to a number of indications, during the last decade economic growth has not resulted in a generalized improvement in welfare for a large segment of the Brazilian population. In fact, a comparative examination of Brazil's census reports for 1960 and 1970 reveals that the prevailing economic system yielded excellent results during the decade for the wealthiest 20 percent of the population, extraordinary benefits for the top 5 percent, and only some improvement for the bottom 40 percent. Whereas the richest 10 percent increased their participation in total income from 39 percent in 1960 to 48 percent in 1970, the poorest 40 percent decreased their share from 11.5 percent to 10 percent.[1]

At the same time, Brazilian economic growth has not been accompanied by advances in political democracy. Since 1964 the Brazilian political regime has been characterized by repression of students, intellectuals, and labor activities; by press censorship; by no direct

---

[1]See Carlos Geraldo Langoni, "Distribuição da Renda e Desenvolvimento Econômico do Brasil," Estudos Econômicos, 2 (October 1972), Table 4, p. 14; Rodolfo Hoffman and João Carlos Duarte, "A Distribuição de Renda no Brasil," Revista de Administração de Empresas, 12 (April/June 1972); and Albert Fishlow, "Brazilian Size Distribution of Income," American Economic Review, 62 (May 1972).

elections for major executive officials; and by prisons and torture of prisoners suspected of insurrectionist activities. These also seem to be the characteristics of other less developed countries which are experiencing high rates of growth of gross domestic product under a mixed capitalist system, and which are very receptive to multinational corporations. Greece, Iran, Turkey, and Thailand are examples.

Perhaps in a few years or decades, Brazilians may decide, hopefully through the democratic process, to follow a new type of economic system which does not lead to increasing social inequities. Major decisions will have to be made with respect to both the domestic and the foreign sector of the economy. This author hopes that this study will contribute to the understanding of the role of the foreign exchange adjustment mechanism in an economy which then will be subject not only to inflationary but also to many other kinds of pressures.

Some suggestions for further research now will be made. It would be interesting to estimate a "domestic resource cost" of Brazilian exports.[2] If the export price

---

[2]See Hollis B. Chenery, "Comparative Advantage and Development Policy," American Economic Review, 51 (March 1961), 18-51; Edmar Bacha and Lance Taylor, "Foreign Exchange Shadow Prices: A Critical Review of Current Theories," Quarterly Journal of Economics, 85 (May 1971), 197-224; and Michael Bruno, "Domestic Resource Costs and Effective Protection," Journal of Political Economy, 80 (January/February 1972), 16-33.

(for manufactures) can be as much as two-thirds of the domestic price owing to tax relief, credit subsidies, and the like, the domestic resource cost ratio of exports may be considerably in excess of one. Thus one important question to examine is whether or not the "equilibrium" exchange rate which the official rate is approximating through minidevaluations is not a distorted one (or at least one which is dependent upon a highly distorted internal price structure).

Another interesting point to be empirically examined is that raised by Ruben D. Almonacid about the possible negative effects of devaluation on the output of the economy through its effects on the aggregate supply of the economy. Almonacid shows that the effects of a devaluation on the aggregate supply is such that it might more than offset the expansionary effects of the devaluation on the aggregate demand of the economy. He argues that the slight overvaluation of the cruzeiro with respect to the dollar (taking consumer price indexes as the basis for comparison) from 1968 to 1971 has been a positive factor in stimulating the Brazilian economy.[3] If this is true, it would be interesting to search for the optimum degree of overvaluation.

---

[3]Ruben Dario Almonacid, "O Efeito da Taxa Cambial Sôbre o Produto," Estudos Econômicos, 2 (October 1972), 155-70.

APPENDIX A

THE BATTERY OF INCENTIVES FOR EXPORTATION

THE BATTERY OF INCENTIVES FOR EXPORTATION

Current incentives for exportation apply in general to manufactured products, but some also apply to primary goods. Table A-1 summarizes the array of incentives which constitute the prevailing international policy matrix of Brazil.[1]

The Fiscal Incentives

Fiscal incentives in Brazil include exemptions from tarrifs, sales taxes, and income taxes on inputs, export products, and export profits.[2] There also are subsidies in the form of tax credits.

IPI Incentives

The IPI (see footnote 5, Chapter III) or tax on industrial products, is a federal tax on the total value of production, but it effectively constitutes a tax on value added. It grew out of the old consumption tax (Imposto de Consumo) and was introduced in late 1964. Administration of the value-added aspect of the tax permits producers of final and/or exported products to deduct amounts equal to

---

[1]See Antonio Nilson Quezado Calvacanti and Ettiene Cracco, "Os incentivos as exportacões de manufaturados; analise e sugestão," Revista de Administracão de Empresas, 12, No. 1 (Jan./Mar. 1972), 63-69.

[2]The ensuing section is based on the work of William G. Tyler, Helmut Hesse, Carlos Von Doellinger, et al., and Bergsman, Brazil.

TABLE A-1.--The International Trade Policies of Brazil.

The main tools involved in planning the foreign trade sector with a view to achieving better integration of Brazil's economy in the expanding world economy.

(A) Adoption of an exchange rate system involving adjustments at short intervals: the minidevaluations

(B) Systematic effort to expand exports through

(1) Fiscal Incentives:

(a) IPI (tax on industrial products) exemption and tax credit
(b) ICM (tax on circulation of goods) exemption
(c) income tax exemption
(d) deduction of export-promoting expenses
(e) reduction of tax on financial transfer to other countries
(f) exemption of tax on financial operations
(g) exemption of tax on combustibles, lubricants and electric energy
(h) exemption of taxes, fees and governmental charges on goods going through Brazilian port facilities
(i) drawback
(j) tax-free import of capital goods

(2) Financial Incentives:

(a) pre-export financing at low interest rates through Bank of Brazil, National Economic Development Bank, BNDE, and private commercial banks
(b) post-export financing at low interest rates through the same agencies listed above
(c) other credit incentives such as financing of export on consignment, of marketing operations abroad, and of economic and engineering studies of potential exports
(d) credit insurance to exporters

(3) Creation of institutions to coordinate policies and promote trade

TABLE A-1.--Continued.

(4) Other Measures

(a) simplification of bureaucratic procedures
(b) promotional activities by Bank of Brazil, CACEX, Ministry of Foreign Relations, and other governmental and private agencies
(c) remittance of samples with no formalities
(d) no formalities for exports in frontier zones
(e) development of export corridors
(f) law regulating creation of trading companies
(g) expositions

(C) Rationalization of Brazil's import policy, in part through unilateral and across-the-board tarrif reductions

(d) Encouragement to foreign capital inflow and cooperation with foreign aid

(E) Introduction of a foreign indebtedness policy to provide adequate financing with which to cover the real resources gap and amortization of the existing foreign debt

(F) Policy to orient and stimulate the absorption of foreign technology

(G) Since 1964, a tough military political regime enthusiastically supported by the multinational--mainly U.S., Western European, Japanese, Canadian, and Brazilian--business community. This regime has ensured political stability, has curbed all signs of social unrest and of potential challenges to itself, has practically forbidden labor strikes, has maintained a strict control on wages and a somewhat milder one on prices, and has multiplied the incentives for entrepreneurs to invest, make profits, and accumulate capital.

the sum of IPI taxes paid on input (calculated by applying the tax rate to product value) from their total tax liability. The IPI, which applies only to manufactured goods, varies from product to product. Excluding tobacco products, the average tax rate has been calculated to be 12.34 percent.

There are three IPI related tax incentives for industrial exports. First, the exporter is exempted from IPI payments which he otherwise would have to make on export products (Law No. 4,502, 30 November 1964, implemented in late August 1965).

Second, the exporter receives a credit equal to the value of IPI taxes paid on inputs used in manufacturing the export product which may be applied against other tax liabilities.[3]

[3] Although the incidence of the IPI is on the total value of production, a provision of credits and debits eliminates its cumulative aspects, which characterized the previous consumption tax. Assume, for the sake of simplicity, a uniform tax rate of 10 percent on the value of production instead of a 12.34 percent average. Then, assume three different firms producing goods in a chain of production. Firm A produces goods purchased and transformed by Firm B; Firm B sells the transformed goods to Firm C, which sells to Firm D after some transformation. Firm D produces the finished goods. The fiscal aspects of the entire production and sales process are shown below:

Firm	Purchases	Value of Production Before Tax	Sales Incl. Tax	Value Added Incl. Tax	Tax Account		
					Credits	Debits	Balance
A	---	100	110	110	---	---	- 10
B	110	300	330	220	10	30	- 20
C	330	700	770	440	30	70	- 40
D	770	1000	1100	330	70	100	- 30

Third, the exporter receives an additional tax credit, the value of which is related to the IPI rate applicable to the respective export product. Whereas the first two incentives are tax rebates, this credit constitutes a genuine subsidy. Initially, under Law No. 5.444, 30 May 1968, implemented in July 1968, the credit was conceded at a percentage equal to half the applicable IPI percentage up to a maximum of 10 percent; more recently (under Decree Law No. 491, 5 March 1969, implemented July 1969) the size of the credit was raised to 100 percent of the applicable IPI rate up to a maximum of 15 percent. These credits are redeemable against other tax liabilities due on domestic sales. For example, if a firm exports

---

Each firm receives tax credits for all of the IPI paid in preceding stages of production. Firm B, for example, buys the product of Firm A and in this operation it receives a tax credit of 10 which was paid by Firm A. When Firm B sells its product to Firm C, a 10 percent tax on its value of production is debited to Firm B's account. Thirty is the tax debited to Firm B, so that it must pay a negative balance of 20 to the government. In effect, the tax balance is a value-added tax of 9.0909 percent of total value added, including tax, in the example. Excluding tax, the tax rate is 10 percent of net value added.

Assume now that Firm D exports its finished product. Since its exports are exempt from the IPI, it does not debit the 100 to its tax account which it would pay if the product were sold in the domestic market. But the firm still has a tax credit of 70 correspondent to taxes paid on previous stages of production. Therefore, in the above example, although the nominal tax rate on value of production is 10 percent, the effective tax rate reduction due to export is 17 percent of the value of production. Firm D benefits from the exemption of taxes paid on all previous stages of production. The supplying firms do not get this windfall, although their sales are augmented by the increased demand due to the tax exemption.

100 units of a certain manufactured good, it not only is exempt from the IPI that it would pay if the product were marketed domestically (plus the IPI on prior stages of production) but also is given an exemption from the IPI that it would pay on another 100 units sold in the domestic market. If the firm exports more than 50 percent of its production, the additional tax credit, or rebate, is to be deducted from other federal taxes payable.[4]

The IPI tax credits are applied against a fob cruzeiro value except when goods are transported and/or insured by a Brazilian company. In this case the IPI credit is based on cif value.

ICM Incentives

The ICM (see footnote 5, Chapter III), or goods circulation tax, is a value-added tax administered by state governments. It grew out of the old sales tax, or IVC (see footnote 5, Chapter III), which was a tax on total

[4]Some firms which produce mostly for the foreign market have some problems in getting their tax credit benefits because they do not have a corresponding amount of domestic sales. The Director of Duratex, Mr. Laerte Setubal Filho, reported in an interview with this author that they were building a new factory to produce wood-fiber sheets to be sold exclusively to the external sector. At the same time, Duratex had accumulated a huge amount of tax credits due to exports which had not yet been redeemed due to the lack of a corresponding volume of domestic sales. In 1972, to solve this problem, Duratex decided to incorporate a new firm, Deca, which produces construction materials for the domestic market. In this case, therefore, the export fiscal incentives created unintended stimuli for the formation of conglomerates.

value of product. The ICM tax rates differ from state to state, but the rate is a uniform 17 percent of value added for industrial south central Brazil. It is subject to some upward variation in the case of poorer states and to some downward variation in the case of interstate--but not international--trade. ICM related export incentives have three characteristics. First, Article 24 of the Federal Constitution of 1967 exempts exports of manufacturers from final-stage ICM taxation. Some states also have reduced the ICM for exports of some nontraditional agricultural commodity exports. In early 1970 the States of Paraná and São Paulo had decreased the ICM for beef exports by 60 percent and that for exported corn, rice, and soybeans by 40 percent.

Second, in contrast to the IPI incentives, initially no exemption from taxation imposed at previous stages of production was offered in 1970, however, the industrial states of south central Brazil began to grant rebates from ICM taxation of raw materials used in production of manufactured exports on the condition that the raw materials be produced in the same state in which the export is produced. Moreover, these rebates are made in the form of credits redeemable only against other ICM liabilities of the same state.

Third, since January 1970, the central and southern states have given additional credits on subsidies to exports of manufacturers at rates equal to IPI rates on respective products up to a maximum of 15 percent. Imported inputs are excluded from the product value against which the ICM credit is applied (so that it relates only to value added in Brazil). These ICM credits are redeemable only in connection with other ICM liabilities. Exporters have been asking state and federal authorities to redeem accumulated ICM credits against federal tax liabilities, but it is not certain that this will be permitted.

Quantification of the ICM tax benefits for exports of industrial goods can be made on the basis of the 17 percent rate applicable in the major industrial areas. The IPI (at the average rate of 12.34 percent) should be included because the ICM is calculated in addition to the IPI. Based on a ratio of value added to total value of output for all industry at around 51.2 percent, Tyler has estimated the value of the ICM exemption to average about 9.30 percent, calculated from the domestic price base. Had the ICM tax exemptions been effectively applied at all stages of production rather than only at the export stage, the incentive would have a quantitative magnitude of 17 percent of the value of the product, which includes the IPI charge.

In August 1964, by implementing State Law No. 8,234 of 17 July 1964, the State of São Paulo already had exempted industrial exports from the payment of the ICM's predecessor, the IVC, a sales tax. The IVC in São Paulo at that time, and until 1967, was 6 percent of the value of the product. Since São Paulo accounts for about one-half of Brazil's industrial exports, the national average of the IVC tax benefit for that period can be considered to be equal to one-half of the São Paulo IVC tax incentive of 6 percent.

Income Tax Incentives

Another significant tax incentive for exporters of manufactures is exemption from the income tax. There are three categories. The first exempts the firm's income earned on exports from the business income tax. The deduction is based on the exported proportion of the firm's output (Law No. 4.862, 29 November 1965, implemented in February 1967). Tyler has estimated the value of this benefit to be 4.2 percent of the domestic market price. The second allows exporters to deduct from their taxable income the following expenses in connection with export sales: commissions and interests paid abroad, exchange operations costs, and expenditures incurred abroad for the promotion and advertising of products (Law 4.862 of 11 November 1965). The third has particular relevance for multinational companies. It either grants a reduction of the income tax levied on funds remitted abroad (such as royalties, technical assistance, and interest on loans that are duly registered with the Bank of Brazil) to a taxpayer who can prove that he has exported manufactured products or provides him with a tax refund (Decree Law No. 491, Article 8).

Other Indirect Tax Incentives

Three other indirect tax incentives should be mentioned. First, the exporter is exempted from paying the financial operations tax on export credit, transport insurance, and export exchange operations. This incentive can be estimated to be equal to 1 percent of product value. Second, the exporter pays no sales tax on combustibles, lubricants, and electric energy related to exports of both manufactured and "extractive" products if the tax exceeds 2 percent of the price of the product. Finally, the exporter also is exempt from all governmental taxes, fees, and charges on goods going through Brazilian port facilities. The quantitative value of this incentive is small, but it indicates governmental good will toward exporters and simplifies administrative procedures.

The Drawback.--The drawback allows an exporter to import raw materials and intermediary products without paying import duties if the final manufactured good is exported. The exporter is able to buy inputs at world instead of domestic prices, which may be higher because of inefficiency or the protection of infant home industry. The drawback, first decreed in 1934, remained dormant. Until it was enacted as part of the general tariff reform of 1957, (Article 34 of Law No. 3244, 14 August 1957), implemented in 1961, and modified in 1964 (Decree No. 53,967, 16 June 1964). It has three main provisions: (1) Exporters need not pay duty on raw materials, semimanufactured products, intermediary goods, and packaging materials if its plan for export production and inputs needed has been approved by the Bank of Brazil; (2) A tax credit equal to the import duties paid on goods subsequently exported in a more finished form is available in cases where exportation was not planned at the time of importation of inputs; (3) The CPA (Conselho de Politica Aduaneira) supervises refunding of import taxes paid by the exporter.

Capital goods cannot be imported under the provisions of the drawback. A firm may submit a production plan to the government, however, and ask permission to import capital goods without the payment of duties.

Complex administrative procedures coupled with the problem of having to adapt the production of goods to the imported inputs, which may differ from domestic ones, seem to have limited the use of the drawback provision at first. From 1961 to 1964 only 66 small transactions involved the drawback, but modifications in 1964 increased its use considerably. For example, in 1970 there were 627 drawback related operations, representing a total of US$43 million (fob) duty-free imports and corresponding to a sum of US$198 million (fob) in exports. This was an increase from 1969 to 1970 of approximately 335 percent.[5] The number of such transactions again rose sharply in 1971, 76 percent more than in 1970.

---

[5]Banco do Brasil, Boletim, 6, No. 2 (1971), p. 13; and Banco do Brasil, Annual Report, 1971.

Financial Incentives

Credit facilities have become a powerful instrument for the Brazilian government's promotion of exports of manufactured and nonmanufactured nontraditional products.[6]

There are provisions for a special line of short-term financing of production for export through the private banking sector at special interest rates.[7] A firm does not have to be an industrial producer to borrow.

Marginal increments for financial contracts are not to exceed US$200,000, a measure designed to protect small firms. To reduce risk and administrative costs, commercial banks have shown a preference for lending the tight funds available to large firms.

In addition to pre-export credit facilities, post-export direct financing for export sales is provided by the Banco do Brasil and those commercial banks which are authorized to deal in exchange transactions.

---

[6]See Hesse, "Promoting of Manufactured Exports," pp. 248-50; Doellinger, et al., *Exportações*, pp. 129-56; and Tyler, "Export Diversification," pp. 141-48.

[7]An exporting firm may apply to CACEX (Department of Foreign Trade of Bank of Brazil) for a certificate to utilize credit made available by Resolution 71. The firm can then go to its commercial bank and borrow funds for 120 days at an annual interest rate of 8 percent. Assuming a 10 percent real opportunity cost for capital in Brazil and 20 percent inflation (which was the approximate rate from 1969 to 1971), the 8 percent rate requests a subsidy equal to about 24 percent of the value of the financing. Resources are made available from the Central Bank to the commercial banks at an annual rediscount rate of only 4 percent and then to the exporting firm.

CACEX and FINAME (A BNDE subsidiary) made available long-term financing of manufactured export sales. The CACEX credit line finances up to 85 percent of cif export values on a one-year term for durable consumer goods and on terms of up to 8 years for producers' goods. The interest rate ranges between 7 and 9 percent per annum depending on the export product and the country of destination. Adding the exchange risk, the total interest cost to the borrower has been about 23 percent, similar to the case of the short-term export sales financing with commercial banks. FINAME finances all sales, either internal or external, of domestically produced goods. Its terms were up to three years with one year's grace. This was not sufficient, however, for export financing of capital goods. More recently, FINAME established a new line of credit from eight-year term (including two years' grace) and with nominal interest of about 28 percent.

Other Credit Incentives

Other credit incentives have been made available, primarily to exporters of manufactured products. First, CACEX may finance for up to 360 days 85 percent of the cif value of durable consumer and capital goods exported on consignment (Resolution 43 of CONCEX of 22 January 1969). Interest rates are: 12 percent annually plus the exchange risk. Second, CACEX may finance expenses associated with marketing operations abroad--such as marketing studies, sales expenses, and advertising--also at a 12 percent annual interest rate. (Resolution 49 of CONCEX of 11 July 1969). US$300,000 to US$500,000 is available annually for this purpose. Finally, CACEX also finances engineering, economic, and other feasibility studies designed to promote exports.

Institutions

Many existing institutions have substantially expanded their activities related to foreign trade in the second-half of the 1960's and in the early 1970's. Most important among them are the CACEX (the foreign trade department of the Bank of Brazil, or the Carteira de Comercio Exterior), the Finance Ministry, the Ministry of Foreign Relations (Itamarati), the Central Bank, the Customs Union, the Ministry of Industry and Commerce, the Ministry of Agriculture, the Association of Industries and of Trade, and especially the newly created National Association of Exporters and the National Council of Foreign Trade or CONCEX (Conselho Nacional de Comercio Exterior). CONCEX, created in October 1966, is an interministerial council which formulates, coordinates, and regulates Brazil's policies dealing with international commerce. At the end of 1972, the government also created an important national trading company.

Other Measures to Promote Exports: Procedure Simplification

During the import substitution phase of Brazil's economic growth, the government ignored exports and even made export shipments rather difficult. Constant inflation, generally coupled with an overvalued exchange rate, was accompanied by incentives for investing Brazilian capital abroad. The government regarded exporters with suspicion and required licensing and copious paper work for all export operations. In 1964 the government announced that to promote exports it was simplifying export procedures, and bureaucratic requirements have been reduced substantially. Licensing has been abolished, and the export price control which sometimes is applied now is made only after shipment. Since 1965 a single form with several functions has been substituted for the numerous forms previously utilized. More important was the change in attitude toward exporters, whom the government now regarded as the key promoters of economic growth.

Promotional Activities

During the import substitution phase, Brazilian industries were selling only in the domestic market and were not prepared, after 1964, to promote their products and to compete in international markets. To assist exporters in these difficulties, the government extended some services through the Bank of Brazil, particularly

CACEX, and the Ministry of Foreign Relations (Itamaraty). CACEX is charged with promotional activities in Brazil, and Itamaraty develops foreign activities. Assisted by newly established branches of the Bank of Brazil in several major cities abroad. The offices of the regional development agency for the Northeast (SUDENE) in Salvador, Recife, and Fortaleza also are engaged in promoting export.

In September 1972, in commemoration of Brazil's 150th year of independence, a private organization with strong government support organized a huge modern EXPO in São Paulo featuring all Brazilian export products. More than 2,000 important foreign businessmen were officially invited.

"Export Corridors"

In order to facilitate bulk transport for domestic, and particularly foreign, trade, the Brazilian government has undertaken a program to develop "export corridors." With an investment of US$900 million, from 1972 to 1974, five or six of the principal Brazilian ports are to be provided with highly specialized, integrated road-rail-portship systems to enable them to attain internationally acceptable levels of operation.

Other measures include the mailing of samples to prospective buyers with no formalities required, the abolition of export formalities in the frontier zones, the National Development Bank (BNDE) guarantee to participants in international competition, and, finally, the establishment by law of incentives for the formation of trading companies.

APPENDIX B

EXPORTS OF INDUSTRIAL GOODS: THE VARIABLES, SOURCES, AND DATA PROBLEMS

EXPORTS OF INDUSTRIAL GOODS: THE VARIABLES, SOURCES, AND DATA PROBLEMS

Several data problems imposed significant constraints on this research. The first is related to the measurement of the dependent variable, the exports of Brazilian industrial products. Since the early sixties, when Brazilian governments started to pay attention to the value of manufactured exports, the Department of Foreign Trade of the Banco do Brasil, CACEX, has changed the classification of exported products at least two times. Because of this, a series of quarterly data for exports of manufactures (used by W. G. Tyler and by C. V. Doellinger) from 1961 to 1970 can be found, but it has no corresponding continuation after 1970. Since 1971, CACEX/NUCEX has been publishing monthly figures of exports of semimanufactures and of manufactures under a different classification. From 1964 to 1971, only annual data were available under this classification. Accordingly, the following procedure was adopted:

1. For annual data: the values of exports of manufactured products (excluding the semiprocessed ones, such as carnauba wax, iron and steel for rerolling, pig iron, sawn wood, cocoa butter, vegetable oils, etc.) under the new CACEX/NUCEX definition were used for the period of 1964-1971. Data for the years before 1964 were not

available. Therefore, the regressions for annual data were limited to only eight observations.

2. For quarterly data: the same annual amounts as in 1 above were used. These totals were then divided into four quarters according to the percentage values of quarterly exports of manufactures under the old classification (used by W. G. Tyler) for the period of the 1st quarter of 1964 to the 4th quarter of 1970. The actual values of quarterly exports of manufactures under the new CACEX/NUCEX classification were then used for the period of the 1st quarter of 1964 to the 2nd quarter of 1972. Annual exports of manufactures in the first classification constituted 65 percent to 85 percent of the total annual values under the new CACEX/NUCEX classification. With this procedure, which, of course, contains important limitations, a total of 33 observations was available. Unfortunately, no better alternative could be found.[1]

To express the value of exports in constant dollar value, the United States wholesale-price index for all commodities was used as a deflator. The values of X_1 for both annual and quarterly data are shown in Table B-1.

---

[1]In correspondence with this author, the Chief of the Núcleo de Estatistica, NUCEX/CACEX, of the Banco do Brasil, Mr. Paulo Monteiro de Araujo, wrote that it was not possible to reconstitute the whole monthly or quarterly series of data for the period before 1970 because of several changes in the classification of products.

TABLE B-1.--Brazil's Exports of Manufactured Products in Constant Dollar Value, Annual and Approximate Quarterly Data: 1964-1972.

	Annual Exports of Manufactures (excluding semi-manufactures) According to the New CACEX Definition in Current U.S.$1,000 (1)	U.S. Wholesale Price-Index (2)	Annual Exports of Manufactures in Constant U.S.$1,000 (1/2)x100 (3)	Percentage Value of Quarterly Exports Over Annual Exports in Tyler's Data (up to 1969) in CACEX Data (including semi-manufactures for 1970-1971, and Actual Quarterly Data for 1972 (4)	Estimated Quarterly Exports of Manufactures in Constant U.S.$1,000 (3x4)/100 (5)
1964					
I	89.492	100	89.492	17.9	16.019
II				13.9	12.439
III				25.3	22.641
IV				42.9	38.392
1965					
I	129.742	102.0	127.198	21.6	27.475
II				24.8	31.545
III				28.0	35.615
IV				25.6	32.563
1966					
I	152.054	105.4	144.264	22.4	32.315
II				24.8	35.777
III				24.2	34.912
IV				28.6	41.260
1967					
I	195.887	105.6	185.499	19.6	36.358
II				25.7	47.673
III				29.4	54.537
IV				25.3	46.931
1968					
I	202.469	108.2	187.125	21.4	40.045
II				24.1	45.097
III				27.9	52.208
IV				26.6	49.775

1969					
I	284.208	112.5	252.629	15.4	38.905
II				20.8	52.547
III				28.4	71.747
IV				35.4	89.430
				weight for broad classification	
1970					
I	415.951	116.6	356.733	20.4	72.774
II				26.3	93.821
III				25.3	90.253
IV				28.0	99.885
1971					
I	581.272	120.4	482.784	19.2	92.695
II				23.0	111.040
III				26.2	126.489
IV				31.6	152.560
1972	(est.)		Quarterly		
I	893.000	123.8	129.474	160.289	129.474
II		125.1	161.470	202.000 (est.)	161.471

Sources: Brasil, Exportacão 1972, CACEX-NUCEX, Banco do Brasil. William G. Tyler's quarterly export values were kindly made available by him in a letter to this author.

Tyler obtained his unpublished data from CACEX and IPEA, Ministry of Planning.

The calculation of X_{2t}, the index of the real-exchange rate adjusted for dollar inflation, is shown in Table B-2 for all months from January of 1963 to July of 1972. The official export (or purchase) exchange rate index was deflated by the Brazilian wholesale price index for industrial goods to obtain the index of the real exchange rate. This index was then multiplied by the United States wholesale price index for all commodities to obtain the index of real exchange rate adjusted to dollar inflation. Figure II-1 on page 67 illustrates the fluctuations in this index, quite wide before August 1968 and only mild since then. August 1968 was chosen as a base.

It may be noted that by using the Brazilian wholesale price index for industrial goods, which is more relevant for measuring the competitive position of exports of manufactures, the index of real exchange rate adjusted to dollar inflation does not decrease in value after August 1968 (as Tyler had found when using the Brazilian wholesale price index for all goods as a deflator). Tyler's calculations are shown in Table B-3 for purposes of comparison. The reason for this difference, as already noted above (page 65), is that industrial prices increased relatively less than nonindustrial prices during 1968-1972.

The index denoting the level of fiscal incentives, X_{3t}, is the one calculated by Tyler.[2]

---

[2] Tyler, "Export Diversification."

TABLE B-2.--The Real Exchange Rate (Wholesale Industrial Price as Deflator) and the Real Exchange Rate Adjusted to Dollar Inflation for Brazilian Exports: 1963-1972.

Period	Official Purchase Exchange Rate Cr$ per U.S.$1.00	Index of Official Purchase Exchange Rate. Base: Aug. 1968, Cr$3.63=100	Brazil's Wholesale Industrial Price Index. Base: Aug. 1968=100	Real Exchange Rate Index of Quotient (2)/(3). Base: Aug. 1968=100	United States' Wholesale-Price Index. Base: Aug. 1968=100	Real Exchange Rate (Adjusted to Dollar Inflation) (4)x(5)/100
	(1)	(2)	(3)	(4)	(5)	(6)
			1963			
Jan	0.46	12.67	11.76	107.74	92.45	99.6
Feb	0.46	12.67	13.12	96.57	92.48	89.3
Mar	0.46	12.67	13.41	94.48	91.90	86.8
Apr	0.60	16.53	13.53	122.17	91.72	112.0
May	0.60	16.53	13.88	119.09	91.99	112.0
Jun	0.60	16.53	15.06	109.76	92.27	101.3
Jul	0.60	16.53	15.24	108.46	92.54	100.4
Aug	0.60	16.53	15.53	106.44	92.36	98.2
Sept	0.60	16.53	15.76	104.89	92.27	96.8
Oct	0.60	16.53	16.59	99.64	92.45	92.1
Nov	0.60	16.53	17.41	94.94	92.64	87.9
Dec	0.60	16.53	18.18	90.92	92.27	84.0
			1964			
Jan	0.60	16.53	19.29	85.59	92.92	79.5
Feb	0.60	16.53	21.18	78.04	92.46	72.2
Mar	1.16	31.96	22.65	141.10	92.36	130.3
Apr	1.16	31.96	24.12	132.50	92.27	122.3
May	1.12	31.96	25.35	126.07	92.09	116.1
Jun	1.16	31.96	26.59	120.20	91.99	110.6
Jul	1.16	31.96	28.47	112.26	92.36	103.7
Aug	1.215	33.47	28.94	115.65	92.27	106.7
Sept	1.55	42.70	29.82	143.19	92.64	132.6
Oct	1.55	42.70	31.47	135.68	92.73	125.8
Nov	1.55	42.70	34.35	124.31	92.36	114.8
Dec	1.825	50.28	36.59	137.41	92.36	126.9

			1965			
Jan	1.825	50.28	38.29	131.31	92.92	122.0
Feb	1.825	50.28	39.47	127.39	93.10	118.6
Mar	1.825	50.28	42.12	119.37	93.19	111.2
Apr	1.825	50.28	43.71	115.03	93.56	107.6
May	1.825	50.28	44.65	112.61	93.93	105.8
Jun	1.825	50.28	44.88	112.03	94.57	105.9
Jul	1.825	50.28	45.18	111.28	94.66	105.3
Aug	1.825	50.28	45.24	111.14	94.66	105.2
Sept	1.825	50.28	45.71	110.00	94.75	104.2
Oct	1.825	50.28	46.59	107.92	94.84	102.3
Nov	2.20	60.61	47.00	128.96	95.22	122.8
Dec	2.20	60.61	48.12	125.96	95.77	120.6
			1966			
Jan	2.20	60.61	52.00	116.55	96.23	112.21
Feb	2.20	60.61	53.70	112.87	96.96	109.5
Mar	2.20	60.61	54.95	110.30	96.96	106.9
Apr	2.20	60.61	56.41	107.44	96.96	104.2
May	2.20	60.61	57.88	104.72	97.14	101.7
Jun	2.20	60.61	58.47	103.66	97.24	100.8
Jul	2.20	60.61	59.41	102.02	97.88	99.8
Aug	2.20	60.61	60.00	101.02	98.25	99.3
Sept		60.61	60.59	100.03	98.25	98.3
Oct	2.20	60.61	62.35	97.21	97.70	95.0
Nov	2.20	60.61	62.94	96.30	97.42	93.8
Dec	2.20	60.61	63.53	95.40	97.42	92.9
			1967			
Jan	2.20	60.61	67.06	90.38	97.70	88.3
Feb	2.70	74.38	68.24	109.00	97.52	106.3
Mar	2.70	74.38	69.41	107.16	97.24	104.2
Apr	2.70	74.38	71.76	103.65	96.87	100.4
May	2.70	74.38	73.53	101.16	97.33	98.5
Jun	2.70	74.38	74.11	100.36	97.79	98.1
Jul	2.70	74.38	75.29	98.79	97.98	96.8
Aug	2.70	74.38	75.88	98.02	97.61	95.7
Sept	2.70	74.38	76.47	97.27	97.70	95.0
Oct	2.70	74.38	77.06	96.52	97.61	94.2
Nov	2.70	74.38	77.67	95.79	97.70	93.6
Dec	2.70	74.38	78.24	95.07	98.25	93.4

TABLE B-2.--continued.

Period	Official Purchase Exchange Rate Cr$ per U.S.$1,000 (1)	Index of Official Purchase Exchange Rate. Base: Aug. 1968, Cr$3.63=100 (2)	Brazil's Wholesale Industrial Price Index. Base: Aug. 1968=100 (3)	Real Exchange Rate Index of Quotient (2)/(3). Base: Aug. 1968=100 (4)	United States' Wholesale-Price Index. Base: Aug. 1968=100 (5)	Real Exchange Rate (Adjusted to Dollar Inflation) (4)x(5)/100 (6)
1968						
Jan	3.20	88.15	83.53	105.53	98.6	104.1
Feb	3.20	88.15	85.88	102.64	99.4	102.0
Mar	3.20	88.15	89.41	98.59	99.5	98.1
Apr	3.20	88.15	91.76	96.07	99.6	97.7
May	3.20	88.15	93.53	94.25	99.8	94.1
Jun	3.20	88.15	96.47	91.38	100.0	91.4
Jul	3.20	88.15	97.65	90.27	100.4	90.6
Aug	3.63	100.00	100.00	100.00	100.0	100.0
Sept	3.675	101.24	101.76	99.49	100.4	99.9
Oct	3.675	101.24	102.94	98.35	100.4	98.7
Nov	3.745	103.17	104.71	98.53	100.7	99.2
Dec	3.805	104.82	105.29	99.55	101.0	100.5
1969						
Jan	3.805	104.82	108.24	96.84	101.8	98.6
Feb	3.905	107.58	109.41	98.33	102.2	100.5
Mar	3.975	109.50	110.00	99.54	102.8	102.3
Apr	3.975	109.50	111.18	97.94	102.9	100.8
May	4.025	110.88	112.35	98.69	103.8	102.4
Jun	4.025	110.88	115.88	95.69	104.1	99.6
Jul	4.075	112.26	115.88	96.88	104.2	100.9
Aug	4.125	113.64	117.65	96.59	104.3	100.7
Sept	4.125	113.64	118.82	95.64	104.5	99.8
Oct	4.185	115.29	119.41	96.54	105.9	101.3
Nov	4.265	117.49	120.59	97.42	105.5	102.8
Dec	4.325	119.15	121.18	98.32	105.9	104.1
1970						
Jan	4.325	119.15	124.12	96.00	107.2	102.9
Feb	4.38	120.66	125.29	96.30	107.5	103.5
Mar	4.46	122.87	127.65	96.26	107.7	103.7
Apr	4.46	122.87	128.24	95.81	107.8	103.3
May	4.53	124.79	131.76	94.71	107.9	102.2
Jun	4.53	124.79	134.12	93.04	108.1	100.6

Jul	4.60	126.72	135.88	93.26	108.7	101.4
Aug	4.62	127.73	138.24	92.40	108.3	100.1
Sept	4.69	129.20	140.59	92.41	108.2	100.0
Oct	4.69	129.20	141.76	91.14	108.8	99.2
Nov	4.80	132.23	142.35	92.89	108.7	101.0
Dec	4.92	135.54	144.12	94.05	108.2	101.8
			1971			
Jan	4.92	135.54	145.29	93.29	109.6	102.2
Feb	5.00	137.74	147.06	93.66	110.6	103.6
Mar	5.08	139.95	148.82	94.04	110.8	104.2
Apr	5.08	139.95	151.76	92.22	111.1	102.5
May	5.16	142.15	155.29	91.54	111.6	102.2
Jun	5.25	144.63	158.24	91.40	112.1	102.5
Jul	5.25	144.63	160.59	90.06	112.4	101.2
Aug	5.37	147.94	162.35	91.12	112.6	102.6
Sept	5.47	150.69	164.71	91.49	112.2	102.7
Oct	5.47	150.69	166.47	90.52	112.2	101.6
Nov	5.60	154.27	167.65	92.02	112.2	103.2
Dec	5.60	154.27	168.24	91.70	113.3	103.9
			1972			
Jan	5.75	158.40	170.59	92.85	114.0	105.8
Feb	5.75	158.40	174.71	90.66	115.0	104.3
Mar	5.81	160.06	176.47	90.70	115.1	104.4
Apr	5.81	160.06	177.65	90.09	115.2	103.8
May	5.88	161.98	180.59	89.69	115.9	104.0
Jun	5.88	161.98	182.35	88.83	116.5	103.5
Jul	5.93	163.36	184.12	88.72	117.4	104.2
Aug	5.93	163.36	186.47	87.61	117.5	102.9
Sept	5.99	165.01	188.82	87.39		
Oct	6.06	166.94	191.18	87.32		
Nov	6.13	168.87	192.94	87.52		
Dec	6.18	170.25	194.12	87.70		

Sources: For (1): Several issues of Conjuntura Econômica.

For (3): Index no. 18 of Conjuntura Econômica'a National Economic Indexes.

For (5): Several issues of U.S. Survey of Current Business.

TABLE B-3.--The Real Exchange Rate (Wholesale Price for all Goods as Deflator) and the Real Exchange Rate Adjusted to Dollar Inflation for Brazilian Exports: 1963-1971 (Tyler's Calculations). (In Constant Terms, i.e., Cr$/US$, of the 1st Quarter, 1961.)

	1963			1964			1965		
	N.D.I.A.	D.I.A.	Index of D.I.A.	N.D.I.A.	D.I.A.	Index of D.I.A.	N.D.I.A.	D.I.A.	Index of D.I.A.
Jan	197.9	198.9	98.2	134.2	135.5	66.9	228.7	231.0	114
Feb	185.5	185.9	91.8	125.8	126.4	62.4	224.8	227.5	112
Mar	175.3	175.1	86.5	312.5	313.8	155.0	216.1	218.9	107
Apr	220.6	219.9	108.6	300.2	301.1	148.7	213.1	216.7	107
May	211.3	211.3	104.3	294.1	294.4	145.3	210.9	215.3	106.3
Jun	199.3	199.9	98.7	282.2	282.2	139	208.6	214.4	105.9
Jul	194.2	195.4	96.5	264.5	265.6	131.1	203.3	209.2	103.3
Aug	186.9	187.6	92.6	194.4	195.0	96	200.4	206.2	101.7
Sept	176.0	176.5	88.1	238.5	240.2	118.6	198.3	204.2	100.7
Oct	165.3	166.1	82.0	226.9	228.7	112.9	193.3	199.3	98.4
Nov	160.0	161.1	79.6	210.6	212.1	104.7	226.6	234.5	115.8
Dec	150.0	150.5	74.3	239.6	241.3	189.1	222.0	231.1	114.1
	1966			1967			1968		
Jan	204.3	213.7	105.5	155.3	164.9	81.4	184.9	198.2	97.8
Feb	200.4	211.2	104.3	186.0	197.2	97.4	180.0	194.4	96
Mar	197.5	208.2	108.2	183.7	194.2	95.9	176.0	190.4	94
Apr	188.5	198.9	98.2	180.4	190.0	93.8	173.8	188.2	93
May	183.3	193.6	95.6	180.0	190.4	94	172.0	186.4	92
Jun	180.3	190.6	94.1	178.5	189.7	93.6	168.4	183.1	90.4
Jul	174.7	185.9	91.8	172.4	183.6	90.7	165.8	180.9	89.3
Aug	171.6	183.3	90.3	171.3	181.7	84.7	186.3	202.5	100
Sept	167.4	178.8	88.3	168.8	179.3	88.5	184.3	201.1	99.3

Oct	163.3	173.4	85.6	165.7	175.8	86.8	179.9	196.3	96.9
Nov	162.2	171.8	84.8	162.7	172.8	85.3	180.0	197.3	97.4
Dec	161.6	171.1	84.4	161.7	172.7	85.3	182.3	200.1	98.8
		1969			1970			1971	
Jan	179.4	198.6	98	166.3	192.9	95.2	159.8	185.2	91.4
Feb	181.9	202.1	99.8	166.1	193.3	95.4	159.8	192.6	95.1
Mar	185.1	206.0	101.7	166.8	194.5	96	152.7	189.9	93.7
Apr	183.1	204.9	101.2	166.8	194.5	96	156.3	189.1	92.4
May	184.3	207.9	102.6	167.1	195.2	96.3	155.8	187.8	92.7
Jun	179.3	203.0	100.2	163.4	191.2	94.4	154.0	183.0	90.4
Jul	178.6	202.4	99.9	163.8	192.8	95.2			
Aug	176.1	199.7	98.6	160.2	187.8	92.2			
Sept	169.8	192.9	95.2	156.3	187.7	92.7			
Oct	167.3	150.7	94.2	156.7	189.6	93.6			
Nov	168.0	192.7	95.1	159.1	187.6	92.6			
Dec	170.3	196.0	91.7	162.4	191.3	94.5			

Notes:

1--Differing only slightly from the rate for non-manufactures (except coffee) and for imports, the export exchange rate for manufactures is presented. The nominal exchange rate used is that in force on the last day of the month. All values are given in old (i.e., pre-1967) cruzeiros.

2--Real exchange rate not adjusted to dollar inflation. It is calculated by deflating the nominal exchange rate by the Brazilian wholesale-price index.

3--Real exchange rate adjusted to dollar inflation. It is calculated as:

$$\frac{\text{N.D.I.A. exchange rate x U.S. wholesale-price index}}{100}$$

Sources: Tyler, "Exchange Rate Flexibility."

Data from Banco Central do Brasil, Boletim, various issues; Conjuntura Econômica, various issues, and the Federal Reserve Bulletin, various issues.

The proxy for world income, X_{4t}, is the total world imports deflated by the world trade price index. The way in which this variable was employed here differs in several respects from Tyler's use of it. First, Tyler had utilized current instead of real values; second, he used them in the form of index instead of dollars; and third, he used them in nonlog form, although the dependent variable was in log form. In this study, the log value of exports (in the order of millions of dollars) is regressed against the log value of world imports (in the order of billions of dollars)--proxy for world income--so as to obtain income elasticity values.

The estimation of X_{5t}, the proxy for capacity utilization, involved some difficulties. Following Doellinger and Tyler, the residual from the time-trend regression of Brazilian industrial production was used as a proxy. For annual data, the real value of Brazilian industrial production was available. Table C-4 shows the time-trend regression calculation. For quarterly data, however, an imperfect proxy for industrial production, the index of consumption of electric energy by industry in the São Paulo-Rio region, was used. In 1971, the São Paulo-Rio region accounted for only about 53 percent of exports of industrialized products from all regions of Brazil.[3] Table B-5 shows the time-trend regression

---

[3]See CACEX, Banco do Brasil, Relatório 1971, Exportacão Brasileira, Regiões e Estados, p. 190.

TABLE B-4.--Residuals from Linear Time Trend Regression of Brazil's Industrial Product in Real Terms--Annual Data: 1959-1971 (Base 1949=100).

(time) X	Year	Real Industrial Product Y	Estimated $\hat{Y}$	Residual $Y-\hat{Y}$
(1)	1959	238.5	219.8	+18.7
(2)	1960	261.4	243.7	+17.7
(3)	1961	289.2	267.6	+21.6
(4)	1962	311.8	291.5	+20.3
(5)	1963	312.4	315.4	- 3.0
(6)	1964	328.5	339.3	-10.8
(7)	1965	313.0	363.2	-50.2
(8)	1966	349.6	387.1	-37.5
(9)	1967	360.0	411.0	-51.0
(10)	1968	415.8	434.9	-19.1
(11)	1969	460.5	458.8	+ 1.7
(12)	1970	511.8	482.7	+29.1
(13)	1971	569.1	506.6	+62.5

Regression equation: $\hat{Y} = 195.9 + 23.9\ X$

Calculations:

$\bar{X} = 7$ $\quad\quad \sum X = 91 \quad\quad \sum (X_i - \bar{X})\ (Y_i - \bar{Y}) = 4349.1$

$\bar{Y} = 363.2$ $\quad\quad \sum Y = 4721.6 \quad\quad \sum (X_i - \bar{X})^2 = 182$

$$\hat{\beta} = \frac{\sum (X_i - \bar{X})\ (Y_i - \bar{Y})}{\sum (X_i - \bar{X})^2} = \frac{4349.1}{182} = 23.896$$

$$\hat{\alpha} = \bar{Y} - \hat{\beta}\ \bar{X} = 363.2 - 23.896 \times 7 = 363.2 - 167.3 = 195.9$$

Source for data on Real Industrial Product: *Conjuntura Econômica*, Vol. 26 (November 1972).

TABLE B-5.--Residuals from Linear Time Trend Regression of Brazilian Industrial Production (Proxy)--Quarterly Data 1961-1972.

	I	II	III	IV
	Quarterly Moving Averages of Industrial Production (Proxy) Index (Y)			
1961	86.1	97.4	96.9	96.8
1962	104.6	99.2	98.8	100.1
1963	100.0	102.4	104.4	98.4
1964	101.3	103.9	104.9	107.4
1965	97.5	85.9	101.9	112.7
1966	102.4	111.4	118.4	114.2
1967	97.1	108.3	125.2	126.7
1968	118.2	125.5	137.6	144.8
1969	138.1	148.3	154.6	141.8
1970	143.9	159.9	170.7	173.0
1971	175.0	183.0	194.0	195.0
1972	191.0	205.0		
	Residuals from Time Trend Regression of Industrial Production Index ($Y - \hat{Y}$)			
1961	11.9	20.9	18.1	15.7
1962	21.2	13.5	10.8	9.8
1963	7.4	7.5	7.2	- 1.1
1964	- 0.5	- 0.2	- 1.5	- 1.3
1965	-13.5	-27.4	-13.7	- 5.2
1966	-17.8	-11.1	- 6.2	-12.9
1967	-32.3	-23.4	-32.2	- 9.6
1968	-20.4	-15.4	- 5.6	- 0.7
1969	- 9.7	- 1.8	2.2	-12.9
1970	-13.1	- 0.6	9.1	9.1
1971	17.9	14.5	23.2	21.9
1972	15.6	27.3		

Regression equation: $\hat{Y} = 74.2 + 2.3\ X$

where X = 0 for first quarter of 1961, X = 1 for second quarter 1961, etc.

Source: The Industrial Production Index is based on electric power industrial consumption in the Rio-São Paula region. Indexes are quarterly moving averages of the monthly indexes published in the Boletim do Banco Central, several issues.

TABLE B-6.--Monthly Variation in the Real Exchange Rate for Exports (Percentage Change, Without Signs).

	1964	1965	1966	1967	1968	1969	1970	1971
Jan	5.86	4.44	7.47	5.26	10.47	2.72	2.36	0.80
Feb	8.82	2.98	3.16	20.60	2.74	1.54	0.31	0.40
Mar	80.80	6.30	2.28	1.69	3.95	1.23	0.04	0.41
Apr	6.09	3.64	2.59	3.28	2.52	1.60	0.47	1.94
May	4.85	2.10	2.53	2.40	1.89	0.77	1.15	0.74
Jun	4.66	0.51	1.01	0.79	3.05	3.04	1.76	0.15
Jul	6.61	0.67	1.58	1.59	1.23	1.24	0.24	1.49
Aug	3.02	0.13	0.98	0.78	10.78	0.30	0.92	1.77
Sept	23.81	1.03	0.98	0.77	0.51	0.98	0.01	0.41
Oct	5.25	1.89	2.82	0.77	1.15	0.94	1.37	0.03
Nov	8.38	19.50	0.94	0.76	0.18	0.91	1.62	1.66
Dec	10.54	2.33	0.93	0.76	1.04	0.92	1.25	0.35
Annual Average	14.1	3.79	2.27	3.29	3.29	1.35	0.96	0.85

Source: Percentage change from month to month in the real exchange rate for exports, Column (4) of Table B-2.

TABLE B-7.--Data for Estimation of Brazil's Supply of Exports of Manufactures Quarterly Data: 1964-1972.

	Exports of Manufacturers in Constant U.S.$1,000	Index of Real Exchange Rate Adjusted to Dollar Inflation	Index of Fiscal Incentive to Exports	World Imports Deflated by World Trade Price Index (1963=100) U.S.$Billions	Proxy for Utilization of Industrial Capacity	Index of Real Remuneration to Exporters of Manufactures $(X_{2t} \times X_{3t})/100$
	X_{1t}	X_{2t}	X_{3t}	X_{4t}	X_{5t}	X_{6t}
1964						
I	16,019	94.0	100	149.1	- 0.5	94.00
II	12,439	116.3	100	158.5	- 0.2	116.30-deleted
III	22,641	114.3	101	152.9	- 1.1	115.44
IV	38,392	122.5	103	166.2	- 1.3	126.17
1965						
I	27,475	117.3	103	158.1	-13.5	120.82
II	31,545	106.4	104	171.7	-27.4	110.66
III	35,615	104.9	109.02	168.0	-13.7	114.36
IV	32,563	115.2	119.07	181.1	- 5.2	137.17
1966						
I	32,315	109.5	119.07	178.4	-17.8	130.38
II	35,777	102.2	119.07	182.8	-11.1	121.69
III	34,912	99.1	119.07	183.0	- 6.2	118.00
IV	41,260	93.9	119.07	194.7	-12.9	111.81
1967						
I	36,358	99.6	121.57	190.6	-32.3	121.48
II	47,673	99.0	129.57	197.6	-23.4	128.27
III	54,537	95.8	129.57	186.4	-32.2	124.13
IV	46,931	93.7	129.57	203.4	- 9.6	121.41
1968						
I	40,045	101.4	129.57	204.9	-20.4	131.38
II	45,097	94.1	129.57	211.5	-15.4	121.92
III	52,208	96.8	135.74	215.6	- 5.6	131.40
IV	49,775	99.5	135.74	235.2	- 0.7	135.06

1969						
I	38,905	100.5	135.06	223.2	- 9.7	136.42
II	52,547	100.9	135.74	243.9	- 1.8	136.96
III	71,747	100.5	141.90	242.4	2.2	142.61
IV	89,430	102.7	141.90	256.6	-12.9	145.73
1970						
I	72,774	103.4	141.90	248.5	-13.1	146.72
II	93,821	102.0	141.90	269.0	- 0.6	174.74
III	90,253	100.5	141.90	257.3	9.1	142.61
IV	99,885	100.7	141.90	281.3	9.1	142.89
1971						
I	92,695	103.3	149.61	272.1	17.9	154.55
II	111,040	102.4	149.61	288.9	14.5	153.20
III	126,489	102.2	149.61	274.3	23.2	152.90
IV	152,560	102.9	149.61	293.9	21.9	153.95
1972						
I	129,474	104.8	149.61	296.8	15.6	156.79
II	161,471	103.7	149.61	307.7	27.3	155.15

Source: See Tables B-1 - B-5 above.

TABLE B-8.--Data for Estimation of Brazil's Supply of Exports of Manufactures, Annual Data: 1964-1971.

	Exports of Manufactures In Constant 1963 U.S.$1,000	Index of Real-Exchange Rate Adjusted to Dollar Inflation	Index of Fiscal Incentives to Exports	Proxy for World Income: World Imports Deflated by World Trade Price Index 1968=100 US$Billions	Index of Utilization of Industrial Capacity	Index of Real Remuneration to Exporters of Manufactures $\frac{(X_{2t} \cdot X_{3t})}{100}$	Average Monthly Variation in the Real-Exchange Rate Adjusted to Dollar Inflation
	X_{1t}	X_{2t}	X_{3t}	X_{4t}	X_{5t}	X_{6t}	X_{7t}
1964	89,492	111.77	101.00	158.1	-10.8	112.89	14.1
1965	125.198	111.22	108.77	170.2	-50.2	120.97	3.79
1966	144,264	101.17	119.07	185.2	-37.5	120.46	2.27
1967	185,499	97.02	125.57	194.1	-51.0	123.77	3.29
1968	187,125	97.95	132.65	218.5	-19.1	129.93	3.29
1969	252.62	101.15	138.82	241.9	1.7	140.42	1.35
1970	356,733	101.65	141.90	264.8	29.1	144.24	0.96
1971	482,784	102.70	149.61	281.1	62.5	153.65	0.85

Source: See Tables B-1 - B-7 above.

calculation for quarterly moving averages of the industrial consumption of electric power.

The variable X_{6t}, the index of remuneration to exporters of industrial goods, is the product of the indexes of dollar inflation adjusted real exchange rate (X_2) and the level of fiscal incentives (X_3).

The variable X_{7t}, used only in regressions with annual data (Appendix C) denotes the frequency of changes in the exchange rate. It is the annual average of the monthly percentage variation (without signs) in the index of real exchange rate. Quarterly averages of monthly variations would not account for the effects of sharp devaluations during quarters in which no devaluation occurred. This might be why Tyler obtained no significance and the theoretically incorrect sign for the coefficient relating exports of manufactures and quarterly fluctuations in the real exchange rate. Table B-6 shows the calculated values of X_{7t}. As expected, the values for the period of minidevaluations (1969-1971) are much smaller than for the period of sharp devaluations (1964-1968).

The values used in the regressions with quarterly data are shown in Table B-7, and those used with annual data are shown in Table B-8.

APPENDIX C

EFFECTS OF MINIDEVALUATIONS ON EXPORTS OF MANUFACTURES: THE REGRESSION RESULTS WITH ANNUAL DATA

EFFECTS OF MINIDEVALUATIONS ON EXPORTS OF MANUFACTURES: THE REGRESSION RESULTS WITH ANNUAL DATA

Working with annual data to analyze exports of manufacturers offers two advantages: (1) the quality of annual data available is better than that of quarterly data; (2) lagged effects which extend for not much longer than four quarters present estimation problems of a smaller degree of difficulty. On the other hand, there is one big disadvantage: a consistent series of data is available for only eight years, 1964 to 1971.

As a first step, the computer was programmed to run the regression model I on the annual data from 1964 to 1971 and instructed to drop the variables which had insignificant coefficients at the 20 percent level. Equation 1a was obtained. All regression results in this appendix are shown in Table C-1.

$$\log X_{1t} = \beta_1 + \beta_2 \log X_{2t} + \beta_3 \log X_{3t} + \beta_4 \log X_{4t} + \beta_5 X_{5t} + \beta_7 X_{7t} + \varepsilon_t . \quad \text{(I)}$$

The variables are defined in Table IV-1, Chapter IV, with the exception of X_{7t}, which is the annual average of the monthly percentage variation (without signs) in the real exchange rate. Measurement procedures are shown in Appendix B.

The independent variables log X_{4t}, X_{5t}, and X_{7t} were deleted from equation 1a for being insignificant (their significance, if included next in the final regression, is shown in parentheses under the word deleted in Table C-1).

This same model was then run for the period of only five years, from 1964 to 1968, which was characterized by sharp adjustments in the exchange rate. Equation 1b was obtained.

The proxy for world income, X_{4t}, which is highly significant for the quarterly regressions, became insignificant in the case of annual regressions. This is probably due to the smaller number of observations, and possibly, because of the greater relevance of price elasticities to explain the annual variations in X_{1t}. As expected, because of the longer period, the price elasticity coefficients of log X_{2t} (real exchange rate adjusted to dollar inflation) and of log X_{3t} (fiscal incentives for exports) are greater than in the case of quarterly regressions. The comparison between 1a and 1b is rather precarious in view of the very small number of observations. Nevertheless, they reveal some interesting support for the main hypothesis of this work. The elasticity coefficients of both log X_{2t} and log X_{3t} increase substantially when the three annual observations composing the period of mini-adjustments in the exchange rate are added to the first five years (one-third of 1968, which should be part of the additional observations, is included as part of the first period). The application of the Chow or Fisher test, however, does not confirm the hypothesis of a structural shift in the equation between the two periods:

$$F = \frac{SSE_a - SSE_b/m}{SSE_b/n - k} = \frac{.0110 - .0029/3}{.0029 - 3} = \frac{.0081}{.0029} \times \frac{2}{3} =$$

$$F = 1.86 \leq F_{3,2,.05} = 19.2 .$$

The computer was then programmed to test model II:

$$\log X_{1t} = \beta_1 + \beta_2 \log X^{*}_{6t} + \beta_4 \log X_{4t} + \beta_5 X_{5t}$$
$$+ \beta_7 X_{7t} + \varepsilon_t , \qquad \text{(II)}$$

where X^{*}_{6t} is a weighted average of X_{6t} and $X_{6(t-1)}$, with weights of 70 percent for X_{6t} and 30 percent for $X_{6(t-1)}$.[1] Insignificant variables at the 20 percent level were instructed to be dropped. The result is Equation 2a.

---

[1] $.7X_{6t} \times .3X_{6(t-1)}$ gave more significant results than X_{6t} and $X_{6(t-1)}$ separated and also than the alternative $.5X_{6t} + .5X_{6(t-1)}$.

TABLE C-1.--Effects of Minidevaluations on Exports of Manufactures (X_{1t}) Ordinary Least-Squares Regressions with Annual Data. Log X_{1t} is the Dependent Variable.

	Eq. 1a	Eq. 1b	Eq. 2a	Eq. 2b	Eq. 3	Eq. 4	Eq. 5a	Eq. 5b
	8 obs. 1964-1971	5 obs. 1964-1968	8 obs. 1964-1971	5 obs. 1964-1968	8 obs. 1964-1968	8 obs. 1964-1968	8 obs. 1964-1971	5 obs. 1964-1968
Constant	- 9.492	- 1.205	- 2.191	- 1.539	- 6.278	- 6.366	- 3.366	- 4.597
log X_{2t}	3.737 (3.999) (.019)	1.202 (.528) (.650)						
log X_{3t}	4.887 (11.555) (<0.0005)	3.352 (2.434) (.135)						
log X_{4t}	deleted (.853)		deleted (.820)		.856 (.563) (.613)	.909 (.909) (.520)	.162 (.148) (.888)	.413 (.299) (.793)
X_{5t}	deleted (.824)		deleted (.642)		.0007 (.332) (.762)			
log X_{6t} ($X_{6t}=X_{2t}\cdot X_{3t}$)					2.332 (.627) (.575)	3.023 (1.199) (.297)		
log X^*_{6t} ($X^*_{6t}=.7X_{6t}+.3X_{6(t-1)}$)			4.978 (16.211) (0.0005)	4.666 (6.205) (.008)			4.664 (2.229) (.076)	3.900 (1.437) (.287)
X_{7t}	deleted (- .839)		deleted (.589)		- .009 (- .592) (.595)	- .005 (- .743) (.499)		
R^2	.973	.959	.978	.928	.973	.971	.978	.929
$\bar{R}^2$	.962	.918	.974	.904	.937	.950	.970	.858
F	89.288	23.402	262.787	36.505	27.031	45.032	113.113	13.455
Sig.	<0.0005	.040	<0.0005	.008	.001	.002	<0.0005	.069
D.W.	1.78	2.60	2.18	2.60	2.27	1.91	2.14	2.68
SSE	.0110	.0029	.0090	.0051			.0087	.0049

The Durbin-Watson statistics indicate absence of autoregression.

Variables log X_{4t}, X_{5t}, and X_{7t} were deleted from the final regression. Their significance if individually added next is shown in parentheses under the word deleted.

The same model was then run for the first five years 1964-1968 to yield Equation 2b. Although less substantial than in the case of Equations 1a and 1b, the comparison of Equations 2a and 2b shows an increase in the elasticity of exports with respect to the index of real remuneration to exporters (X_{6t}) when the period of minidevaluations is included. The application of the Fisher or Chow test again does not confirm a structural shift in the equation between the two periods of 1964-1968 and 1969-1971.

An explanation must now be given for the insignificance of the deleted variables. The very small number of observations might be partly responsible. Equation 3 regressed on annual observations from 1964 to 1971, without deletion of variables, yields some interesting results, particularly with respect to the signs of the coefficients. The over-all regression is significant at the 1 percent level and presents a high $\bar{R}^2$ (although lower than that of 1a or 2a), results which are relatively good for only eight observations. The signs of the coefficients of log X_{6t}, log X_{4t}, and of X_{7t} are the expected ones theoretically. That of X_{5t} indicates an interesting phenomenon, already observed. Tyler and Doellinger, as shown in Chapter III, had found an inverse and significant relation between exports of manufacturers and the level of utilization of industrial capacity during the periods of 1961-1970 (Tyler) or 1963-1968 (Doellinger). Since the beginning of the mini-adjustments in the exchange rate, however, industries began to regard exports as a regular activity and not only as alternative for slackening domestic market such as happened in 1965-1967. The result of this change in attitude was that the export expansion contributed to the full utilization of industrial capacity during the years of great activity of the Brazilian economy after 1968. This interpretation is supported by the following: the simple correlation coefficient between log X_1 and X_5 is negative, equal to -.35, for the period of 1964-1968, and positive, equal to .88, for the period of 1964-1971, a dramatic change already noted with the quarterly observations. In view of this, X_{5t} should be dropped as an explanatory variable from the export function.

Equation 4 is then obtained with the deletion of X_{5t}. The over-all significance is high as well as the value of $\bar{R}^2$ (although still lower than that of Equation 2a). All coefficients, although being relatively insignificant--perhaps due to the small size of the sample--show the expected signs. The coefficient of X_{4t}, the proxy for world income, shows again the lowest level of significance. An explanation for this is that the level of real remuneration to exporters appears to be the overwhelming factor in determining the supply of exports, so that the level of world income does not make much difference. Given that the percentage value of Brazilian exports of manufactures is so small in relation to that of world imports, only 0.17 percent in 1971, a high significance should not be expected for the coefficient of log X_{4t} in a very small sample size.

Finally, the coefficient of X_{7t} shows a negative sign, indicating that a lower degree of fluctuations in the real exchange rate had a positive effect on exports of manufactures. The low significance of the coefficient, however, does not permit a strong conclusion in this case.

The best fit with quarterly observations was obtained with a model which had log X_{6t} and log X_{4t} as independent variables. The same model is also significant when tested with annual data, and more so when the weighted form $X^{*}_{6t} = .7X_{6t} + .3X_{6(t-1)}$ is used instead of X_{6t}. Equations 5a and 5b are the estimated regressions for two periods, 1964-1968 and 1968-1971. Contrary to what was found with quarterly regressions, changes in the level of world trade, log X_{4t}, again do not show significance in these annual regressions. Its coefficient decreases in value and loses significance when the years 1969-1971 are added. The coefficient of log X_{6t}, which denotes the elasticity of exports of manufactures with respect to changes in the level of real remuneration to exporters, on the other hand, increases in value and significance when the period of 1969-1971 is added to the regression. This indicates that the policy of mini-adjustments in the exchange rate made exporters more responsive to changes in X_{6t}. The application of the Chow or Fisher test, however, does not permit a strong conclusion as to the existence of a structural shift in the equation after 1968. This result is rather precarious in view of the very small sample size available.

Conclusion

The regression analysis with annual data fell short of supporting the positive effect of minidevaluations on exports of manufactures with strong conclusive evidence. Nevertheless, it gave indications that exports of manufactures became more responsive to changes in the level of remuneration to exporters, both via changes in the real exchange rate and changes in the level of fiscal incentives during the period of minidevaluations.

APPENDIX D

EXPORTS OF BASIC PRODUCTS: THE VARIABLES, THE DATA, AND MEASUREMENT PROBLEMS

EXPORTS OF BASIC PRODUCTS: THE VARIABLES, THE DATA, AND MEASUREMENT PROBLEMS

Table D-1 shows the deflated values of exports of basic products other than coffee. The price index for total world imports was considered to be an appropriate deflator, as good as other alternatives such as the U.S. wholesale price index for agricultural products. There was not much difference between these two during the period covered by the study. Table D-2 shows the export exchange rate for basic products other than coffee deflated by the Brazilian general wholesale price index.

Tables D-3 through D-5 show the construction of a weighted average price index for 28 basic products exported by Brazil. The average price index of each good in each year was weighted according to its respective participation in total basic exports.

Table D-6 shows the percentage change in the real exchange rate (X_{7t}) for exports from one month to another and the average monthly variation for each year. The greater this variation, the greater the exchange risk to the exporter. Therefore, a negative relation between X_{7t} and log X_{1t} should be expected. (See Appendix E.)

Finally, Table D-7 shows the values of all variables used in the regression analysis.

TABLE D-1.--Brazilian Exports of Basic Products Other than Coffee.

	Exports of Basic Products Other Than Coffee in Current U.S.$1,000 (fob) (1)	Price Index for total World Imports (2)	Exports of Basic Products Other Than Coffee in Constant Dollar Value (1)/(2) x 100 (3)
1964	460,897	100	460,897
1965	594,396	101	588,511
1966	680,507	102	667,164
1967	597,732	102	586,012
1968	717,258	101	710,156
1969	983,226	104	945,410
1970	1,109,943	109	1,018,296
1971	1,215,910	115	1,057,313
1972	1,215,910	115	1,057,313

Source: For exports of basic products, <u>Relatório, Exercicio</u> de 1971, Banco do Brasil S.A., p. 174, and for world imports price index, <u>International Financial Statistics</u>, IMF, several issues.

TABLE D-2.--Export Exchange Rate for Basic Products Other Than Coffee.

	Official Purchase Exchange Rate Cr$ per U.S.$1.00 (1)	Wholesale General Price Index for Brazil Base: 1968=100 (2)	Real Purchase Exchange Rate (1)/(2) x 100 (3)
1964	1.224	31.15	3.929
1965	1.888	47.12	4.007
1966	2.200	64.74	3.398
1967	2.658	80.77	3.290
1968	3.411	100.00	3.411
1969	4.068	120.51	3.376
1970	4.584	146.79	3.123
1971	5.271	176.92	2.979

Source: Conjuntura Econômica, Vol. 26 (November 1972).

TABLE D-3.--Price Indexes of 28 Basic Products Exported by Brazil Based on the Average Price per Unit (US$/ton) Base 1964=100.

	1964	1965	1966	1967	1968	1969	1970	1971
1. Sugar	100	58.22	61.33	61.44	75.72	80.08	86.01	94.17
2. Cotton wool	100	97.99	94.13	105.94	105.94	89.43	90.31	121.21
3. Cotton linters	100	121.52	238.42	254.40	196.37	135.00	134.35	162.50
4. Peanuts, green	100	120.55	135.93	124.40	123.82	121.00	124.20	133.96
5. Rice	100	146.53	168.19	220.60	195.82	162.72	104.45	112.53
6. Banana	100	112.71	118.84	125.77	135.93	232.63	203.49	229.14
7. Cocoa beans	100	64.61	96.77	111.02	130.47	189.31	139.17	111.16
8. Shrimps	100	97.08	112.82	143.16	135.38	152.28	131.91	161.57
9. Beef, chilled or frozen	100	111.69	102.95	95.42	84.47	88.26	116.24	182.69
10. Horse meat	100	78.08	99.34	113.30	122.19	124.01	133.18	148.31
11. Cashew nuts	100	130.46	120.64	115.07	121.98	110.96	129.33	135.23
12. Brazil nuts	100	135.17	115.44	117.67	96.05	116.22	98.09	132.10
13. Hides, raw, non cattle	100	162.16	143.26	154.96	203.64	269.78	251.73	215.52
14. Cattle hides	100	85.03	168.19	131.17	93.64	104.22	125.02	144.46
15. Hides of domestic non cattle animals	100	102.53	120.06	104.02	98.29	100.37	89.72	89.50
16. Mate	100	103.47	120.86	120.76	110.31	115.32	115.32	117.28
17. Peanuts, cake and bran	100	108.42	115.03	119.97	117.50	112.83	119.39	127.26
18. Cotton seed, cake & bran	100	74.90	166.57	153.79	155.73	148.80	161.66	175.14
19. Soybean, cake and bran	100	105.87	114.32	118.13	116.97	114.87	120.36	129.65
20. Tobacco leans	100	100.65	101.39	95.47	103.52	117.32	123.14	128.07
21. Lobsters	100	181.97	205.75	170.72	195.68	248.42	215.78	306.11
22. Corn	100	106.15	107.92	109.02	98.00	107.89	116.62	125.45
23. Iron ore	100	97.59	93.61	86.85	83.71	82.75	90.11	92.28
24. Manganese ore	100	110.54	113.17	104.04	86.75	80.16	77.82	84.77
25. Crude oil	--	--	--	--	--	--	100	123.44
26. Pepper, black or white	100	108.48	112.84	85.19	76.44	83.54	120.93	114.78
27. Sisal	100	59.26	54.89	46.06	42.15	42.20	40.17	37.52
28. Soybeans	--	100	110.18	98.45	97.94	96.70	95.88	116.78

Source: Relatório, Exercício de 1971, CACEX, Banco do Brasil, p. 177.

TABLE D-4.--Participation of Basic Products in the Total Value of Brazilian Exports (To be Used in Table D-5).

	1964	1965	1966	1967	1968	1969	1970	1971
Total Exports	100	100	100	100	100	100	100	100
Basic Products (28) Except Coffee and Other Minor Items	28.3	32.7	34.4	31.9	34.5	38.1	36.8	38.8
1. Sugar	2.3	3.4	4.6	4.9	5.4	5.0	4.6	5.1
2. Cotton wool	7.6	6.0	6.4	5.5	7.0	8.5	5.6	4.8
3. Cotton linters	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
4. Peanuts, green	0.0	0.3	0.2	0.2	0.1	0.3	0.4	0.3
5. Rice	0.1	1.5	1.9	0.3	1.1	0.3	0.2	0.4
6. Banana	0.4	0.4	0.4	0.3	0.3	0.4	0.4	0.3
7. Cocoa beans	2.4	1.7	2.9	3.6	2.5	4.6	2.8	2.1
8. Shrimps	0.0	0.1	0.0	0.1	0.2	0.3	0.2	0.4
9. Beef chilled or frozen	0.8	1.5	0.7	0.4	1.1	1.8	2.5	3.4
10. Horse meat	0.0	0.0	0.1	0.2	0.3	0.3	0.3	0.4
11. Cashew Nuts	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.2
12. Brazil Nuts	0.7	0.7	0.9	0.6	0.8	0.5	0.5	0.5
13. Hides, raw, non cattle	0.2	0.3	0.2	0.3	0.3	0.4	0.3	0.2
14. Cattle hides	0.2	0.4	0.3	0.2	0.1	0.5	0.3	0.2
15. Hides of domestic non cattle animals	0.3	0.5	0.7	0.5	0.4	0.5	0.3	0.3
16. Mate	0.5	0.4	0.4	0.3	0.3	0.2	0.2	0.2
17. Peanuts cake or bran	0.1	0.5	0.7	0.7	0.4	0.4	0.6	0.6
18. Cotton seed, cake or bran	0.1	0.0	0.1	0.1	0.2	0.4	0.4	0.3
19. Soybean, cake or bran	0.2	0.5	0.8	0.6	1.0	1.0	1.6	2.8
20. Tobacco leaves	2.0	1.6	1.3	1.2	1.0	1.1	1.1	1.3

21. Lobsters	0.2	0.2	0.2	0.2	0.3	0.4	0.4	0.5
22. Corn	0.2	1.7	1.8	1.3	3.0	1.4	2.9	2.6
23. Iron ore	5.6	6.5	5.8	6.2	5.6	6.4	7.7	8.3
24. Manganese ore	1.4	1.8	1.5	0.8	1.3	0.7	1.1	1.3
25. Crude oil	--	--	--	--	--	--	0.1	0.3
26. Pepper, black or white	0.2	0.4	0.3	0.4	0.3	0.4	0.3	0.5
27. Sisal	2.6	1.5	1.3	1.0	0.9	0.7	0.6	0.5
28. Soybean	--	0.5	0.7	1.8	0.3	1.3	1.0	0.9
29. Coffee, green in grains	53.1	44.3	43.9	42.6	41.2	35.2	34.3	26.4
30. Fruits (except items 6, 11, 12)	0.3	0.6	0.4	0.3	0.3	0.3	0.2	0.2
31. Ores (except items 23, 24)	0.1	0.3	0.4	0.5	0.5	0.6	0.8	0.5
32. Other basic products	3.6	3.6	3.9	3.4	2.9	3.5	2.6	2.8

Source: Relatório, Exercício de 1971, CACEX, Banco do Brasil S.A., p. 176.

TABLE D-5.--Construction of Price Index of Exports of 28 Basic Products Price Index Times Proportion of Participation in Total Exports.

	1964	1965	1966	1967	1968	1969	1970	1971
1. Sugar	230	197.95	282.12	301.06	408.88	400.40	395.64	480.27
2. Cotton wool	760	587.94	603.78	528.72	741.58	760.16	505.74	581.81
3. Cotton linters	10	121.51	23.84	25.44	19.64	13.50	13.44	16.25
4. Peanuts, green	0.0	36.17	27.19	24.88	12.38	36.30	49.68	40.19
5. Rice	10	219.80	319.56	66.18	215.40	48.82	20.89	45.01
6. Banana	40	45.08	47.54	37.73	40.77	93.05	81.40	68.74
7. Cocoa beans	240	109.84	280.63	399.67	326.18	870.83	389.68	233.44
8. Shrimps	0	9.71	0.0	14.32	27.08	45.68	26.38	64.63
9. Beef, chilled or frozen	80	167.54	72.06	38.17	92.92	158.87	290.60	621.15
10. Horse meat	0	0.0	9.93	22.66	36.66	37.20	39.95	59.32
11. Cashew nuts	10	13.05	12.06	11.51	24.40	22.19	41.25	27.05
12. Brazil nuts	70	94.62	103.90	70.60	76.84	52.11	49.04	66.05
13. Hides, raw, non cattle	20	48.65	28.65	46.49	61.09	107.91	75.52	43.10
14. Cattle hides	20	34.01	50.45	26.23	9.36	62.11	37.50	28.89
15. Hides of domestic-non cattle animals	30	51.26	84.04	52.01	39.32	50.19	26.92	26.85
16. Mate	50	41.39	48.34	38.33	36.23	22.06	23.06	23.46
17. Peanut, cake or bran	10	54.21	80.52	83.98	47.00	45.13	71.63	76.36
18. Cotton seed, cake or bran	10	0.0	16.66	15.38	31.15	59.52	64.66	52.54

19. Soybean, cake or bran	20	52.94	9.46	70.88	116.97	114.87	121.96	363.02
20. Tobacco leaves	200	161.04	131.80	114.56	103.52	129.05	135.45	166.49
21. Lobsters	20	36.39	41.15	34.14	58.70	99.37	86.31	153.06
22. Corn	20	180.45	194.26	141.73	294.00	151.05	338.20	326.17
23. Iron ore	560	634.34	542.94	538.47	468.78	529.60	693.85	765.92
24. Manganese ore	140	198.97	169.76	83.23	112.78	56.11	85.60	110.20
25. Pepper, black or white	20	43.39	33.85	34.08	22.93	33.42	36.28	57.39
26. Sisal	260	88.89	71.36	46.06	37.94	29.54	24.10	18.76
27. Soybeans	0	50.00	77.13	177.21	29.38	125.71	95.88	105.10
28. Crude oil	--	--	--	--	--	--	10.00	37.03
Sum	2830.00	3169.78	3362.98	3043.72	3493.88	4154.76	3830.61	4648.25
divided by % Participation of the above 28 products in total exports:								
	28.3	32.7	34.4	31.9	34.5	38.1	36.8	38.8
Price index for the year	100	96.94	97.76	95.41	101.27	109.05	104.09	120.06

Source: Calculated from data in Tables D-3 and D-4.

TABLE D-6.--Monthly Variation in the Real Exchange Rate for Exports (Percentage change, without signs).

	1964	1965	1966	1967	1968	1969	1970	1971
Jan	5.86	4.44	7.47	5.26	10.47	2.72	2.36	0.80
Feb	8.82	2.98	3.16	20.60	2.74	1.54	0.31	0.40
Mar	80.80	6.30	2.28	1.69	3.95	1.23	0.04	0.41
Apr	6.09	3.64	2.59	3.28	2.52	1.60	0.47	1.94
May	4.85	2.10	2.53	2.40	1.89	0.77	1.15	0.74
Jun	4.66	0.51	1.01	0.79	3.05	3.04	1.76	0.15
Jul	6.61	0.67	1.58	1.59	1.23	1.24	0.24	1.49
Aug	3.02	0.13	0.98	0.78	10.78	0.30	0.92	1.77
Sept	23.81	1.03	0.98	0.77	0.51	0.98	0.01	0.41
Oct	5.25	1.89	2.82	0.77	1.15	0.94	1.37	0.03
Nov	8.38	19.50	0.94	0.76	0.18	0.91	1.62	1.66
Dec	10.54	2.33	0.93	0.76	1.04	0.92	1.25	0.35
Annual Avg.	14.1	3.79	2.27	3.29	3.29	1.35	0.96	0.85

Source: Percentage change in the real exchange rate for exports (Column (4) of Table B-2.

TABLE D-7.--Data for Estimation of Brazil's Export Supply Function of Basic Products Other Than Coffee.

	Exports of Basic Products Other Than Coffee Deflated by World Trade Price Index U.S.$1,000 (1)	Index of Real Exchange Rate for Exports of Basic Products Other than Coffee (Export Exchange Rate Deflated by Brazil's W.P.I.) Base: 1964=100 (2)	Price Index for Brazil's Exports of Basic Products Other Than Coffee. Base 1964=100 (3)	Index of Real Remuneration to Exporters of Basic Products Other Than Coffee (2)x(3)/100 (4)	World Imports Deflated by World Imports Price Index U.S.$1,000 (5)	Annual Average of Monthly Variation in Real Exchange Rate (6)
1964	460,897	100	100	100	158,100,000	14.1
1965	588,511	102	96.94	99	170,020,000	3.79
1966	667,164	86	97.76	84	185,200,000	2.27
1967	586,012	84	95.41	80	194,100,000	3.29
1968	710,156	87	101.27	88	218,500,000	3.29
1969	945,410	86	109.05	94	241,900,000	1.35
1970	1,018,296	79	104.09	82	264,800,000	0.96
1971	1,057,313	76	120.06	91	281,100,000	0.85

Source: Tables D-1 to D-6 above.

APPENDIX E

THE ANNUAL AVERAGE OF THE MONTHLY PERCENTAGE VARIATION (WITH NO SIGNS) IN THE REAL EXCHANGE RATE

THE ANNUAL AVERAGE OF THE MONTHLY PERCENTAGE VARIATION (WITH NO SIGNS) IN THE REAL EXCHANGE RATE

The following situations illustrate how the variable X_{7t} (in Chapter V and Appendix B), which is similar to variable f_t (in Chapters VII and VIII) denotes the level of fluctuations in the real exchange rate and, therefore, the minidevaluations.

X_{7t} is the annual average of the monthly percentage change (with no signs) in the real export (purchase) exchange rate and f_t is the same but for variations in the real import (sale) exchange rate.

Table E-1 illustrates the case of rapid inflation and one sharp devaluation. The domestic price index rises from 100 in December to 220 in December of the next year. In each month there is a ten point increase in the price index. Concomitantly, the nominal exchange rate remains pegged at the level of 100 (say, cruzeiros per dollar) from December to the next November. In December, the government decides to devalue the domestic currency sharply, and the new exchange rate becomes 220. The third and fourth columns show the real exchange rate and the monthly percentage variation (with no signs) in the real exchange rate, respectively. In this example, as expected, the annual average of this last variable has a high value, equal to 15.14 percent.

Table E-2 illustrates the case of rapid inflation, but with monthly devaluations. The nominal exchange rate is changed every month by the same rate as the domestic price index. As a result the real exchange rate remains constant and the annual average of the monthly percentage change (with no signs) in the real exchange rate is zero.

Table E-3 shows the official import exchange rate deflated by the Brazilian wholesale price index and then adjusted to the U.S. dollar inflation from 1955 to 1972. Variable f_t, as shown in Tables VIII-2, VIII-6, and G-1, was calculated from the data in column (3) of Table E-3. The calculation of f_t is shown in Table E-4.

TABLE E-1.--Case of Rapid Inflation and One Sharp Devaluation.

Period	Domestic Price Index (1)	Nominal Exchange Rate (2)	Real Exchange Rate (3) = (1/2)	Monthly % Change (with no signs) in the Real Exchange Rate (4)
December	100	100	100.00	
January	110	100	90.91	9.09
February	120	100	83.33	8.34
March	130	100	76.92	7.69
April	140	100	71.43	7.14
May	150	100	66.66	6.68
June	160	100	62.50	6.24
July	170	100	58.82	5.89
August	180	100	55.55	5.56
September	190	100	52.63	5.26
October	200	100	50.00	5.00
November	210	100	47.62	4.76
December	220	220	100.00	110.00
Annual Average				15.14

TABLE E-2.--Case of Rapid Inflation and Monthly Devaluations.

Period	Domestic Price Index (1)	Nominal Exchange Rate (2)	Real Exchange Rate (3)=(2/1)x100	Monthly Percentage Change (with no signs in the Real Exchange Rate (4)
December	100	100	100	0
January	110	110	100	0
February	120	120	100	0
March	130	130	100	0
April	140	140	100	0
May	150	150	100	0
June	160	160	100	0
July	170	170	100	0
August	180	180	100	0
September	190	190	100	0
October	200	200	100	0
November	210	210	100	0
December	220	220	100	0
Annual Average				0

TABLE E-3.--The Official Import Exchange Rate and the Import Real Exchange Rate Adjusted to Dollar Inflation; 1955-1972.

	Monthly Average Import Exchange Rate	Brazil's Wholesale Price Index	Real Exchange Rate for Imports [(1)/(2)]x100	U.S.A. Wholesale Price Index	Real Exchange Rate Adjusted to Dollar Inflation for Imports [(3)x(4)]/100	Index of Real Exchange Rate Adjusted to Dollar Inflation Base: Sept. 1968=100
	(1)	(2)	(3)	(4)	(5)	(6)
1955						
Jan	.0760	2.47	307	92.7	285	116
Feb	.0873	2.45	356	92.9	331	135
Mar	.105	2.46	427	92.6	395	161
Apr	.106	2.50	424	93.0	394	161
May	.105	2.49	422	92.5	390	159
June	.103	2.49	414	92.8	384	157
July	.103	2.52	409	93.0	380	155
Aug	.110	2.59	425	93.3	396	162
Sept	.0972	2.62	371	94.0	349	142
Oct	.100	2.63	380	93.9	357	146
Nov	.0996	2.63	379	93.6	354	144
Dec	.0909	2.64	344	93.7	323	132
1956						
Jan	.101	2.65	381	93.9	358	146
Feb	.119	2.74	434	94.6	411	168
Mar	.107	2.78	385	94.9	365	149
Apr	.145	2.83	512	95.6	490	200
May	.148	2.93	505	96.3	486	198
June	.137	3.02	454	96.1	436	178
July	.115	3.09	372	96.0	357	146
Aug	.106	3.15	336	96.5	325	133
Sept	.0999	3.21	311	97.2	302	123

Oct	.0917	3.27	280	97.3	273	111
Nov	.0881	3.31	266	97.6	260	106
Dec	.0863	3.32	260	97.9	254	104
1957						
Jan	.084	3.47	242	98.4	238	97
Feb	.0863	3.46	249	98.5	246	100
Mar	.0849	3.44	247	98.4	243	99
Apr	.0857	3.38	253	98.6	250	102
May	.0844	3.37	250	98.6	247	101
June	.0840	3.37	249	98.8	246	100
July	.0885	3.40	260	99.5	259	106
Aug	.0808	3.39	238	99.7	238	97
Sept	.0894	3.37	265	99.3	263	107
Oct	.0830	3.36	247	99.2	245	100
Nov	.0794	3.38	235	99.4	233	95
Dec	.0863	3.44	251	99.7	250	102
1958						
Jan	.112	3.49	321	100.1	321	131
Feb	.131	3.49	375	100.2	376	153
Mar	.137	3.51	390	100.7	393	110
Apr	.158	3.57	442	100.4	444	181
May	.150	3.64	412	100.6	415	169
June	.150	3.66	410	100.3	411	168
July	.156	3.74	417	100.3	416	170
Aug	.169	3.86	438	100.2	439	179
Sept	.210	3.98	528	100.2	529	216
Oct	.205	4.14	495	100.2	496	202
Nov	.199	4.35	457	100.3	459	187
Dec	.209	4.40	475	100.3	476	194

TABLE E-3.--Continued.

	Monthly Average Import Exchange Rate	Brazil's Wholesale Price Index	Real Exchange Rate for Imports [(1)/(2)]x100	U.S.A. Wholesale Price Index	Real Exchange Rate Adjusted to Dollar Inflation for Imports [(3)x(4)]/100	Index of Real Exchange Rate Adjusted to Dollar Inflation Base: Sept. 1968=100
	(1)	(2)	(3)	(4)	(5)	(6)
1959						
Jan	.245	4.57	536	100.6	539	220
Feb	.280	4.84	578	100.6	582	238
Mar	.292	4.86	600	100.7	605	247
Apr	.239	4.95	483	101.0	488	199
May	.194	5.01	387	100.9	391	160
June	.183	5.07	361	100.7	363	148
July	.182	5.19	351	100.6	353	144
Aug	.177	5.46	324	100.2	325	133
Sept	.216	5.61	385	100.7	388	158
Oct	.222	5.72	388	100.2	389	159
Nov	.212	5.90	359	100.0	359	147
Dec	.209	6.00	348	100.0	348	142
1960						
Jan	.209	6.11	342	100.4	343	140
Feb	.214	6.35	337	100.4	338	138
Mar	.244	6.43	379	101.0	383	156
Apr	.242	6.48	373	101.0	377	154
May	.238	6.48	367	100.7	370	151
June	.232	6.54	355	100.6	357	146
July	.229	6.69	342	100.8	345	141
Aug	.228	6.97	327	100.3	328	134
Sept	.229	7.26	315	100.3	316	129

Oct	.229	7.61	301	100.7	303	124
Nov	.229	7.78	294	100.7	296	121
Dec	.229	7.94	228	100.6	290	118
1961						
Jan	.229	8.10	283	100.9	285	116
Feb	---	8.09	---	101.0	---	---
Mar	.271	8.26	328	100.9	331	135
Apr	.284	8.67	328	100.5	329	134
May	.270	8.81	306	99.9	306	125
June	.261	8.97	291	99.5	289	118
July	.263	9.12	288	99.8	288	118
Aug	.270	9.67	279	100.1	279	114
Sept	.294	10.1	291	100.0	291	119
Oct	.298	11.1	268	100.0	268	109
Nov	.314	11.5	273	100.0	273	111
Dec	.317	11.9	266	100.4	267	109
1962						
Jan	.318	12.7	250	100.8	252	103
Feb	.318	12.9	246	100.7	248	101
Mar	.318	13.0	245	100.7	246	100
Apr	.318	13.1	243	100.4	242	99
May	.335	13.6	246	100.2	247	101
June	.361	14.0	259	100.0	259	106
July	.367	14.7	250	100.4	251	102
Aug	.407	15.0	271	100.5	273	111
Sept	.480	15.4	312	101.2	315	129
Oct	.475	15.9	299	100.6	300	122
Nov	.475	17.1	278	100.7	280	114
Dec	.475	17.9	265	100.4	266	109

TABLE E-3.--Continued.

	Monthly Average Import Exchange Rate	Brazil's Wholesale Price Index	Real Exchange Rate for Imports [(1)/(2)]x100	U.S.A. Wholesale Price Index	Real Exchange Rate Adjusted to Dollar Inflation for Imports [(3)x(4)]/100	Index of Real Exchange Rate Adjusted to Dollar Inflation Base: Sept. 1968=100
	(1)	(2)	(3)	(4)	(5)	(6)
1963						
Jan	.475	19.6	242	100.5	244	100
Feb	.508	20.8	244	100.2	245	100
Mar	.531	22.1	240	99.9	240	98
Apr	.558	22.2	251	99.7	251	102
May	.620	23.1	268	100.0	268	109
June	.630	24.6	256	100.3	257	105
July	.643	25.2	255	100.6	257	105
Aug	.667	26.2	255	100.4	256	104
Sept	.708	27.8	255	100.3	255	104
Oct	.679	29.6	229	100.5	230	94
Nov	.653	30.6	213	100.7	215	88
Dec	.730	32.6	244	100.3	225	92
1964						
Jan	.884	36.5	242	101.0	245	100
Feb	.896	38.9	230	100.5	231	94
Mar	.900	41.8	215	100.4	216	88
Apr	.910	43.5	209	100.3	210	86
May	1.124	44.4	253	100.1	253	103
June	1.200	46.3	259	100.0	259	106
July	1.200	49.3	243	100.4	244	100
Aug	1.234	51.0	242	100.3	243	99
Sept	1.589	53.0	300	100.7	302	123

Oct	1.610	55.6	289	100.8	292	119
Nov	1.610	60.0	268	100.7	270	110
Dec	1.656	63.0	263	100.7	265	108
1965						
Jan	1.850	66.0	280	101.0	283	116
Feb	1.851	67.1	276	101.2	279	114
Mar	1.846	69.8	264	101.3	268	109
Apr	1.840	70.7	260	101.7	265	108
May	1.840	71.5	257	102.1	263	107
June	1.840	72.3	254	102.8	262	107
July	1.840	74.2	248	102.9	255	104
Aug	1.840	75.3	244	102.9	251	102
Sept	1.845	76.8	240	103.0	247	101
Oct	1.845	78.0	236	103.1	244	100
Nov	2.061	79.2	260	103.5	269	110
Dec	2.213	80.8	274	104.1	285	116
1966						
Jan	2.216	87.8	252	104.6	264	108
Feb	2.219	89.5	248	105.4	261	107
Mar	2.220	90.8	245	105.4	258	104
Apr	2.220	95.1	233	105.4	246	100
May	2.220	97.8	226	105.6	239	97
June	2.22	99.5	223	105.7	236	96
July	2.22	103	215	106.4	229	93
Aug	2.22	105	211	106.8	226	92
Sept	2.22	107	207	106.8	222	91
Oct	2.22	110	202	106.2	214	87
Nov	2.22	111	200	105.9	212	87
Dec	2.22	111	200	105.9	212	87

TABLE E-3.--Continued.

	Monthly Average Import Exchange Rate	Brazil's Wholesale Price Index	Real Exchange Rate for Imports [(1)/(2)]x100	U.S.A. Wholesale Price Index	Real Exchange Rate Adjusted to dollar Inflation for Imports [(3)x(4)]/100	Index of Real Exchange Rate Adjusted to Dollar Inflation Base: Sept. 1968=100
	(1)	(2)	(3)	(4)	(5)	(6)
1967						
Jan	2.22	116	191	106.2	203	83
Feb	2.591	118	220	106.0	233	95
Mar	2.715	120	226	105.7	239	98
Apr	2.715	122	223	105.3	234	96
May	2.715	122	223	105.8	235	96
June	2.715	123	220	106.3	235	96
July	2.715	128	212	106.5	226	92
Aug	2.715	129	210	106.1	223	91
Sept	2.715	130	209	106.2	222	91
Oct	2.715	133	204	106.1	217	89
Nov	2.715	135	201	106.2	214	87
Dec	2.715	136	200	106.8	213	87
1968						
Jan	3.210	141	228	107.2	244	100
Feb	3.210	145	221	108.0	239	98
Mar	3.210	148	217	108.2	235	96
Apr	3.210	150	214	108.3	232	95
May	3.224	152	212	108.5	230	94
June	3.225	155	208	108.7	226	92
July	3.220	157	205	109.1	224	91
Aug	3.300	159	207	108.7	226	92
Sept	3.660	163	225	109.1	245	100

Oct	3.700	167	221	109.1	242	99
Nov	3.732	170	219	109.5	240	98
Dec	3.818	170	225	109.8	247	101
1969						
Jan	3.830	174	220	110.7	244	100
Feb	3.925	176	223	111.1	248	101
Mar	3.966	174	228	111.7	255	104
Apr	4.000	176	227	111.9	254	104
May	4.013	178	225	112.8	254	103
June	4.050	183	221	113.2	251	102
July	4.091	188	218	113.3	247	101
Aug	4.066	192	212	113.4	240	98
Sept	4.082	196	208	113.6	237	97
Oct	4.205	201	209	114.0	238	97
Nov	4.254	204	208	119.7	239	98
Dec	4.316	203	213	115.1	245	100
1970						
Jan	4.350	212	205	115.9	238	97
Feb	4.403	215	205	116.3	238	97
Mar	4.420	218	203	116.5	236	96
Apr	4.490	218	206	116.5	240	98
May	4.520	221	205	116.7	239	98
June	4.560	226	202	117.0	236	96
July	4.610	230	200	117.6	235	96
Aug	4.650	235	198	117.2	232	95
Sept	4.680	240	195	117.7	230	94
Oct	4.720	244	193	117.7	227	93
Nov	4.830	245	197	117.6	232	95
Dec	4.890	247	198	117.7	233	95

TABLE E-3.--Continued.

	Monthly Average Import Exchange Rate	Brazil's Wholesale Price Index	Real Exchange Rate for Imports [(1)/(2)]x100	U.S.A. Wholesale Price Index	Real Exchange Rate Adjusted to dollar Inflation for Imports [(3)x(4)]/100	Index of Real Exchange Rate Adjusted to Dollar Inflation Base: Sept. 1968=.00
	(1)	(2)	(3)	(4)	(5)	(6)
1971						
Jan	4.950	251	197	118.6	234	96
Feb	4.999	255	196	119.6	234	96
Mar	5.060	261	194	119.8	232	95
Apr	5.110	265	193	120.1	231	94
May	5.190	270	192	120.7	232	95
June	5.255	278	189	121.2	229	93
July	5.285	281	188	121.5	228	93
Aug	5.390	283	190	121.8	231	94
Sept	5.465	287	190	121.4	231	94
Oct	5.505	290	190	121.3	230	94
Nov	5.596	294	190	121.4	231	94
Dec	5.635	297	190	122.4	233	95
1972						
Jan	5.654	303	187	123.3	231	94
Feb	5.785	309	187	124.4	233	95
Mar	5.816	314	185	124.5	230	94
Apr	5.845	317	184	124.6	229	93
May	5.899	318	185	125.3	232	95
June	5.915	322	184	126.0	232	95
July	5.944	32b	181	126.9	230	94
Aug	5.965	335	178	127.1	226	92
Sept	6.015	338	178	127.5	227	93

Oct	6.059	342	177	127.2	225	92
Nov	6.114	346	177	128.0	227	93
Dec	6.191	349	177	130.3	231	94

Sources: For (1): Conjuntura Econômica, 26 (November 1972 Supplement) and 27 (March 1973).

For (2): Index 16 of Conjuntura Econômica, 26 (November 1972) and 27 (March 1973).

For (4): International Financial Statistics, several issues.

TABLE E-4.--Monthly Percentage Change in the Real Exchange Rate for Imports.

	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963
Jan	8.57	6.97	10.76	6.92	27.89	12.84	1.72	1.74	6.02	8.68
Feb	12.03	15.96	13.91	2.89	16.82	7.84	1.46	---	1.60	0.83
Mar	6.38	19.94	11.29	0.80	4.00	3.81	12.46	15.90	0.41	1.64
Apr	17.92	0.70	32.99	2.43	13.33	19.50	1.58	0.0	0.82	4.58
May	4.37	0.47	1.39	1.18	6.79	19.86	1.61	6.71	1.23	6.77
June	1.37	1.90	10.10	0.40	0.49	6.72	3.27	4.90	5.28	4.48
July	16.20	1.20	18.06	4.42	1.71	2.77	3.66	1.04	3.47	0.39
Aug	12.35	3.91	9.68	8.46	5.04	7.69	4.39	3.12	8.40	0.0
Sept	4.25	12.71	7.44	11.34	20.55	18.83	3.67	4.30	15.13	0.0
Oct	6.67	2.43	9.97	6.79	6.25	0.78	4.44	7.90	4.17	10.20
Nov	34.03	0.26	5.00	4.86	7.68	7.47	2.33	1.87	7.02	6.99
Dec	14.51	9.23	2.25	6.80	3.94	3.06	2.04	2.56	4.68	5.16
Average (f_t)	11.55	6.31	11.07	4.77	9.54	9.26	3.55	4.55	4.85	4.14

	1964	1965	1966	1967	1968	1969	1970	1971	1972
Jan	8.04	6.47	8.03	4.50	14.00	2.22	3.76	0.51	1.58
Feb	4.96	1.43	1.59	15.18	3.07	1.36	0.0	0.51	0.0
Mar	6.52	4.34	1.21	2.72	1.81	2.24	0.98	1.03	1.07
Apr	2.79	1.54	3.00	1.33	1.38	0.44	1.48	0.52	0.54
May	21.05	1.15	1.33	0.00	0.93	0.88	0.49	0.52	0.54
June	2.37	1.17	3.59	1.34	1.89	1.78	1.46	1.56	0.54
July	6.18	2.36	3.72	3.64	1.44	1.36	0.99	0.53	1.63
Aug	0.41	1.61	1.86	0.94	0.98	2.75	1.00	1.06	1.65
Sept	23.97	1.64	1.89	0.48	8.70	1.89	1.51	0.0	0.0
Oct	3.67	1.67	2.42	2.39	1.78	0.48	1.03	0.0	0.56
Nov	7.27	10.17	0.99	1.47	1.36	0.48	2.07	0.0	0.0
Dec	1.90	5.38	0.0	0.49	2.74	2.40	0.51	0.0	0.0
Average (f_t)	7.42	3.24	2.47	2.87	3.34	1.52	1.27	0.52	0.63

Real exchange rate is the monthly average import exchange rate divided by the Brazilian wholesale price index (Column 3 of Table E-3).

APPENDIX F

DATA USED IN THE ANALYSIS OF BRAZILIAN IMPORTS

TABLE F-1.--Brazil's Import Coefficient Calculated in Current Prices, 1947-1972.

Year	Gross Domestic Product (Million CR$)	Imports (Million CR$)	Import Coefficient Imports/GDP
1947	164.9	22.8	13.8
1948	194.6	21.0	10.8
1949	229.9	20.6	9.0
1950	272.1	20.3	7.5
1951	322.7	37.2	11.5
1952	397.3	37.2	9.4
1953	469.5	25.1	5.3
1954	627.4	55.2	8.8
1955	783.4	60.2	7.7
1956	995.9	71.6	7.2
1957	1,218.0	86.5	7.1
1958	1,457.5	103.3	7.1
1959	1,989.6	161.3	8.1
1960	2,755.7	201.2	7.3
1961	4,052.1	299.4	7.4
1962	6,601.4	511.7	7.8
1963	11,928.6	782.2	6.6
1964	23,055.9	1,242.9	5.4
1965	38,817.6	1,929.6	5.0
1966	53,724.1	3,264.8	6.1
1967	71,486.3	4,291.9	6.0
1968	99,879.3	6,826.2	6.8
1969	133,116.9	8,982.0	6.7
1970	174,624.1	12,903.6	7.4
1971	234,005.3	19,216.1	8.2
1972			

Source: Current imports from CACEX, Banco do Brasil, Brasil, Comércio Exterior--Foreign Trade 1971, and current GDP from Conjuntura Economica, 26 (November 1972).

TABLE F-2.--Brazil's Import Coefficient Calculated in Constant Prices of 1949, 1947-1971.

Year	GDP (1949 prices)	Imports (1949 Prices)	Import Coefficient Imports/GDP %
1947	200.7	27.1	13.5
1948	215.6	22.9	10.6
1949	229.9	20.6	9.0
1950	244.8	18.0	7.4
1951	259.3	27.4	10.6
1952	281.9	24.8	8.8
1953	289.0	14.5	5.0
1954	318.2	24.5	7.7
1955	340.0	23.7	7.0
1956	350.8	23.6	6.3
1957	379.1	25.4	6.7
1958	408.3	27.0	6.6
1959	431.1	30.7	7.1
1960	472.9	29.2	6.2
1961	521.6	31.4	6.0
1962	549.0	35.0	6.4
1963	557.5	30.8	5.6
1964	573.8	25.6	4.5
1965	589.5	26.3	4.5
1966	619.6	32.3	5.2
1967	649.2	34.1	5.3
1968	709.7	43.8	6.2
1969	773.6	47.8	6.2
1970	847.2	56.3	6.6
1971	942.9	69.6	7.4

Sources: CACEX, Banco do Brasil, Brasil, Comercio Exterior--Foreign Trade 1971, and Conjuntura Econômica, 26 (November 1972). GDP values were deflated by the national income implicit deflator and imports by the global supply wholesale price index for all commodities (Index 16 of Conjuntura Econômica).

TABLE F-3.--Brazil's Import Coefficient in Several Periods.

Period	Import Coefficient: Current Cruzeiros %	Import Coefficient: Constant Cruzeiros of 1949 %	Real GDP Annual Average Growth Rate
1947-52	10.3	10.0	7.04*
1953-57	7.2	6.5	5.68
1958-61	7.5	6.5	8.33
1962-67	6.1	5.2	3.72
1968-71	7.3	6.6	9.78

Source: See Tables F-1 and F-2.

*Excludes 1947.

TABLE F-4.--Brazilian Imports US$ millions (FOB), 1964-1971.

	1964	1965	1966	1967	1968	1969	1970	1971
Livestock and Animal and Vegetable produce	258.3	183.2	240.1	281.3	290.1	263.9	259.8	283.6
Wheat	176.0	114.0	142.0	153.2	153.7	134.8	103.9	107.7
Miscellaneous	82.3	69.2	98.1	128.1	136.4	129.1	156.0	175.9
Products of food industry: beverages, liquid, alcohol and vinegar, tobacco and its products	2.9	1.4	2.7	8.7	13.2	8.4	11.8	15.3
Mineral products	209.2	188.4	206.4	194.0	256.5	260.0	301.1	405.7
Petroleum				111.4	137.9	147.5	173.6	250.6
Miscellaneous				82.6	118.6	112.5	127.5	155.1
Products of chemical and related industries: natural and synthetic rubber and their products	148.9	167.0	219.0	225.1	311.8	311.9	430.1	525.1
Textile and textile goods	5.0	4.0	4.3	10.7	29.9	24.3	39.0	57.0
Common metals and products	113.8	115.3	196.3	173.7	201.6	257.8	330.0	428.4
Machinery and equipment; electric material, transport material	287.0	227.3	351.3	437.7	603.9	712.3	907.8	1,251.6
Miscellaneous	61.3	54.0	83.3	110.1	148.1	154.6	227.2	283.4
Total	1,086.4	940.6	1,303.4	1,441.3	1,855.1	1,993.2	2,506.9	3,250.1

Source: Relatório 1971, CACEX, Banco do Brasil.

TABLE F-5.--Brazilian Imports: 1964-1971. Index Numbers Base Index: 1964 = 100.

	1964	1965	1966	1967	1968	1969	1970	1971	1972
Total Imports	100	86.6	120.0	132.7	170.8	183.5	230.8	299.2	
1--Livestock and animal and vegetable produce	100	70.9	93.0	108.9	112.3	102.2	100.6	109.8	
2--Products of food industry: beverages, liquid alcohol and vinegar, tobacco and its products	100	48.3	93.1	300	455.2	289.6	406.9	527.6	
3--Mineral products	100	90.1	98.7	92.7	122.6	124.3	143.9	193.9	
4--Products of chemical and related industries; natural and synthetic rubber and their products	100	112.2	147.1	171.3	209.4	209.5	288.9	352.7	
5--Textile and textile goods	100	80.0	86.0	214.0	598.0	486.0	780.0	1140.0	
6--Common metals and products	100	101.3	172.5	152.7	177.2	226.5	290.0	376.4	
7--Machinery and equipment; electric material; transport material	100	79.2	122.4	152.5	210.4	248.2	316.3	436.1	
8--Other imports	100	88.1	135.9	179.6	241.6	252.2	370.6	462.3	

Source: Table F-4.

TABLE F-6.--Brazilian Imports by Groups of Products. Percentage Share of Each Group in Total Imports 1964-1971.

	1964	1965	1966	1967	1968	1969	1970	1971	1972
Total imports	100	100	100	100	100	100	100	100	100
1--Livestock and animal and vegetable produce	23.7	19.5	18.4	19.5	15.6	13.2	10.4	8.7	
2--Products of food industry: beverages, liquid alcohol and vinegar, tobacco and its products	0.3	0.2	0.2	0.6	0.7	0.4	0.5	0.5	
3--Mineral products	19.3	20.0	15.8	13.5	13.8	13.0	12.0	12.5	
4--Products of chemical and related industries; natural and synthetic rubber and their products	13.7	17.7	16.8	15.6	16.8	15.7	17.1	16.2	
5--Textile and textile goods	0.5	0.4	0.3	0.7	1.6	1.2	1.6	1.7	
6--Common metals and products	10.5	12.3	15.1	12.1	10.9	12.9	13.2	13.2	
7--Machinery and equipment; electric material, transport material	26.4	24.2	27.0	30.4	32.6	35.7	36.2	38.5	
8--Other imports	5.6	5.7	6.4	7.6	8.0	7.8	9.1	8.7	

Source: Table F-4.

TABLE F-7.--Purchasing Power of Exports and Capacity to Import.

Periods (t)	No.	Exports of Goods at Current Prices	Index of Prices 1965/67 = 100		Exports of Goods at 1965/67 Prices	Index of Terms of Trade 1965/67=100	Purchasing Power of Exports	Change of the Purchasing Power of Export Against 1959			No.
			Exports	Imports				Total	By Changes in the Quantum of Exports	By Changes in the Terms of Trade	
		(1)	(2)	(3)	$(4)=100\frac{(1)}{(2)}$	$(5)=100\frac{(2)}{(3)}$	$(6)=\frac{4x5}{100}$	$(7)=(6)_t-(6)_{1959}$	$(8)=(4)_t-(4)_{1959}$	(9)=(7)-(8)	
1959	1	1 282	95,1	97,2	1 348	97,8	1 318	----	----	----	1
1960	2	1 270	93,3	94,8	1 361	98,4	1 339	21	13	8	2
1961	3	1 405	98,0	96,4	1 434	102,0	1 463	145	86	59	3
1962	4	1 215	85,5	97,2	1 421	88,0	1 250	- 68	73	-141	4
1963	5	1 406	85,2	99,5	1 650	85,6	1 412	94	302	-208	5
1964	6	1 430	102,0	96,4	1 402	105,8	1 483	165	54	111	6
1965	7	1 596	103,0	97,7	1 550	105,4	1 634	316	202	114	7
1966	8	1 741	98,7	99,8	1 764	98,9	1 745	427	416	11	8
1967	9	1 654	98,5	102,0	1 679	96,6	1 622	304	331	- 27	9
1968	10	1 881	97,2	105,0	1 935	92,6	1 792	474	587	-113	10
1969	11	2 311	100,0	103,0	2 311	97,1	2 244	926	963	- 37	11
1970	12	2 739	113,0	105,0	2 424	107,6	2 608	1 290	1 076	214	12
1971	13	2 882	96,0	105,0	3 002	91,4	3 284	1 966	1 654	312	13

TABLE P-7.--continued.

No.	Services								No.
	Receipts				Payments				
	Commercial[2]		Non-Commercial[2]		Commercial[2]		Non-Commercial[2]		
	Current Prices	At 1965/67 Prices	Current Prices	At 1965/67 Prices	Current Prices	At 1965/67 Prices	Current Prices	At 1965/67 Prices	
	(10)	$(11)=100\frac{(10)}{(3)}$	(12)	$(13)=100\frac{(12)}{(3)}$	(14)	$(15)=100\frac{(14)}{(3)}$	(16)	$(17)=100\frac{(16)}{(3)}$	
1	42	43	117	120	-138	-142	-394	-405	1
2	50	53	143	151	-135	-142	-517	-545	2
3	53	55	82	85	-136	-141	-349	-362	3
4	49	50	35	36	-133	-137	-290	-298	4
5	53	53	43	43	-153	-154	-212	-213	5
6	52	54	66	68	-125	-130	-252	-261	6
7	59	60	102	104	- 93	- 95	-430	-440	7
8	65	65	76	76	-117	-117	-487	-488	8
9	77	75	108	106	-135	-132	-577	-566	9
10	99	94	106	101	-171	-163	-590	-562	10
11	134	130	156	151	-280	-272	-640	-621	11
12	169	161	209	199	-367	-350	-826	-787	12
13	192	183	251	239	-440	-419	-961	-915	13

TABLE F-7.--continued.

No.	Amortizations: Current Prices (18)	Amortizations: At 1965/67 Prices (19)=100 (18)/(3)	Net Inflow of Capital[3]: Current Prices (20)	Net Inflow of Capital[3]: At 1965/67 Prices (21)=100 (20)/(3)	Capacity of Foreign Payments (22)=(6)+(11)+(13)+(19)+(21)	Capacity to Import (23)=(22)+(15)+(17)	Change in the Capacity of Import Against 1959: Total (24) (23t-23 1959)	Change in the Capacity of Import Against 1959: By Changes in the Quantum of Exports (25) (4t-4 1959)	Change in the Capacity of Import Against 1959: Changes in the Behavior of other Variables[4] (26) (24-25)	Imports of Goods: Current Prices (27)	Imports of Goods: At 1965/67 Prices (28)=100 (27)/(3)	Deficit (-) or Surplus in Capacity to Import (29)=(23)+(28)	No.
1	-377	-388	599	575	1 668	1 [illegible]	----	----	----	-1 210	-1 245	- 124	1
2	-417	-440	475	501	1 694	[illegible]	- 204	13	- 217	-1 293	-1 364	- 447	2
3	-327	-339	615	638	1 902	1 [illegible]	278	86	192	-1 292	-1 340	59	3
4	-310	-319	419	505	1 522	1 [illegible]	- 24	73	- 107	-1 304	-1 342	- 255	4
5	-364	-366	310	312	1 454	1 [illegible]	- 34	302	- 336	-1 294	-1 301	- 214	5
6	-277	-287	359	372	1 690	1 [illegible]	178	54	124	-1 086	-1 127	172	6
7	-304	-311	298	305	1 792	1 257	136	202	- 66	- 941	- 963	294	7
8	-350	-351	474	475	2 010	1 405	284	416	- 132	-1 303	-1 306	99	8
9	-444	-435	471	462	1 830	1 132	11	331	- 320	-1 441	-1 413	- 281	9
10	-484	-461	1 025	976	2 502	1 777	656	587	69	-1 855	-1 767	10	10
11	-493	-479	1 364	1 324	3 370	2 477	1 356	963	393	-1 993	-1 935	542	11
12	-672	-640	1 687	1 607	3 935	2 798	1 677	1 076	601	-2 507	-2 388	410	12
13	-850	-810	2 696	2 568	5 464	4 130	3 009	1 654	1 355	-3 245	-3 090	1 040	13

Sources: Banco Central do Brasil
Columns (2) and (3): Indexes no. 117 and 166, respectively, of Conjuntura Econômica.

[1]Excludes Reinvestments.

[2]Commercial Services: transpor-ation and insurance.
Non-commercial: other items of the standard balance of payments.

[3]Includes amortizations and reinvestments.

[4]That is, terms of trade, services, amortizations, and net inflow of capital.

APPENDIX G

DATA USED IN ESTIMATING THE BEHAVIOR OF

DIRECT FOREIGN INVESTMENTS

TABLE G-1.--Data Used in Estimating the Behavior of Direct Foreign Investments.

	Direct Foreign Investments in Current US$ millions (1)	U.S. Wholesale Price Index (2)	Constant Dollar Value of Direct Foreign Investments (1/2)x100 I_t	Proxy for Profit Opportunities Rate of Growth of Real GDP $\dot{y}_t$	Annual Average of Monthly Percentage Change (with no signs) in the Official Real Exchange Rate f_t
1963	30	100	30	1.5	4.14
1964	28	100.2	27.9	2.9	7.42
1965	70	102.2	68.5	2.7	3.24
1966	74	105.6	70.1	5.1	2.47
1967	76	105.8	71.8	4.8	2.87
1968	81	108.4	74.7	9.3	3.34
1969	139	112.7	123.3	9.0	1.52
1970	128	116.8	91.3	9.5	1.27
1971	146	120.6	121.1	11.3	0.52
1972	200	126.5	158.1	10.4	0.63

Source: For (1) and $\dot{y}_t$: Conjuntura Econômica, 26 (November 1972) and 27 (February 1973).

For (2): International Financial Statistics, current issues.

For f_t: Table E-4, Appendix E.

APPENDIX H

EVIDENCE OF GREATER EFFICIENCY AFTER MINIDEVALUATIONS

EVIDENCE OF GREATER EFFICIENCY AFTER MINIDEVALUATIONS

An examination of the residual factor in economic growth can give an indication as to whether or not the economy was more efficient in the use of productive factors after 1968, following the introduction of minidevaluations. The residual factor in economic growth is the growth of output that cannot be accounted for by the growth of labor and capital. Assuming that the economy can be represented by a constant return to scale production function and also assuming competitive factor pricing, the residual (R) can be written as

$$R = \dot{y} - n_k \dot{k} - n_L \dot{L},$$

where $\dot{y}$ is the rate of growth of real GDP, n_k is the capital share in national income, n_L is the labor share, $\dot{k}$ is the rate of growth in the capital stock, and $\dot{L}$ is the rate of growth of the labor force. It also may be written as

$$R = \dot{y} - C_k - C_L,$$

where C_k is the contribution of capital growth and C_L is that of labor growth. Using the data for C_k and C_L

estimated by Carlos G. Langoni,[1] it is clearly seen in Table H-1 that the residuals for the period after 1968 are much greater than those for the period 1962-1967.[2] The average residual was about 5.0 percent from 1968 to 1972 as compared to only 0.795 percent during the previous five years. Therefore, it may be asserted that the economy became substantially more efficient after the introduction of minidevaluations.

---

[1]Carlos G. Langoni, "As Fontes do Crescimento Econômico Brasileiro," Tables 1 and 10.

[2]The high residuals in the years 1960-1961 reflect the last stage of easy import substituting industrialization.

TABLE H-1.--The Productivity Residual in Brazilian Economic Growth.

Years	$R = \dot{y} - C_k - C_L$	Productivity Residual
1960	R = 9.7 - 1.833 = 1.7 =	6.167
1961	R = 10.3 - 1.677 - 1.6 =	7.023
1962	R = 5.3 - 1.714 - 1.6 =	1.986
1963	R = 1.5 - 1.570 - 1.6 =	-1.670
1964	R = 2.9 - 1.611 - 1.6 =	- .311
1965	R = 2.7 - 1.432 - 1.6 =	- .332
1966	R = 5.1 - 1.902 - 1.6 =	2.698
1967	R = 4.8 - 1.830 - 1.6 =	1.390
1968	R = 8.4 - 2.286 - 1.6 =	4.514
1969	R = 9.0 - 2.665 - 1.6 =	6.335
1970	R = 9.5 - N.A. - 1.6 $\gtrsim$	4.2*
1971	R = 11.3 - N.A. - 1.6 $\gtrsim$	6.0*
1972	R = 10.4 - N.A. - 1.6 $\gtrsim$	5.1*

Source: For C_k and C_L, Carlos Geraldo Langoni, "As Fontes do Crescimento Econômico no Brasil," Estudos Econômicos, 2, No. 4 (1972), 13 and 23. For $\dot{y}_t$, Conjuntura Econômica, 26 (November 1972) and 27 (February 1973).

*Assuming C_k = 3.7.

BIBLIOGRAPHY

Alejandro, Carlos Diaz. Exchange-Rate Devaluation in a Semi-Industrialized Country: The Experience of Argentina, 1955-1961. Cambridge, Mass.: The M.I.T. Press, 1968, p. 191.

Alejandro, Carlos Diaz. "Stop-Go Cycles and Inflation During the Portwar Period." In Essays on the Economic History of the Argentine Republic. New Haven and London: Yale University Press, 1970, pp. 367-89.

Allen, R. G. D. Macro-Economic Theory, A Mathematical Treatment. New York: Macmillan, St. Martin's Press, 1968.

Almonacid, Ruben Dario. "O Exeito da Taxa Cambial Sôbre o Produto." Estudos Economicos, 2 (October 1972), 155-70.

Bacha, Edmar and Taylor, Lance. "Foreign Exchange Shadow Prices: A Critical Review of Current Theories." Quarterly Journal of Economics, 85 (May 1971), 197-224.

Balassa, Bela and Schydlowsky, Daniel M. "Effective Tariffs, Domestic Cost of Foreign Exchange and the Equilibrium Exchange Rate." Journal of Political Economy, 76 (May-June 1968), 356-59.

Banco Central do Brasil. Relatório 1967-1971.

Banco do Brasil S.A. Relatório, Exercício de 1971.

Banco do Brasil, S.A. Brasil, Exportação 1972. CACEX-NUCEX.

Banco do Brasil, Brasil-Comércio Exterior--Foreign Trade 1971.

Bergsman, Joel. Brazil Industrialization and Trade Policies. Oxford: OECD, Oxford University Press, 1970.

Bergsman, Joel and Candal, Arthur. "Industrialization: Past Success and Future Problems." In The Economy of Brazil. Edited by H. S. Ellis. Berkeley: University of California Press, 1969, p. 33.

Boletim do Comércio Exterior.

Boletim, Banco Central do Brasil.

Bracher, Fernao C. B. "Sistema Cambial de Taxa Flexivel." O Estado de São Paulo, 24 (November 1968), 71.

Branson, T. H. and Willet, T. D. "Policy Toward Short-Term Capital Movements. Some Implications of the Portfolio Approach." Paper presented at the conference on International Mobility and Movement of Capital, sponsored by The International Bureau of Economic Research, January, 1970.

Bruno, Michael. "Domestic Resource Costs and Effective Protection." Journal of Political Economy, 80 (January-February 1972), 16-33.

Cavalcanti, Antonio Nilson Quezado and Cracco, Ettiene. "Os Incentivos e as Exportações de Manufaturados; Análise e Sugestão." Revista de Administração de Emprêsas, 12 (January-March 1972), 63-9.

Chenery, Hollis B. "Comparative Advantage and Development Policy." American Economic Review, 51 (March 1961), 18-51.

Chow, G. C. "Tests of Equality Between Sets of Coefficients in Two Linear Regressions." Econometrica, 28 (1960), 591-605.

Christoffersen, Leif. "Taxas de juros e a Estrutura de um Sistema de Bancos Comerciais em Condições Inflacionárias." Revista Brasileira de Economia, 23 (June 1969).

Clement, M. O.; Pfister, Richard L.; and Rothwell, Kenneth J. Theoretical Issues in International Economics. Boston: Houghton, Mifflin Co., 1967.

Conjuntura Econômica.

Delfim, Netto A.; Pastore, A. C.; Cipollari, P.; and Carvalho, E. P. Alguns Aspectos da Inflação Brasileira. São Paulo: ANPES, 1965.

Diz, Adolfo C. "Money and Prices in Argentina, 1935-1962." Unpublished Ph.D. dissertation, University of Chicago, 1966.

Doellinger, Carlos Von. "Exportações brasileiras: diagnostico e perspectivas." Pesquisa e Planejamento (June 1971), 83-140.

Doellinger, Carlos Von. "Capitais Externos, Balanço de Pagamentos e Crescimento Econômico." Internal Document, IPEA, 1972.

Doellinger, Carlos Von; Faria, H. B. B.; Pereira, J. E. C.; and Horta, M. H. T. T. Exportações denamicas brasileiras. Rio de Janeiro: 1971, IPEA.

Donges, Juergen B. Brazil's Trotting Peg, A New Approach to Greater Exchange Rate Flexibility in Less Developed Countries. Washington, D.C.: American Enterprise Institute for Public Policy Research, August, 1971.

Fajnzylber, Fernando. Sistema Industrial e Exportação de Manufaturados. Análise da Experiência Brasileira. Rio de Janeiro: IPEA/INPES, 1971.

Federal Reserve Bulletin.

Fisher, F. M. "Tests of Equality Between Sets of Coefficients in Two Linear Repressions: An Expository Note." Econometrica, 38 (1970), 361-66.

Fishlow, Albert. "Brazilian Size Distribution of Income." American Economic Review, 62 (May 1972).

Friedman, M. "The Case for Flexible Exchange Rates." In Essays in Positive Economics. Edited by M. Friedman. Chicago: University of Chicago Press, 1953, pp. 157-203.

Furtado, Celso. Obstacles to Development in Latin America. Translated by Charles Ekker. Garden City, New York: Andros Books, 1970.

Gudin, E. "The Chief Characteristics of the Postwar Economic Development of Brazil." In The Economy of Brazil. Edited by Howard Ellis. Berkeley: University of California Press, 1969.

Halm, George N. Toward Limited Flexibility of Exchange Rates. Princeton: International Finance Section, Department of Economics, Princeton University, 1969.

Halm, George N., ed. Approaches to Greater Flexibility of Exchange Rates: The Burgenstock Papers. Arranged by C. Fred Bergsten, George N. Halm, Fritz Machlup and Robert V. Roosa. Princeton: Princeton University Press, 1970.

Harberger, Arnold C. "The Dynamics of Inflation in Chile." In Measurement in Economics: Studies in Mathematical Economics and Econometrics in Memory of Yettuda Grunfeld. Edited by Carl Christ et al. Stanford: Stanford University Press, 1963.

Heller, R. and Kreinin, M. "Adjustment Costs, Optimal Currency Areas, and International Reserves."

Hesse, Herman. "Promotion of Manufactured Exports as Development Strategy of Semi-Industrialized Countries: The Brazilian Case." Weltwirtschaftliches Archiv., Review of World Economics, 108, No. 2 (1972), 234-55.

Hoffman, Rodolfo and Duarte, João Carlos. "A Distribuição de Renda no Brasil." Revista de Administração de Emprêsas, 12 (April-June 1972).

International Financial Statistics.

Johnson, Harry G. "The Case for Flexible Exchange Rates, 1969." In V. K. and Floating Exchanges. Edited by H. G. Johnson and J. E. Nash. London: The Institute of Economic Affairs, 1969. Reprinted in Halm, ed., Approaches to Greater Flexibility, pp. 91-111.

Johnston, J. Econometric Methods. 2nd Ed. New York: McGraw-Hill Book Company, 1972.

Kafka, Alexander. "The Brazilian Exchange Auction System." Review of Economics and Statistics, 38 (August 1956), 308-22.

Kenen, Peter B. "The Theory of Optimum Currency Areas: An Eclectic View." In Monetary Problems of the International Economy: Papers and Discussions. Edited by Robert A. Mundell and Alexander Snoboda. Chicago: University of Chicago Press, 1969), pp. 41-60.

Kmenta, Jan. Elements of Econometrics. New York: The Macmillan Company, 1971.

Koyck, L. M. Distributed Lags and Investment Analysis. Amsterdam: North-Holland Publishing Co., 1954.

Kreinin, Mordechai E. International Economics: A Policy Approach. New York: Harcourt, Brace, Jovanovich, Inc., 1971.

Kreinin, Mordechai E. Alternative Commercial Policies--Their Effect on the American Economy. East Lansing: Michigan State University, 1967.

Langoni, Carlos G. "As Fontes de Crescimento Economico Brasiliero." Estudos Econômicos, 2, No. 4 (1972), 3-34.

Langoni, Carlos G. "Distribuição de Renda e Desenvolvimento Econômico do Brasil." Estudos Econômicos, 2 (October 1972).

Lira, Paulo H. Pereira. "Cruzeiro o Preço Exato da Moeda." Revista Econômica, Jornal do Brasil, 26 (March 1971), 32.

Lira Paulo H. Pereira. "Endividamento Externo e Desenvolvimento." Revista Economica, Jornal do Brasil, 31 (March 1972), 120.

Lira, Paulo H. Pereira. "Politica de Endividamento externo." Unpublished Conference Paper Delivered to the Superior War College, July 1972.

McKinnon, Ronald I. "Optimum Currency Areas." American Economic Review, 53 (September 1963), 717-25.

McKinnon, Ronald I. Monetary Theory and Controlled Flexibility in the Foreign Exchanges. Essays in International Finance, No. 84. Princeton: Princeton University Press, 1971, pp. 21-3.

Mundell, Robert A. "Flexible Exchange Rate and Employment Policy." Canadian Journal of Economics and Political Science, 27 (November 1961), 509-17.

Mundell, Robert A. "The Monetary Dynamics of International Adjustment Under Fixed and Flexible Exchange Rates." Quarterly Journal of Economics, 84 (May 1960), 227-57.

Mundell, Robert A. International Economics. New York: The Macmillan Company, 1968.

Mundell, Robert A. "A Theory of Optimum Currency Areas." American Economic Review, 50 (September 1961), 657-65.

Rhomberg, R. Rudolf. "Canada's Foreign Exchange Market: A Quarterly Model." International Monetary Fund Staff Papers, 7 (April 1960), 439-56.

Robinson, Sherman. "Sources of Growth in Less Developed Countries." Quarterly Journal of Economics, 85, No. 3 (August 1971), 391-408.

Selowsky, Marcelo. "On the Measurement of Education's Contribution to Growth." Quarterly Journal of Economics, 83 (August 1969), 449-63.

Simonsen, Mario H. Inflação, Gradualismo x Tratamento de Choque. Rio: APEC, 1970.

Simonsen, Mario H. Brasil 2002. APEC Editora, Rio de Janeiro: 1972.

Sohmen, Egon. International Monetary Problems and the Foreign Exchanges. Princeton N. J.: International Finance Section, Department of Economics, Princeton University, 1963.

Sohmen, Egon. Flexible Exchange Rates: Theory and Controversy. Chicago: University of Chicago Press, 1961.

Suplicy, Eduardo M. "Graphic Presentation of a Macroeconomic Model: The Inflationary Spiral." Revista Brasileira de Economia, 24 (Oct.-Dec. 1970).

Tyler, William G. "As Taxas de Câmbio Cadentes e a Inflação Endemica." Revista Brasileira de Economia, 22 (December 1968), 80-93.

Tyler, William G. "Exchange Rate Flexibility Under Conditions of Endemic Inflation: A Case Study of Recent Brazilian Experiences." Unpublished Paper, U.S. AID, 1971.

Tyler, William G. "Export Diversification and the Promotion of Manufactured Exports in Brazil." Mimeographed U.S. AID Study, August 1969.

Tyler, William G. "Fiscal Incentives for Manufactured Export Promotion: The Brazilian Case." Working Paper 72-01, Department of Economics, University of Florida.

U. S. Survey of Current Business.

U. S. Federal Reserve Bulletin.

Wonnacott, Ronald J. and Wonnacott, Thomas H. Econometrics. New York: John Wiley and Sons, Inc., 1970.