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Stopping High Inflation: An Analytical Overview

Vegh, Carlos

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Stopping High Inflation: An Analytical Overview 1/

Prepared by Carlos A. Végh

Authorized for Distribution by Mohsin S. Khan

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Abstract

This paper reviews the evidence on stabilization plans in high
inflation countries within a unified theoretical framework. The evidence
suggests that hyperinflations have been stopped almost instantaneously
with no major output costs, while stabilization programs in chronic-
inflation countries have resulted in an initial expansion followed by
a later recession, in addition to a sustained real exchange rate
appreciation and current account deficits. These outcomes turn out
to be consistent with the predictions of the analytical model.

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I. Introduction

High inflation has been a recurrent problem in developing countries. More often than not, stabilization programs designed to stop high inflation are short-lived, and inflation resurges with a vengeance. The frequent failure of stabilization programs makes the public skeptical of the chances of success of any new attempt. High inflation becomes entrenched, and countries have no choice but to learn how to live with high inflation by creating various indexing mechanisms. As countries adapt to higher inflation and the credibility of policymakers suffers with each failed program, the eradication of inflation becomes an even more elusive goal.

As stabilization programs are implemented and then abandoned, economists have focused on developing analytical frameworks that may be helpful in understanding the problems of stopping high inflation. After the Southern-Cone stabilization programs of the late 1970's, for instance, a large literature developed trying to explain what was viewed at the time as the most puzzling feature of those programs, namely, the large real-exchange-rate appreciation that resulted from the slow convergence of the inflation rate to the rate of devaluation. The slow response of inflation prompted some influential economists to conclude that incomes policies should be a key component of future stabilization programs. The lessons of the late 1970's undoubtedly influenced the design of the so-called heterodox programs of the mid 1980's, which in turn brought forth new issues--most notably, the expansion of real activity at the beginning of the programs, followed by a later slowdown (see Kiguel and Liviatan (1990)). While such a business-cycle associated with exchange-rate-based stabilization had already been discussed in connection with the Southern-Cone stabilization programs, the issue of real-exchange-rate appreciation had, to a large extent, overshadowed it.

While new experiences have brought about novel features that need to be explained, a consensus has emerged within the profession on some key issues in stabilization policy. For instance, most economists would agree that fiscal adjustment is a necessary condition for a successful stabilization, independently of whether incomes policies are used or not. If stabilization programs keep failing due to a lack of fiscal adjustment (for instance, the Brazilian Cruzado plan of 1985), it should most probably be attributed to political and institutional considerations rather than to economic ignorance on the part of policymakers. 1/

More interestingly, even in the presence of a serious fiscal adjustment, stabilization programs seem to have a hard time achieving the goal of low inflation. Factors such as real exchange rate appreciation, current account deficits, and rising real domestic interest rates may all

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1/ It should not be concluded, however, that economic analysis has nothing to contribute to the issue, as the expanding literature on political economy suggests.

contribute to put pressure on policymakers and force them to give up programs that, in the first instance, seem well conceived. Therefore, understanding why such problems may arise clearly constitutes an essential step in the fight against inflation. Furthermore, it is essential to analyze these issues in a general equilibrium framework. Otherwise, the incompatibility of different objectives at an analytical level--let alone at a practical level--may go undetected. For instance, theory suggests and experience seems to confirm that inflation stabilization is accompanied by an appreciation of the real exchange rate. Therefore, aiming at achieving low inflation and real-exchange-rate stability simultaneously would appear not to be feasible.

This paper surveys the main issues associated with exchange-rate-based stabilization. 1/ Specifically, it first reviews the stylized facts that have characterized attempts to stop both hyperinflation and chronic inflation. Then, a unified analytical framework is presented in order to contrast the predictions of the model with the empirical evidence. Finally, policy conclusions are drawn in light of the analysis.

The model utilized in this paper is the one developed by Calvo and Végh (1991). While the choice of a particular model is to a large extent arbitrary, there are substantial benefits from such a strategy, especially in terms of keeping the discussion clearly focused by concentrating on one particular model. Calvo and Végh's (1991) model relies on intertemporal substitution effects as the key channel through which non-credible stabilization policies--stabilization policies that are viewed by the public as temporary--have real effects. 2/

An important result of the model is that <u>if the authorities announced a reduction of the rate of devaluation that is credible, in the sense that the policy is viewed as permanent by the public, inflation falls instantaneously without any output costs</u>. Sticky prices do not prevent an instantaneous adjustment because all price-setting behavior is forward looking. It is argued that the analytical exercise of a permanent reduction in the rate of devaluation is, to a first approximation, relevant for interpreting the end of hyperinflations. The reasons are that, first, hyperinflationary processes are characterized by the absence of backward-looking behavior; and, second, it has been argued that programs designed to stop hyperinflations are more credible than those designed to stop high but

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1/ Experience shows that stabilization programs that attempt to stop high inflation are often based on the control of the nominal exchange rate. Therefore, this paper will focus on exchange-rate-based stabilization. See Calvo and Végh (1990a) for an analysis of money-based stabilization.

2/ Real effects from exchange-rate management have also been explained by the presence of wealth effects. For instance, Helpman and Razin (1987) emphasize wealth effects that arise from the absence of Ricardian equivalence. Drazen and Helpman's (1987, 1988) analyze wealth effects that result from anticipated future changes in government spending.

persistent inflation. The evidence seems to bear out the prediction that hyperinflations can be stopped abruptly and at small output costs--although the evidence on the latter is a matter of controversy.

If the authorities announce a stabilization plan based on reducing the rate of devaluation but the public perceives the policy as not credible--in the sense that it expects the higher rate of devaluation to resume at some later date--the effects of the policy will be the same as those that would result from a temporary reduction in the rate of devaluation. The model predicts that <u>a non-credible reduction in the rate of devaluation leads to an expansion in the home-goods sector, a current account deficit, real appreciation, and a lower domestic real interest rate. Later in the program, there is sharp contraction in the home goods sector</u>. It is argued that this experiment may be useful in interpreting stabilization in chronic-inflation countries where the failure of many past attempts at controlling inflation, and the adjustment of the economy to living with high inflation make any attempt to stop inflation less than fully credible. The stylized facts are apparently consistent with the predictions of the model. The behavior of the domestic real interest rate, however, remains a thorny issue because although it has fallen in some stabilization programs--most notably, the Southern-Cone programs--it has risen in most programs.

The paper proceeds as follows. Section II reviews the stabilization episodes that will serve as reference points throughout the paper and summarizes the stylized facts that need to be explained. Section III introduces the model and analyzes the effects of a permanent reduction in the rate of devaluation. Section IV discusses the end of hyperinflations in light of the model. Section V examines a temporary reduction in the rate of devaluation, and links the theoretical framework with evidence on stopping chronic inflation. Section VI briefly analyzes the effects of backward indexation. Section VII draws policy implications from the analysis and provides concluding remarks.

II. Stylized Facts of High-Inflation Stabilization

Since the main objective of this study is to link theory with evidence, there will be numerous references to episodes of hyperinflation and chronic inflation. It will prove useful, therefore, to group the different episodes in some systematic way. Besides providing a basis for further references, this classification highlights the fact that many stabilization plans shared some fundamental characteristics. These common features, in turn, have not only generated important discussions in the literature, but have also been influential in the design of subsequent stabilization plans. 1/

1/ This is not to deny the importance of factors which were specific to each stabilization episode.

For practical purposes, the term "hyperinflation" will be defined as in Cagan's (1956) classic paper. 1/ At a conceptual level, it is useful to keep in mind the distinction between "hyperinflation" and "chronic-inflation," emphasized by Pazos (1972), in his well-known study of Latin-American high inflations. Pazos (1972) argues that chronic inflation exhibits two key characteristics. First, chronic inflation may last for many years; it is not a temporary phenomenon as is the case of most hyper-inflations. Second, chronic inflation has an intermediate intensity--higher than that of moderate inflation but much lower than that of hyperinfla-tion--which results from the fact that countries learn how to live with high and persistent inflation by creating various mechanisms, and are therefore able to continue to function. Inflation does not have an inherent propensity to accelerate or, if it does, it soon reaches a new plateau. In hyperinflations, however, the rate of inflation oscillates freely, before accelerating exponentially in the last six months or so in most cases. *Pazos (1972, p. 19), commenting on the inflation rate during the German hyperinflation, points out that* "oscillations were so large and so erratic that the chart [of the inflation rate] seems to register the movements of an object that has been let loose in a frictionless environment and is reacting, without offering resistance, to the external forces being applied to it."

Although there is not a generally-accepted definition of what constitutes a "chronic inflation" country, some cases are beyond dispute. Figures 1 through 3 illustrate the 12-month inflation rate during the last 30 years in Argentina, Brazil, and Uruguay--which would be considered, by most definitions, chronic-inflation countries. Figure 4 shows the 12-month inflation rate during the same period for Bolivia, a traditionally low-inflation country which ended up in hyperinflation. These countries provide an interesting illustration of the inflationary process over long periods of time in both chronic-inflation and low-inflation countries.

In Argentina, except for a four-month period in 1961 and a seventeen-month period that runs from November 1968 to March 1970, the 12-month inflation has always been above 10 percent (see Figure 1). Moreover, beginning in June 1976, when the inflation rate surpassed 100 percent for the first time since December 1959, inflation never fell below 50 percent and only rarely did it fall below 100 percent. 2/ In June 1985, inflation surpassed 1,000 percent. The Austral Plan (June 1985) prevented the economy *from falling into hyperinflation but, finally, in June 1990, hyperinflation*

1/ Cagan (1956, p.25) defines hyperinflations "as beginning in the month the rise in prices exceeds 50 percent and as ending in the month before the monthly rise in prices drops below that amount and stays below for at least a year." Note, for further reference, that a 50 percent monthly rate is equivalent to a 12,875 percent yearly rate.

2/ Inflation fell below 100 percent only twice: for a period of 11 months in 1980 and 1981 (the Tablita program) and a 10 month period in 1985 and 1986 (the Austral Plan))

Figure 1. Argentina: 12-Month Inflation Rate

1958.01 - 1988.12

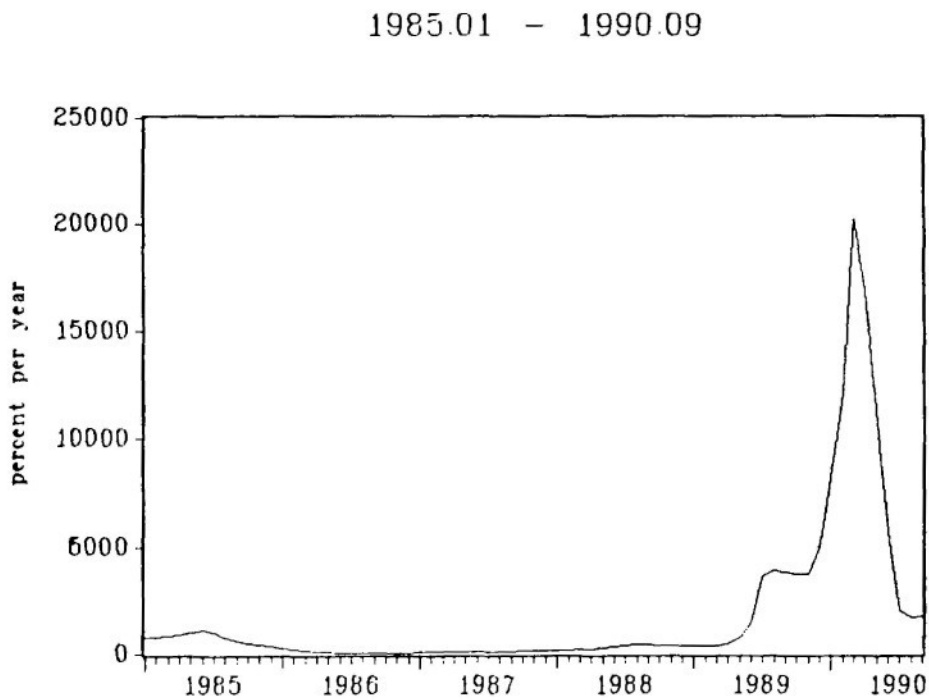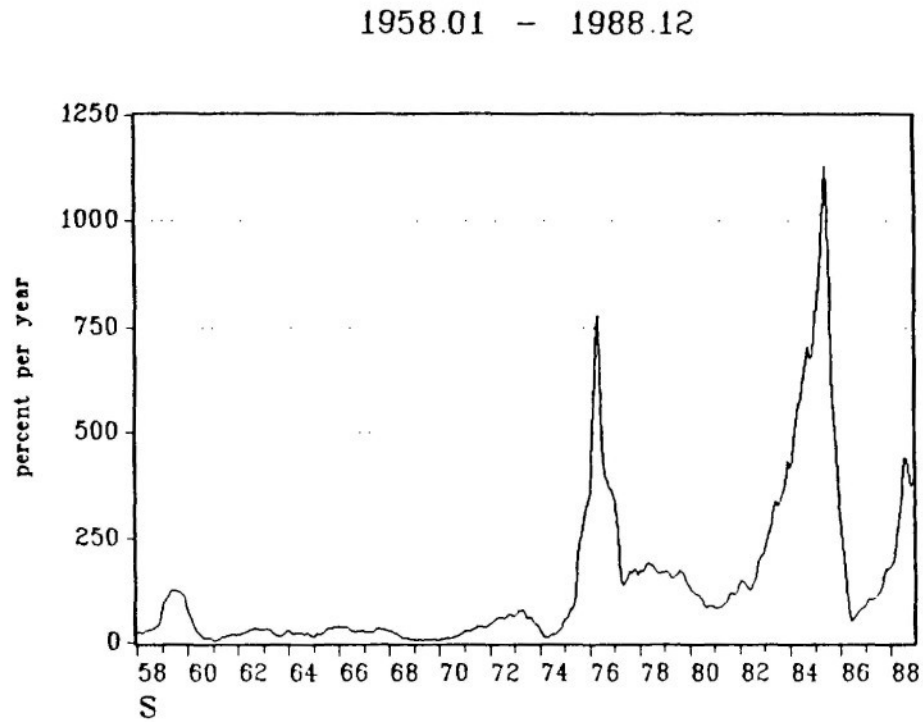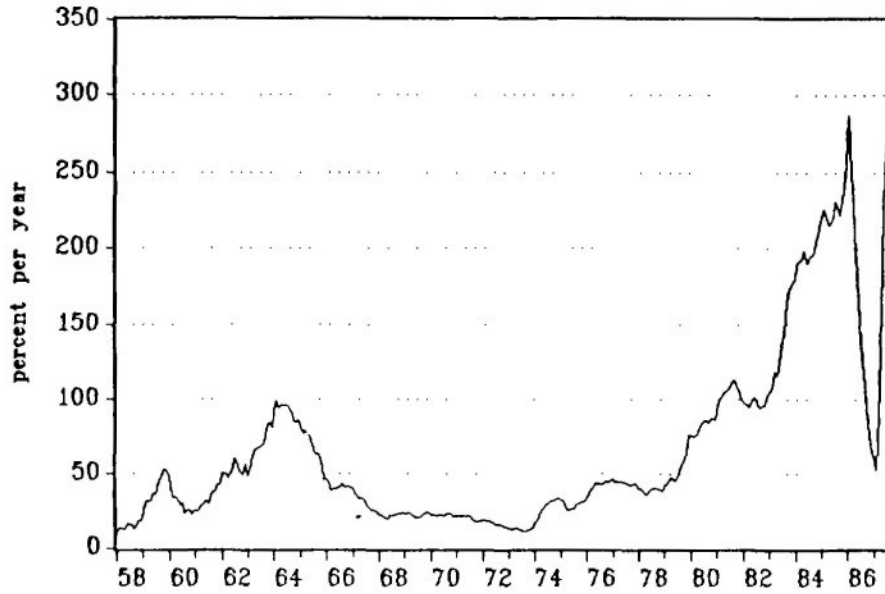

1985.01 - 1990.09

Source: IFS

Figure 2. Brazil: 12-Month Inflation Rate

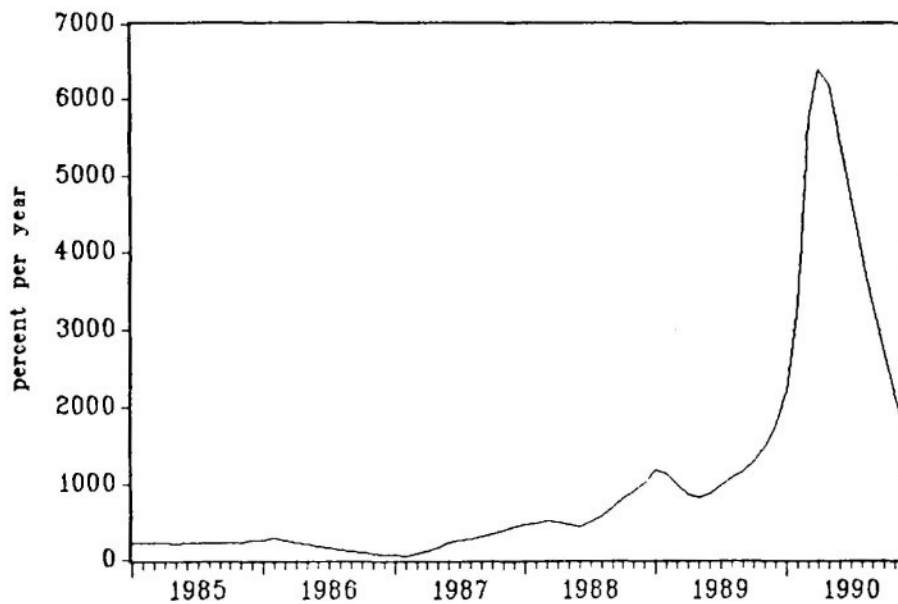### 1958.01 — 1987.09

1985.01 — 1990.12

Figure 3. Uruguay: 12-Month Inflation Rate

1958.01 — 1990.12
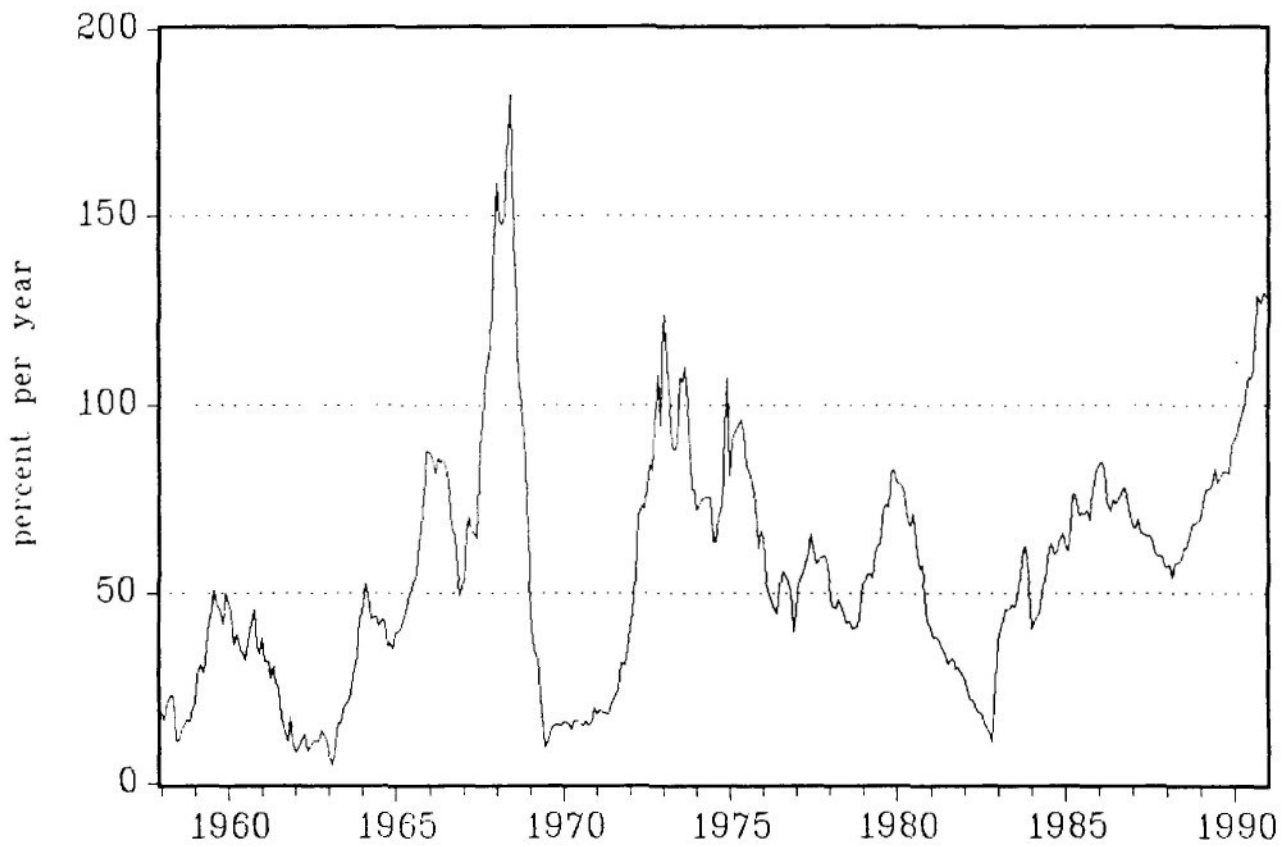
Figure 4. Bolivia: 12-Month Inflation Rate

1959.01 — 1983.12

1980.01 — 1989.12

Source: IFS
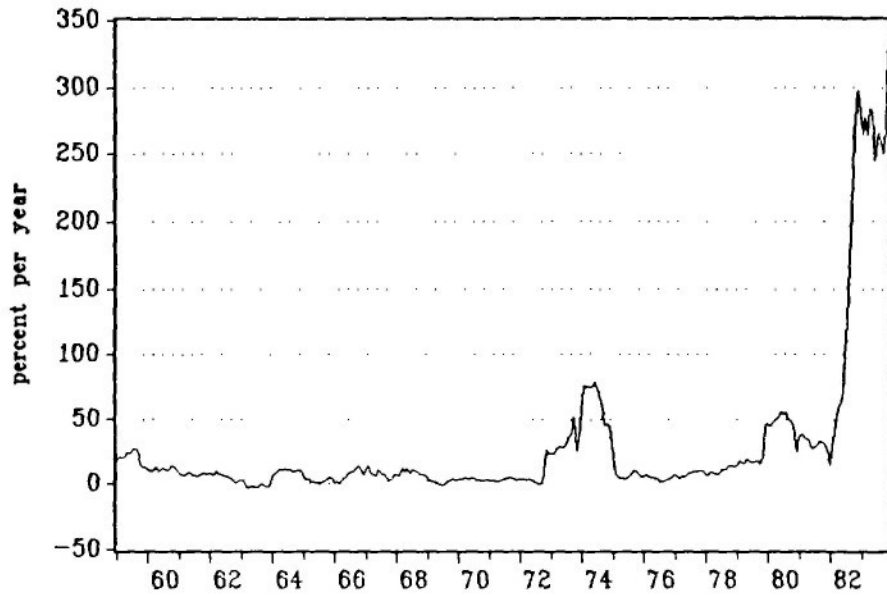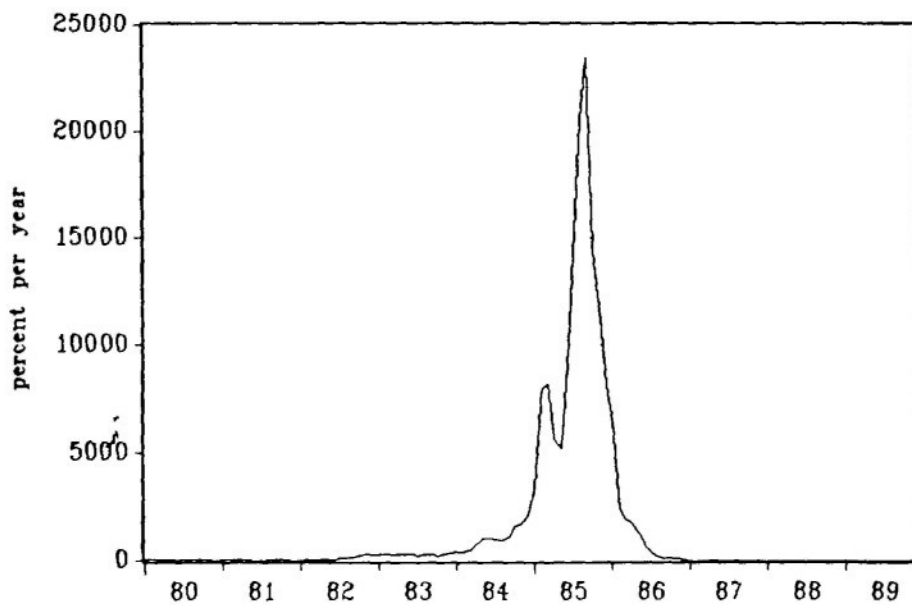
(which lasted 11 months) could not be avoided. Argentina thus provides a case study of how a chronic-inflation country may end up in hyperinflation.

The 12-month inflation rate in Brazil has never been below 10 percent since February 1958 (see Figure 2). It reached 100 percent in March 1981 and, except for 9 months in 1982, never fell below that level. The 1,000 percent mark was reached in December 1988 and the economy was in hyper-inflation in December 1989. As in the case of Argentina, inflation rates of above of 1,000 percent a year eventually led to hyperinflation.

Unlike the cases of Argentina and Brazil, inflation in Uruguay has not reached hyperinflationary proportions at the end of this thirty-year period (see Figure 3). The reason is that inflation has never gone beyond levels above 200 percent. (In fact, only rarely did inflation go over the 100 percent mark.) However, except for a 13-month period in 1982 (at the end of the Tablita program), inflation has always been above 30 percent since November 1970.

Bolivia illustrates how a low inflation country can find itself in a full-blown hyperinflation in a short-period of time. Between January 1959 and July 1979, the average 12-month inflation rate was 11 percent. The 100 percent mark was reached in July 1982 and the process was explosive from then on. When inflation reached the 500 percent mark in May 1984, the economy had gone into hyperinflation. Thus, in contrast to Argentina and Brazil, high levels of inflation in Bolivia quickly degenerated into hyperinflation.

As indicated above, Pazos (1972) associates high oscillations of the inflation rate with hyperinflationary periods. To illustrate this point, the 30-year period from 1960 to 1989 in the four countries illustrated in Figures 1 through 4 has been divided into five-year periods. 1/ Table 1 shows the mean, standard deviation, and coefficient of variation of the monthly inflation rate in each of these four countries for the six five-year periods. Except for Uruguay, the correlation coefficient between the mean and the standard deviation is always above 80 percent. The highest standard deviations are present during periods that include hyperinflations (almost 30 percent in Argentina and Bolivia during 1985-1989). In this sense, therefore, higher inflation is associated with higher variability. Note, however, that the correlation between the mean and the coefficient of variation is, if anything, negative. The highest coefficient of variations correspond to the periods of lowest inflation (Bolivia between 1960 and 1970).

1/ Since it is generally not possible to reject non-stationarity of the inflation rate in these countries, these figures should be taken with caution.

Table 1. Variability of monthly inflation rate in Argentina, Bolivia, Brazil, and Uruguay

Period	Argentina			Bolivia			Brazil			Uruguay		
	Mean	S. D.	C. V.	Mean	S. D.	C. V.	Mean	S. D.	C. V.	Mean	S. D.	C. V.
1960.01 - 1964.12	1.66	2.13	1.28	0.49	1.55	3.16	3.80	2.29	0.60	1.99	2.53	1.27
1965.01 - 1969.12	1.69	2.93	1.73	0.49	1.70	3.47	2.32	1.37	0.59	4.41	4.26	0.97
1970.01 - 1974.12	2.96	3.26	1.10	1.61	4.14	2.57	1.53	0.81	0.53	4.26	4.26	1.00
1975.01 - 1979.12	10.34	7.09	0.69	1.24	3.01	2.43	3.21	1.30	0.40	3.90	2.11	0.54
1980.01 - 1984.12	11.30	5.99	0.53	12.13	15.24	1.26	7.22	2.23	0.31	2.94	2.48	0.84
1985.01 - 1989.12	17.90	29.77	1.66	11.85	29.55	2.49	16.34	11.74	0.72	4.71	1.70	0.36
Correlation (M, SD)		0.86			0.91			0.96			0.23	
Correlation (M, CV)		-0.14			-0.74			0.40			-.065	

1. <u>Hyperinflations</u>

For the purposes of this paper, it is useful to divide hyperinflations as follows:

a) European hyperinflations of the 1920's and 1940's.
b) The Taiwanese hyperinflation of 1945-1949.
c) The Bolivian hyperinflation of 1985.

a. <u>European hyperinflations</u>

This group includes the seven hyperinflations that took place in Europe after World War I and World War II: Austria (October 1921-August 1922), Germany (August 1922-November 1923), Greece (November 1943-November 1944), Hungary (March 1923-February 1924, and August 1945-July 1946), Poland (January 1923-January 1924), and Russia (December 1921-January 1924). 1/ Heavy disruptions and reparation payments resulting from the two World Wars led to accelerating budget deficits that were financed by printing money. The German hyperinflation--arguably, the more heavily studied episode in monetary history--reached monthly rates of inflation of 32.4×10^3 percent, and was, with the exception of the Russian hyperinflation, the longest in duration (16 months). The world's record, according to Cagan (1989) occurred in Hungary after World War II, when prices rose an average of 19,800 percent between August 1945 and July 1946 and 4.2×10^{16} percent in the peak month of July.

The unifying theme behind these episodes is how hyperinflation was successfully brought under control by introducing drastic fiscal reforms and restoring convertibility of the domestic currency in terms of the dollar or gold, as emphasized by Sargent (1982) in his paper on four of these hyperinflations (Austria, Germany, Poland, and Hungary after World War I). In Sargent's (1982) interpretation, these four episodes illustrate how a change in policy regime, if believed by the public, is enough to stop inflation at once with no major disruptions. As discussed in detail in Section IV, Sargent's (1982) views have not gone unchallenged, most notably by Sachs (1986, 1987) and Dornbusch (1988). Dornbusch (1988) argues that, at least in the German case, the stabilization was a much more diffuse and accidental matter than claimed by Sargent (1982). Sargent's (1982) interpretation of the small costs, in terms of output, suffered by these four economies has also been disputed by Wicker (1986).

1/ Dates indicate approximate beginning and end as reported by Cagan (1956). Cagan (1956), Yeager (1981), Sargent (1982), Dornbusch and Fischer (1986), and Siklos (1989), among many others, have studied these episodes exhaustively.

b.   <u>Taiwanese Hperinflation</u> <u>1</u>/

The Taiwanese hyperinflation is much less known compared to its European counterparts. Our interest in this episodes derives from the fact that it is relevant for the discussion on Sargent's (1982) views, concerning the importance of a change in policy regime in stopping hyperinflation.

In November 1945 Taiwan reverted to Chinese sovereignty. The Chinese national government attempted to isolate Taiwan from the hyperinflation taking place on the mainland by letting Taiwan be an independent currency area. Inflationary finance, however, led to hyperinflation in Taiwan as well. In terms of monthly inflation rates, however, the Taiwanese hyperinflation was the mildest of the hyperinflations. Average monthly inflation rates during 1946, 1947, and 1948 were 11.3 percent, 18.5 percent, and 22.5 percent, respectively. During the first five months of 1949, before the June 15 stabilization, prices rose at an average monthly rate of 53 percent. Inflation did not stop immediately but it did slowed down dramatically. Inflation from the middle of June through December was 82 percent compared to 729 percent in the first five months. During 1950, inflation was 89 percent.

An interesting aspect of the Taiwanese stabilization is that, according to Makinen and Woodward (1989), it apparently took place not only without any fiscal adjustment, but, more importantly, with no prospects of any future fiscal adjustment. Neither a major tax increase, nor the ability to refuse the government's requests for credit took place, as was the case in the European hyperinflations. The key measure was to restore public confidence in a new currency by making it convertible into gold and foreign exchange. As a result, the authorities reduced money creation by financing the deficit with reserves. It was only in mid-1952 that massive aid from the United States helped in closing the budget deficit. Thus, although the Taiwanese stabilization could be interpreted along Sargent's (1982) lines--the public perceived a change in regime, and inflation came down with mild costs--Makinen and Woodward (1989) argue that such a change in regime cannot possibly have been perceived, since it ultimately depended on an unforeseen event (the United States aid prompted by the Korean War).

c.   <u>The Bolivian hyperinflation</u> <u>2</u>/

The Bolivian hyperinflation was the first hyperinflation in thirty-five years. During 1984-5, inflation in Bolivia was the highest in Latin American history and, according to Sachs (1986), the seventh largest in the 20th century. Inflation during the first half of 1985 averaged roughly 60 percent a month, with a peak of 183 percent in February. When foreign

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<u>1</u>/ The discussion of the Taiwanese hyperinflation draws on Makinen and Woodward (1989).
<u>2</u>/ See Sachs (1986, 1987) and Morales (1988). Figure 5 illustrates the Bolivian stabilization.

Figure 5. Bolivian Stabilization

Devaluation Rate

Inflation Rate

Devaluation and Inflation (post-stabilization)

Real Effective Exchange Rate

Trade Balance

Real GDP Growth

Source: IFS
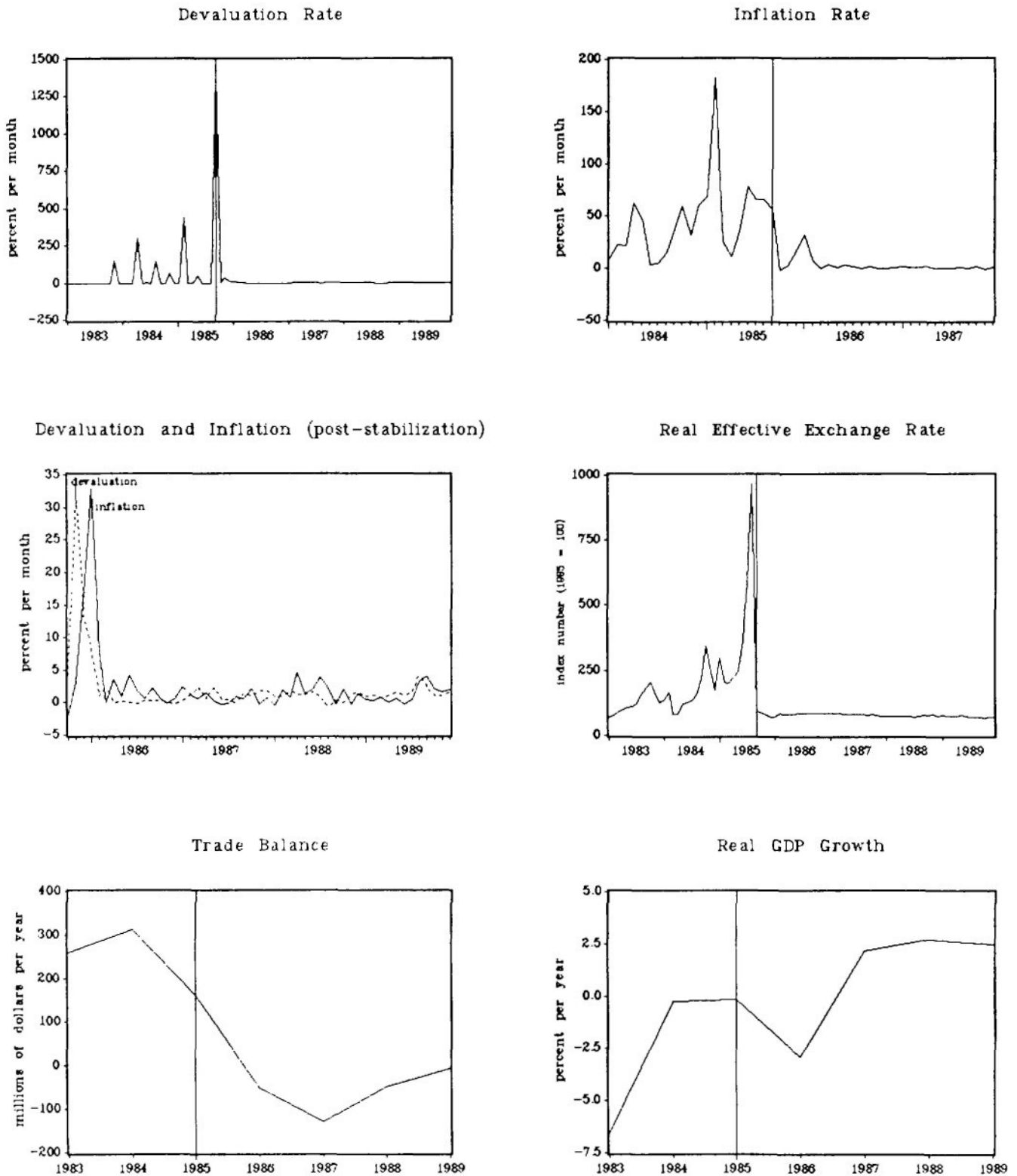
capital inflows stopped in early 1982, the government resorted to domestic credit to finance its deficit, thus setting off the inflationary process. After several failed attempts, the program announced on August 29, 1985 succeeded. After only 10 days, inflation dropped from 36 percent in the first week of September to 4.6 percent in the second week. Inflation in October and November was -1.9 percent and 3.2 percent, respectively. After a resurgence of inflation in December 1985 and January 1986, inflation was held to an annual rate below 26 percent between February and September. Inflation remained below 20 percent during 1988 and 1989.

The key components of the stabilization program were a drastic fiscal correction, unification of exchange rates, and a return to full convertibility--capital controls had been in place since late 1982. Unlike the European stabilization plans of the 1920's which were based on a fixed exchange rate, the exchange rate system in Bolivia during the stabilization plan is best characterized as a "dirty" floating. Private agents were allowed to buy and sell foreign exchange freely, but the Central Bank would sell foreign exchange rate to the public in a daily auction and buy foreign exchange at the average price fixed in the last auction. For each auction, the central bank would fix both a base price at which it would sell foreign exchange and the amount that it would offer; bidders would not know beforehand either the base price or the amount offered by the central bank.

Upon unification of the exchange rate markets, the official exchange rate depreciated by 1600 percent in one day (see Figure 5), thus eliminating overnight the parallel market premium. The exchange rate stabilized immediately after this initial adjustment providing a de facto anchor to the system, although the program did not seek to use the exchange rate as the nominal anchor. Rather, the commitment of the authorities was to drastically reduce money creation that was not backed by reserve holdings.

Sachs (1986, 1987) argues, based on the Bolivian case, that a regime change is not necessary for the initial success in stopping hyperinflation. Credibility, Sachs (1987) argues, was established after inflation was stopped abruptly by stabilizing the exchange rate. Sachs's (1987) arguments, therefore, reinforce those of Dornbusch (1988) and Makinen and Woodward (1989), mentioned above.

2. Chronic inflations

The episodes of chronic inflation that serve as background for the theoretical discussion can be divided as follows: (a) Latin-American heterodox programs of the 1960's; (b) Southern-Cone stabilization programs of the late 1970's; and (c) Heterodox programs of the mid-1980's

a.   Heterodox programs of the 1960's

These programs include the 1967 Argentinean Plan (the Krieger-Vasena stabilization), the 1964 Brazilian plan, and the Uruguayan plan of 1968. 1/ 2/ The common elements of these plans are, first, the use of the exchange rate as the nominal anchor and, second, the use of incomes policies in varying degrees. While price controls were mainly voluntary in Argentina and Brazil, in Uruguay there was a comprehensive freeze similar to that of the heterodox programs of the mid-80's. 3/

The short-run reduction in inflation in the three cases was important, particularly in Uruguay where inflation fell from 13.5 percent in June 1968 to just over half a percentage point in July and turned negative in August (see Figure 7 for the quarterly behavior of inflation in Uruguay). Only in Brazil, however, was the reduction in inflation sustained, lasting well into the 1970's, and reaching 12.7 percent in 1973. In Argentina and Uruguay, inflation resumed after two years, primarily due to a loss of fiscal discipline. In Uruguay, for example, the fiscal deficit jumped from 1.3 to 5.8 percent of GDP in 1971 (see Figure 7).

These three programs also shared other important characteristics. The fall in inflation at the beginning of the programs was accompanied by high rates of growth of GDP and consumption. The trade balance deteriorated during the programs. After an initial real depreciation due to step adjustments at the time of the implementation of the programs, the real exchange rate appreciated (see Figures 6 and 7). Real wages fell at the beginning of the programs and recovered later.

Real interest rates were negative in Argentina at the beginning of the program but turned highly positive later (Figure 6). 4/ In Brazil, growth continued for over six years. This combination of low inflation and high rates of growth has become known as the "Brazilian Miracle." In Uruguay, the resumption of inflation that marked the end of the program was accompanied by a sharp fall in output (Figure 7).

1/ Figures 6 and 7 illustrate the Argentinean and Uruguayan plans. See Kiguel and Liviatan (1989) for a comparison of the heterodox programs of the 1960's with those of the 1980's. On the Uruguayan 1968 stabilization plan, see Finch (1979), Végh Villegas (1970) and Viana (1990). The Brazilian 1964 plan is discussed by Kakfa (1964), Pazos (1972), and Foxley (1980). The Argentinean stabilization of 1967 is discussed by de Pablo (1970, 1974).
2/ Another heterodox program of interest in Argentina is the Peronist stabilization of 1973-5 (see di Tella (1989)). This program made use of comprehensive wage and price controls, but was not supported by a fiscal adjustment.
3/ In Brazil, however, incentives were provided for firms to comply with the suggested price guidelines (Foxley (1980)).
4/ Lack of data on curb markets in Uruguay and Brazil makes it difficult to assess what happened to real interest rates in these countries.

Figure 6. Argentinean 1967 Stabilization

Devaluation Rate

Four-Quarter Inflation Rate

Real Exchange Rate (for imports)

Trade Balance

Real GDP Growth

Real Interest Rates
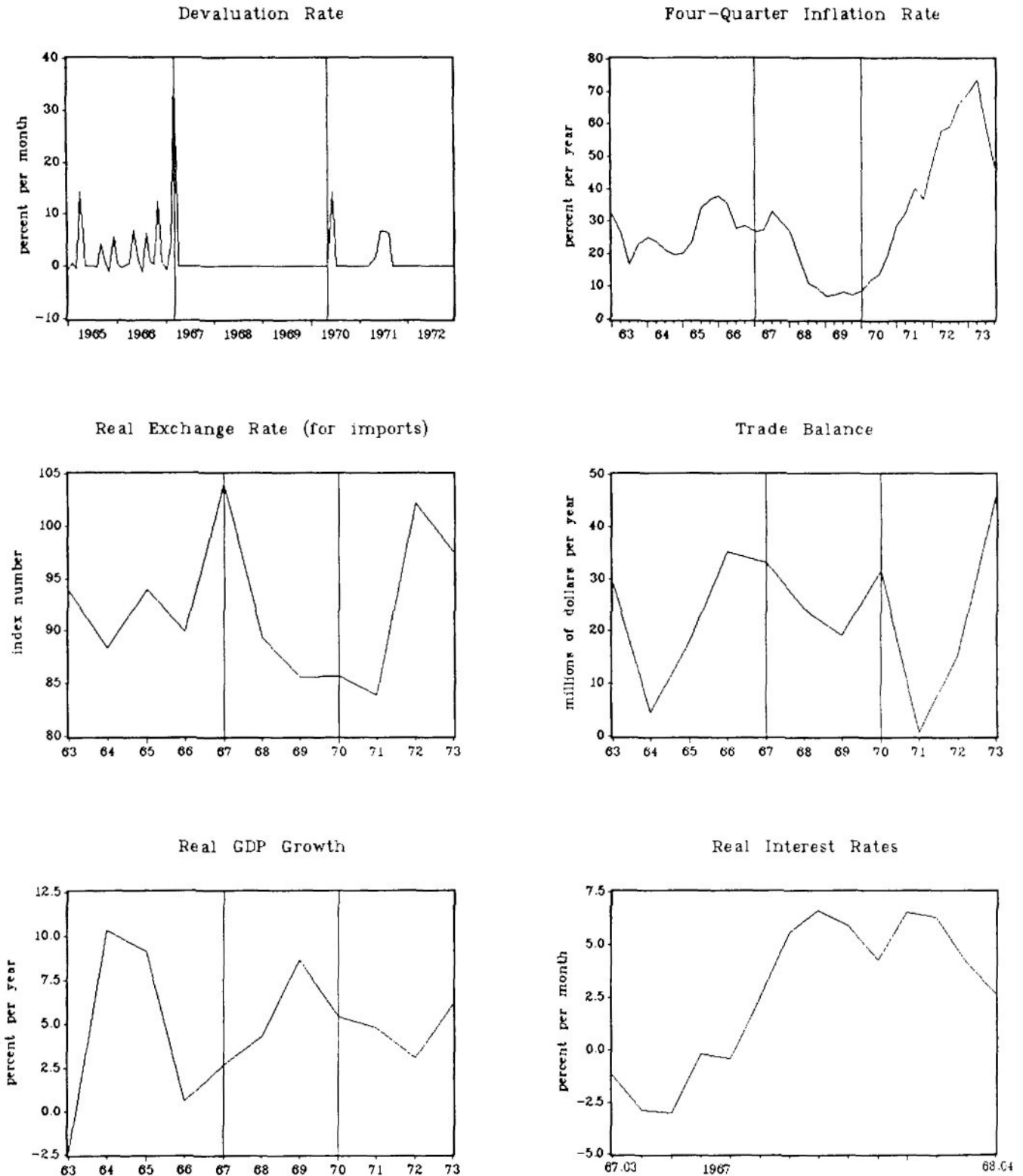
Source: IFS, Fundacion Mediterranea, and De Pablo (1970)

Figure 7. Uruguayan 1968 Stabilization

Devaluation Rate

Inflation Rate

Real Exchange Rate

Trade Balance

Private Consumption (rate of growth)

Fiscal Surplus

Source: IFS, Viana (1990)
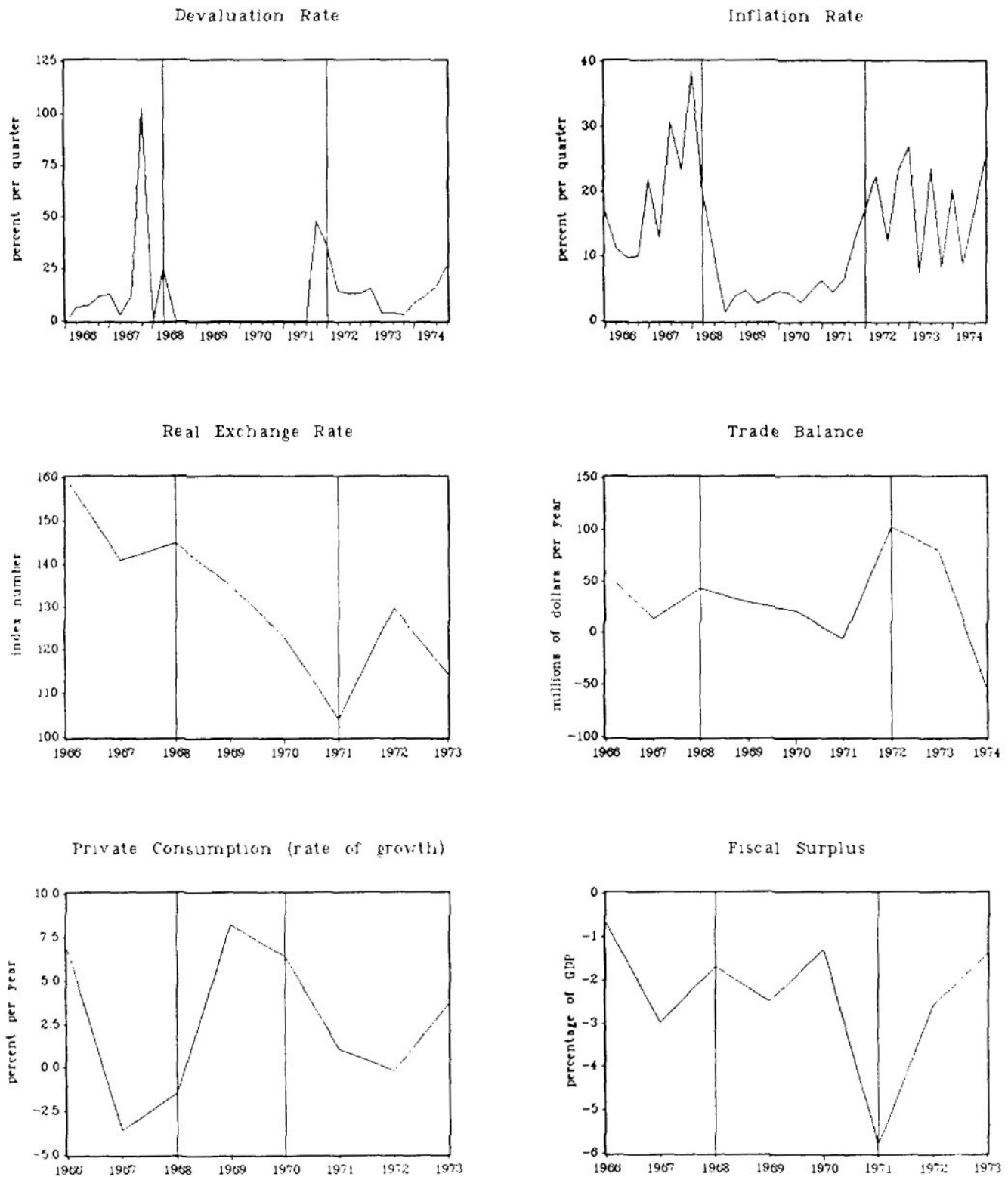
b.   Southern-Cone stabilizations of the late 70's.

This group comprises stabilizations in Argentina (December 1978-March 1981), Chile (July 1976-June 1982), and Uruguay (October 1978-November 1982), which are illustrated in Figures 8 through 10. 1/ 2/ By the mid-1970's, all three Southern Cone countries had highly-protected economies, large budget deficits, high inflation, balance-of-payments problems, and extensive government intervention. At that time, all three countries launched liberalization and stabilization programs. While the sequencing of liberalization measures differed among the three countries, the fight against inflation followed a similar path in that the money supply was used in a first stage and then there was a switch to controlling the nominal exchange rate as the key policy instrument. 3/ The exchange-rate policy consisted of announcing a devaluation schedule of the domestic currency against the dollar (the so-called "tablita"), with a decreasing rate of devaluation. The "tablita" represented a dramatic turnaround in policy; up until that time, the exchange rate had been basically adjusted to past inflation to prevent the real exchange rate from appreciating. Unlike the stabilization programs of Argentina, Brazil, and Israel in the 1980's, all these programs were "orthodox" in the sense that wage and price controls were not part of the programs. The response of the different macroeconomic variables in the three countries to the devaluation schedule was remarkably similar. Inflation decreased only slowly, a sudden increase in real economic activity was observed, the real exchange rate appreciated, the trade balance deteriorated, and real interest rates declined (see Figures 8 through 10). 4/ After an initial success, however, all three countries were again in crisis in the early 1980's. The Argentine experience inspired a highly influential paper by Rodriguez (1982), which presented a model with adaptive expectations that was consistent with the main stylized facts of the Southern Cone experiences just described. In particular, the model explained the appreciation of the real exchange rate, which was at the time the most important issue in policy discussions. This paper also popularized in academic and business communities the notion of "recession now versus

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1/ The Chilean stabilization consisted of two stages. From July 1976 to January 1978, the exchange rate started to be explicitly used for stabilization. Beginning in January 1978, a lasting preannounced schedule was introduced (see Corbo (1985)).

2/ These episodes are discussed, among many others, by Harberger (1982), Corbo (1985), Hanson and de Melo (1985), Fernandez (1985), Ramos (1986), Kiguel and Liviatan (1988), and Edwards and Edwards (1991). Another orthodox stabilization program of interest is the Frondizi stabilization in Argentina during 1959-62 (named after President Frondizi); see Petrecolla (1989).

3/ Argentina and Uruguay opened first the capital account and only later reduced tariffs, while Chile began by a comprehensive trade liberalization program and opened the capital account at a later stage.

4/ The evidence for Argentina on the initial fall in real interest rates is not clear.

recession later" in comparing money-based stabilization with exchange-rate-based stabilization. 1/

The Southern-Cone experiences thus brought forth the issues of real exchange rate appreciation, low real interest rates, and increased real economic activity as a result of exchange-rate-based stabilization. The problem of the real appreciation was the issue that received the most attention. The programs were based on the belief that the inflation rate would quickly converge to the world inflation plus the preset rate of devaluation. However, to the surprise of policymakers, such convergence was remarkably slow. Eventually, the appreciation of the real exchange rate proved to be deadly, because it fueled speculation that the programs were unsustainable. "Guesstimates" of the "atraso cambiario" (the extent of the real appreciation) were one of the most popular pastimes. Soon the public had decided that the programs were unsustainable and the question switched to when the "tablita" would be abandoned rather than if it would be abandoned. These experiences undoubtedly play an important role in the decision of policymakers in the late 1980's to impose price controls to combat the "inertial" component of inflation.

c.   Heterodox programs of the mid-1980's.

This group comprises the Austral Plan in Argentina (June 1985), the Cruzado Plan in Brazil (February 1986), the Israeli Plan (July 1985), and the Mexican Plan (December 1987). 2/ While the Israeli and Mexican program have been successful, the other two failed. The four programs were implemented after many years of high inflation and balance of payments crisis. Argentina had suffered from three-digit inflation since the mid-1970's. On a quarterly basis, inflation reached its peak in the second quarter of 1985--1,898 percent at an annual rate--just before the Austral plan was implemented. 3/ Brazil's inflation rate doubled in 1979 from 50 percent to 100 percent and then doubled again in 1983 to reach 200 percent. Israel's inflation rate reached the three-digit threshold in 1979. On a quarterly basis, the highest inflation rate was 535.9 percent in the third quarter of 1984. Mexico was hit hard by the 1986 oil shock which resulted in an rise in inflation from 64 percent in 1985 to 106 percent in 1986.

A key common element of the four plans was the use of wage and price controls. Price controls were viewed as an important element in the program in that they would stop the inertial component of inflation. Policymakers view the traditional fiscal adjustment as a necessary but not sufficient

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1/   See Fernandez (1985) and Calvo and Végh (1990a).
2/   Figures 11 through 13 illustrate the Israeli, Austral, and Mexican plans. Discussions of these programs are contained in, among many others, Dornbusch and Simonsen (1987), Kiguel and Liviatan (1989), and Helpman and Leiderman (1988), as well as the papers in Bruno, Di Tella, Dornbusch, and Fischer (1988).
3/   See Machinea and Fanelli (1988).

Figure 8. Argentinean Tablita

Devaluation Rate

12-Month Inflation Rate

Real Effective Exchange Rate

Trade Balance

Consumption Growth

Real Deposit Interest Rate
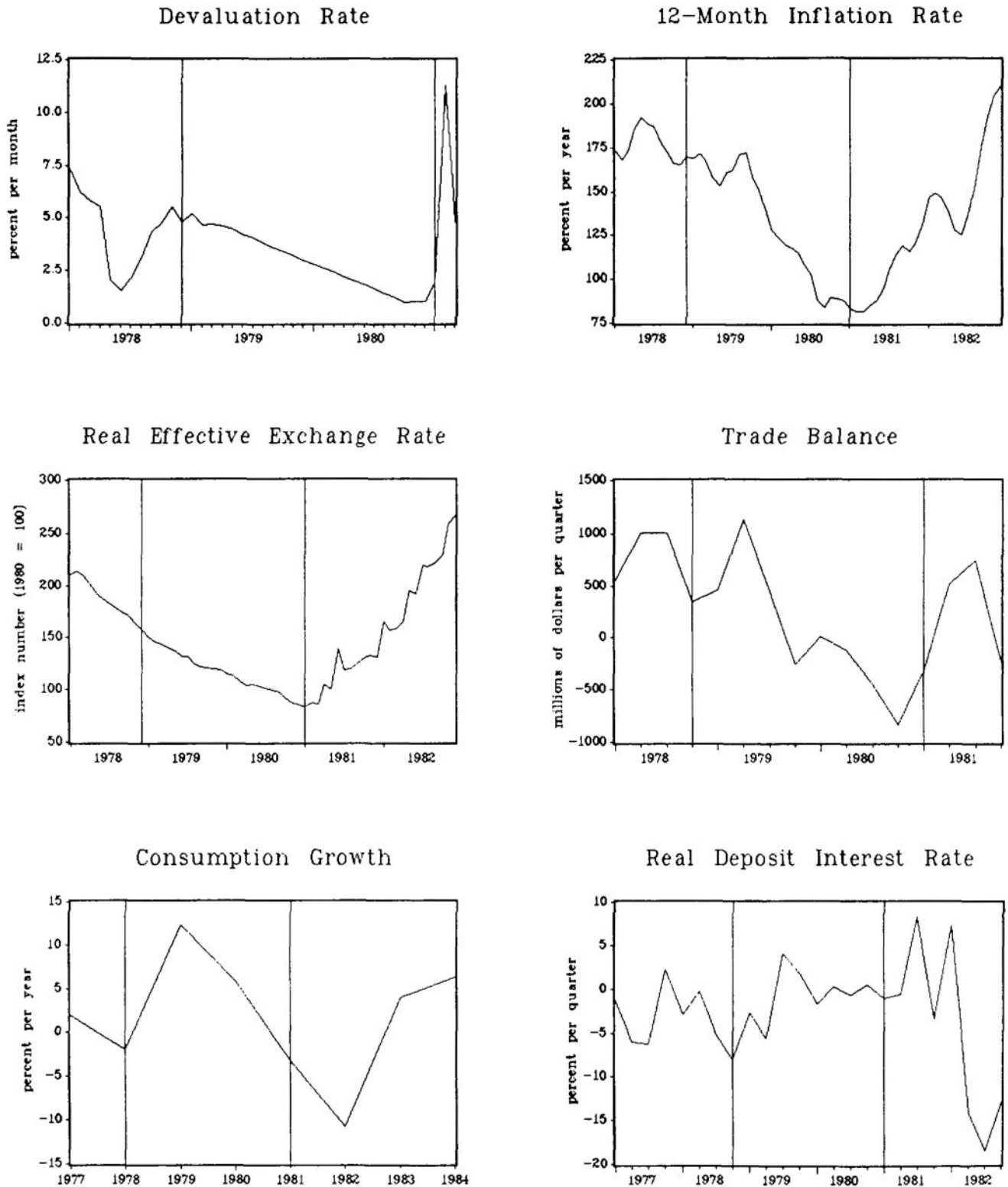
Source: IFS, Balino (1987), and Fund staff estimates

Figure 9. Chilean Tablita

Devaluation Rate

12-Month Inflation Rate

Real Effective Exchange Rate

Trade Balance

Consumption Growth

Real Deposit Interest Rate
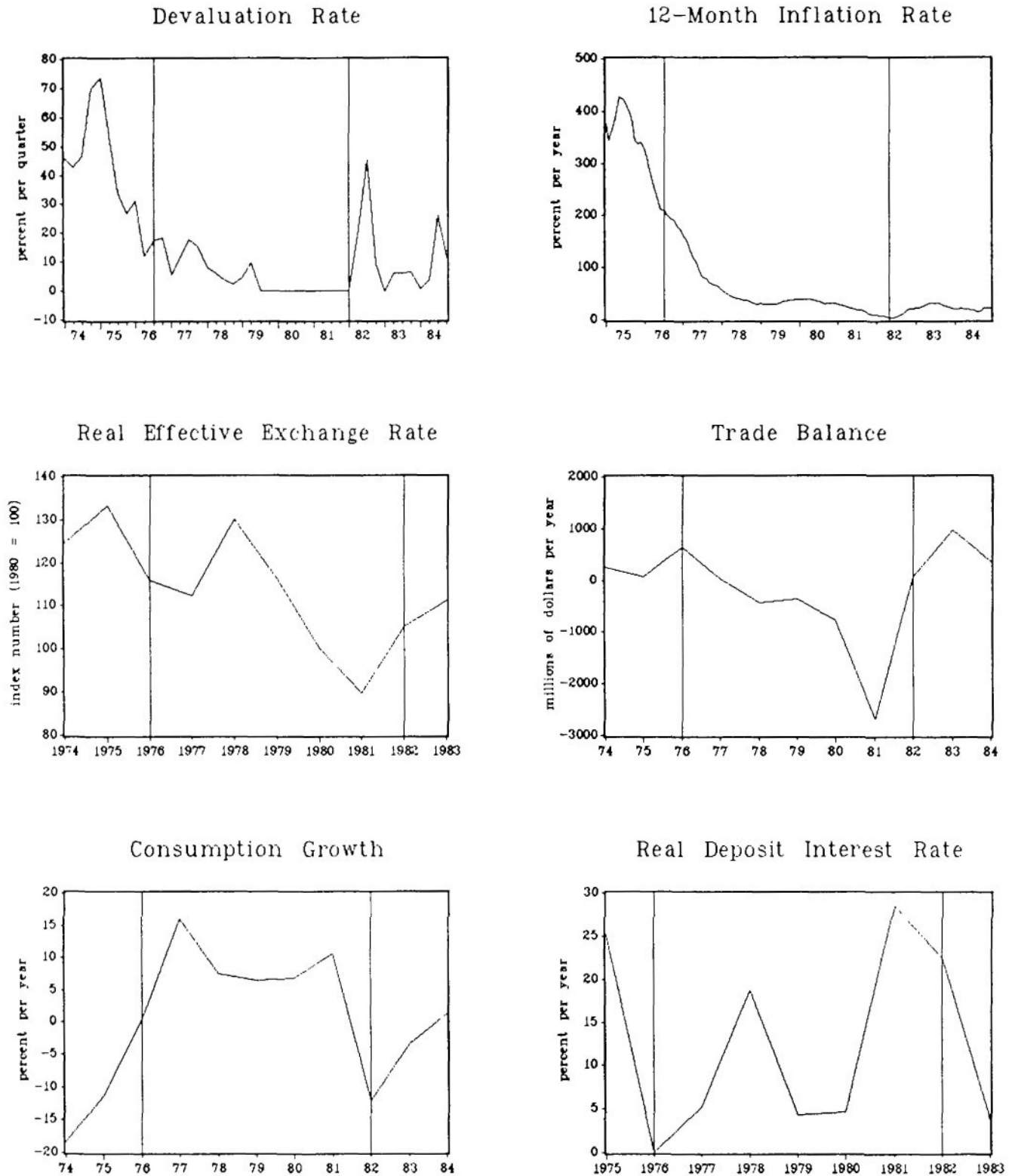
Note: Figure for 1975 corresponds to second semester

Source: IFS, Banco Central de Chile, and Ramos (1986)

Figure 10. Uruguayan Tablita

Devaluation Rate

Note: Devaluation in 1982.4 was 155 percent

4-Quarter Inflation Rate

Real Effective Exchange Rate

Trade Balance

Real GDP Growth

Real Deposit Interest Rate

Source: IFS, Perez-Campanero and Leone (1991), and Fund staff estimates
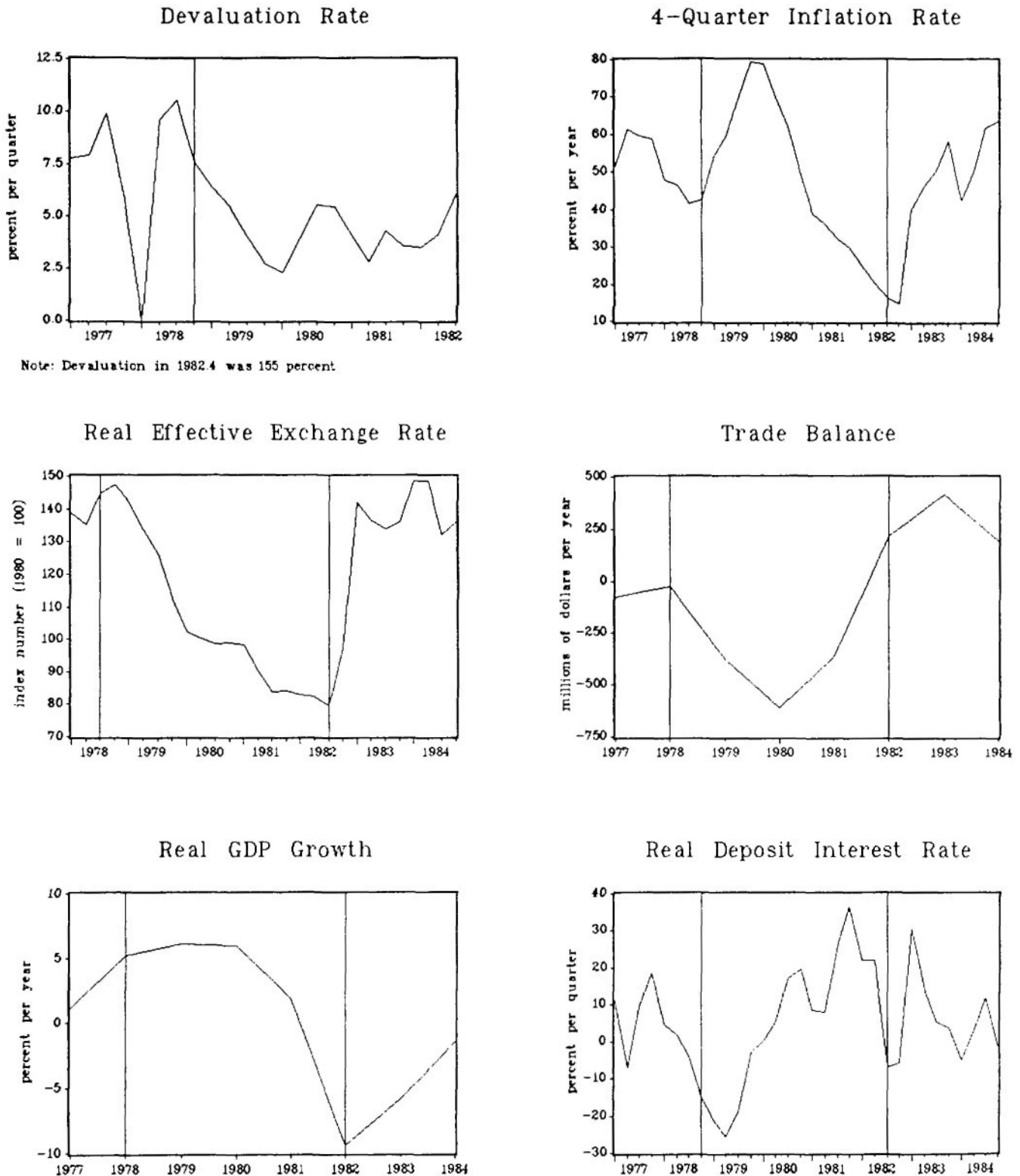
Figure 11. Israeli Stabilization

Devaluation Rate

Inflation Rate

Real Effective Exchange Rate

Trade Balance

Consumption Growth

Real Lending Interest Rate
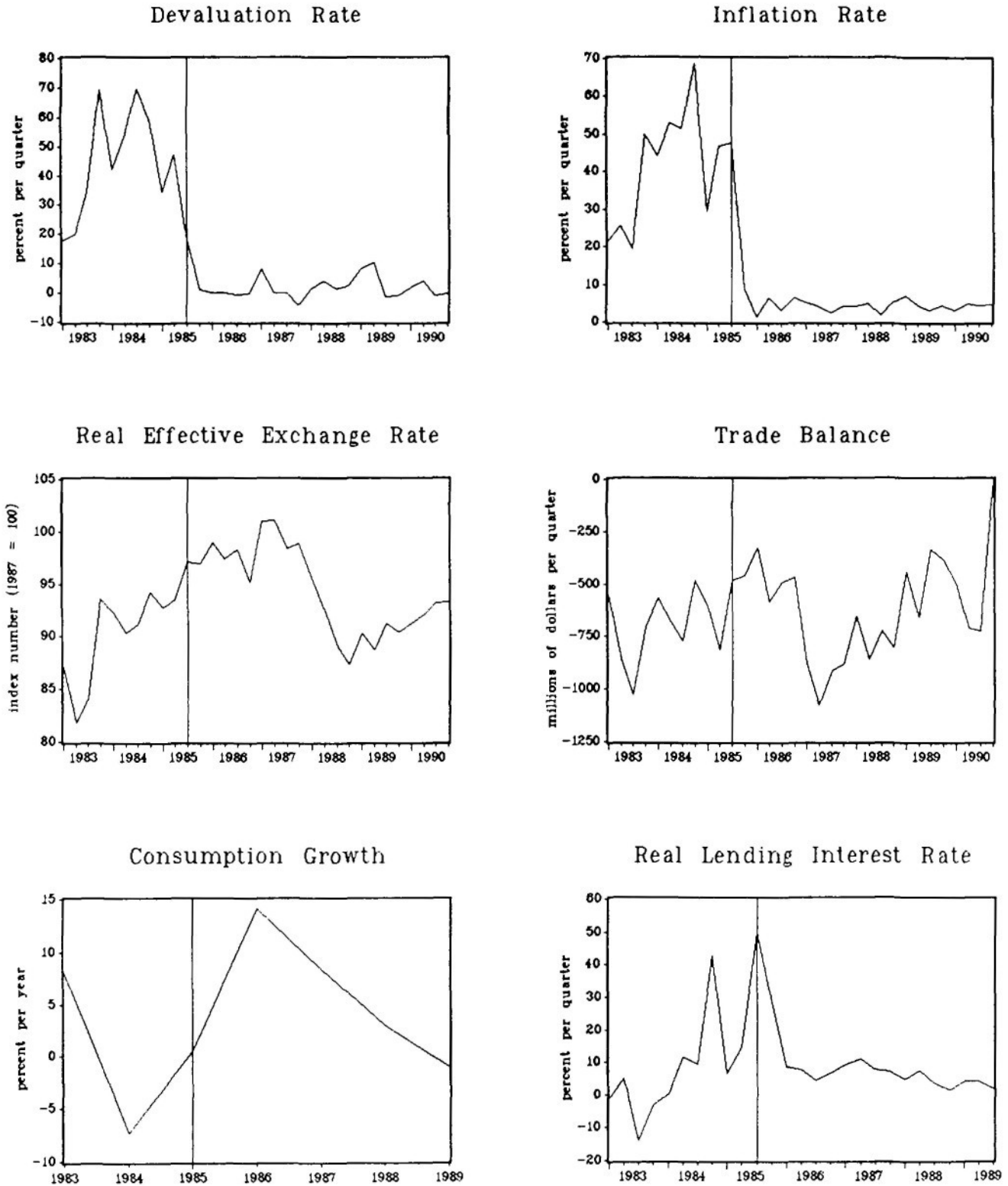
Source: IFS, Bruno and Meridor (1990), and Fund staff estimates

Figure 12. Austral Plan

Devaluation Rate

Inflation Rate

Real Effective Exchange Rate

Trade Balance

Real GDP (quarterly)

Real Deposit Interest Rate
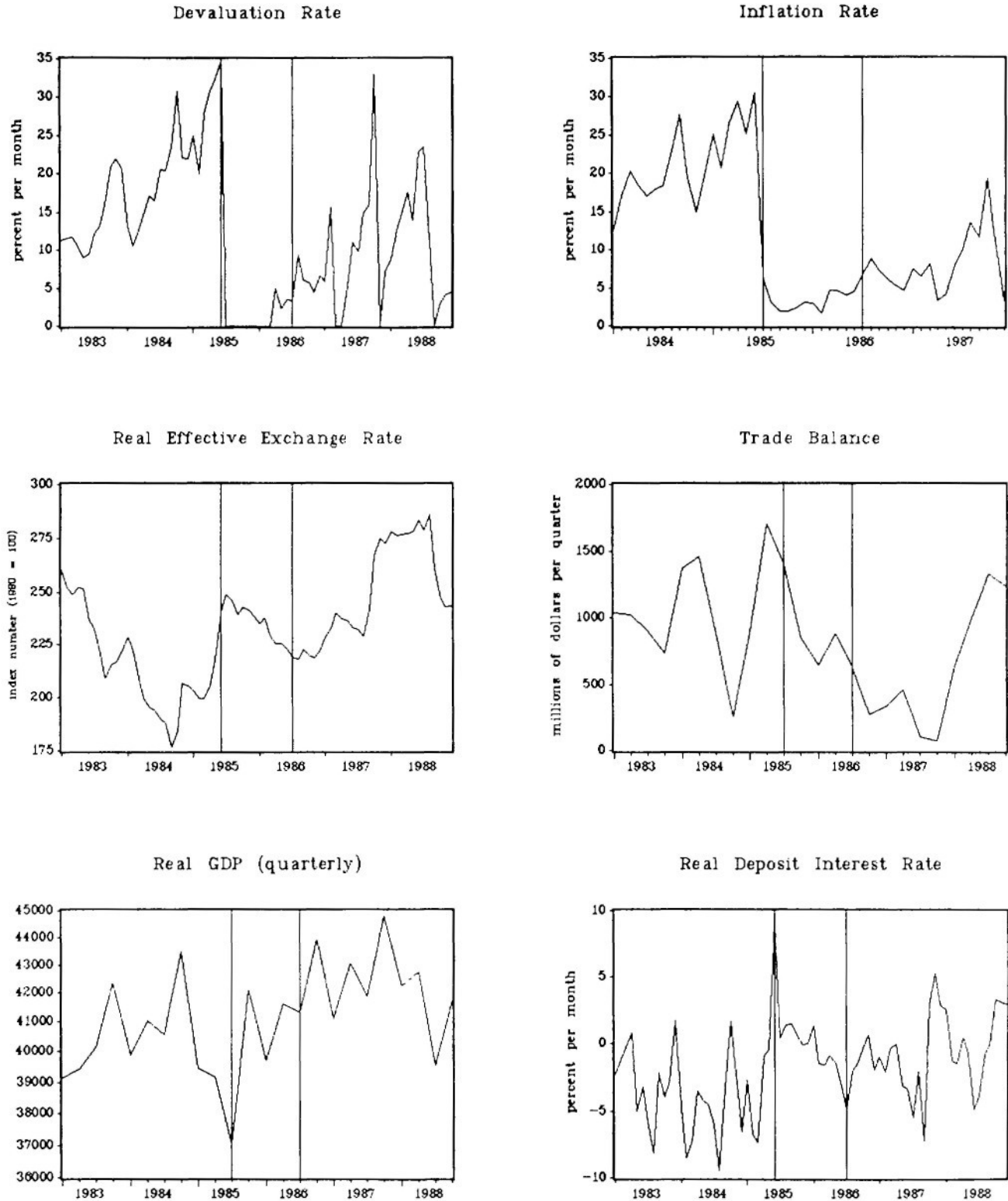
Source: IFS and Fund staff estimates

Figure 13. Mexican Stabilization

Devaluation Rate

Inflation Rate

Real Effective Exchange Rate

Trade Balance

Industrial Production

Real Treasury Bill Rate

Source: IFS and Fund staff estimates
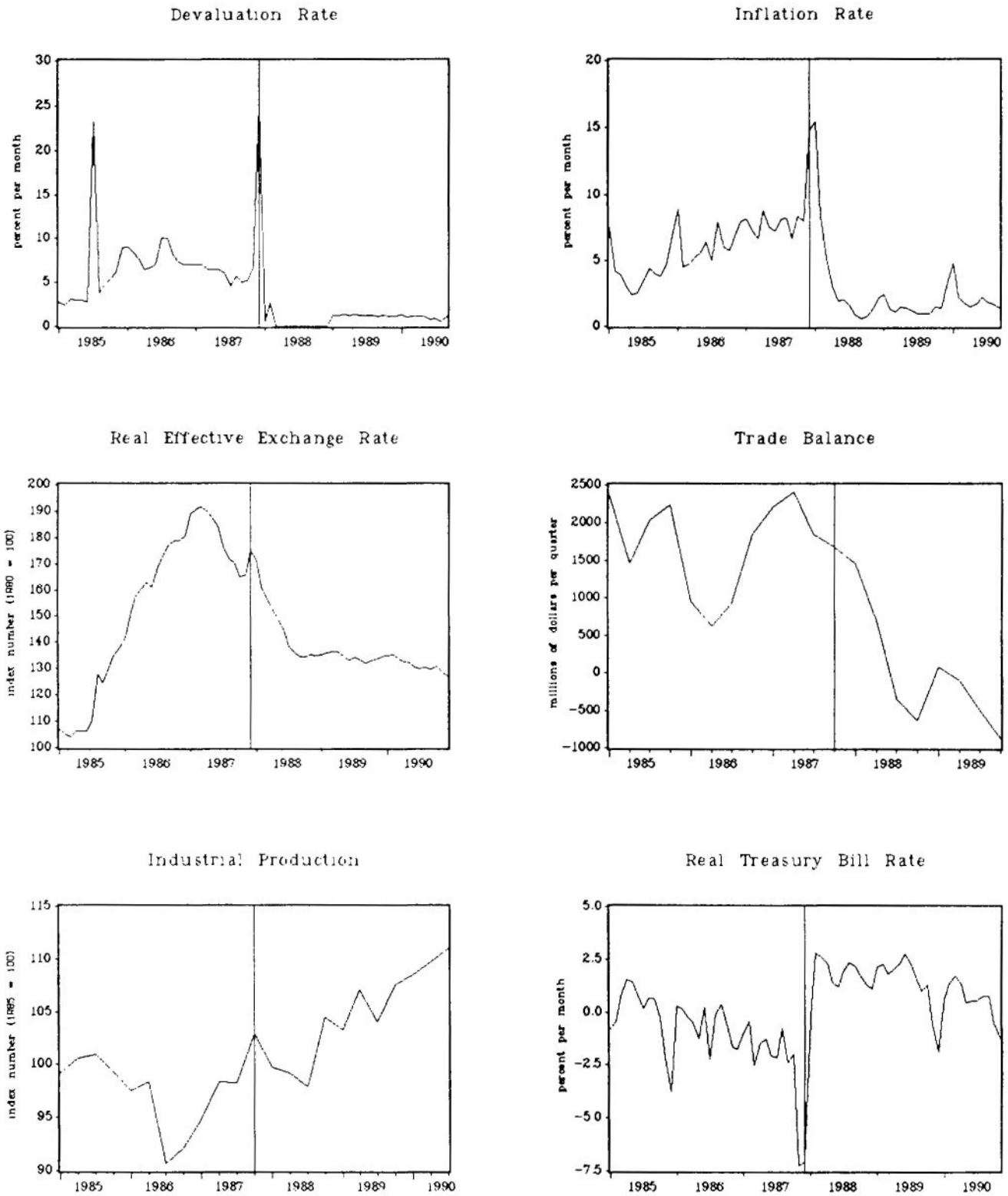
condition for a successful stabilization attempt. 1/ The failure of the Southern Cone programs of the late 70's led some analysts (for instance, Dornbusch (1982)) to conclude that wage and price controls should be part of a stabilization package.

In spite of the fact that the Israeli and the Mexican plans were the only successful ones in terms of reducing inflation on a long-term basis , the response of the economy to the stabilization plans was remarkably similar in the four cases. As happened in the Southern-Cone programs, there was an initial expansion accompanied by real exchange rate appreciation and current account deficits. Later in the program a recession set in. 2/ The Israeli boom-and-recession cycle was the one that commanded the most attention, probably because the recession could not be attributed to the failure of the program.

Real domestic interest rates increased in response to the heterodox programs of the mid-80's, unlike the Southern-Cone programs where real domestic interest rates fell. The behavior of real interest rates has been somewhat overlooked in the literature, and remains a challenging and particularly important analytical issue.

3. Stylized facts in chronic-inflation stabilization

Having reviewed several stabilizations in chronic-inflation countries, it is useful to highlight the stylized facts that can be inferred from them. These are the features that the theory should try to explain. 3/

   i) Real activity increases at the beginning of the program and later contracts. This is the conclusion reached by Kiguel and Liviatan (1990), who study a sample of 12 stabilization programs. 4/ A recessionary phase arises later in the program. The pattern of an initial boom and later recession appears in both successful and failed plans.

   ii) The current account goes into deficit. It is generally observed in exchange-rate-based stabilization programs that the current account balance worsens at the beginning of the program.

   iii) The real exchange rate appreciates. Although when the program is first implemented, there may be a real depreciation as a result of a step

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1/ The fiscal adjustment was all but absent, however, in Brazil and soon deteriorated in Argentina.
2/ In the Mexican case, it is still to early to characterize late stages of the program.
3/ See Kiguel and Liviatan (1990) for a detailed discussion of the stylized facts associated with exchange-rate-based stabilization in chronic-inflation countries.
4/ Kiguel and Liviatan conclude that the expansionary phase remains so even when characterized as deviations from trend.

devaluation, the real exchange rate usually appreciates once the program is under way.

iv) <u>Real domestic interest rates may rise or fall</u>. In the Southern Cone tablitas, real interest rates fell at the beginning of the programs. 1/ In fact, the expansion in economic activity was attributed to the fall in real interest rates. However, real domestic interest rates rose in the heterodox programs of the 1980's. 2/

III. The Analytical Model

This section presents an analytical framework due to Calvo and Végh (1991) within which some of the basic issues that arise in exchange-rate-based stabilization can be addressed. Since the model is described in detail elsewhere, most formal derivations will be bypassed and emphasis will be placed on the results and their intuition.

Consider a small open economy with predetermined exchange rates. There are two (non-storable) goods: a tradable good (c^*) and a non-tradable (or home) good (c). The representative consumer maximizes

$$(1) \qquad \int_0^\infty [\log(c_t) + \log(c_t^*)]\exp(-\beta t)dt,$$

where β denotes the constant and positive subjective discount rate.

The consumer is required to use money to carry out purchases. The cash-in-advance constraint is thus

$$(2) \qquad \alpha(c_t/e_t + c_t^*) = m_t, \quad \alpha>0,$$

where e denotes the relative price of traded goods in terms of home goods; that is, $e=EP^*/P$, where E is the nominal exchange rate (in units of domestic currency per unit of foreign currency), P^* is the (constant) price of the traded good in foreign currency, and P is the domestic price of the home

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1/ See Ramos (1986, p. 154), Corbo (1985, p. 900), Hanson and de Melo (1985), and Fernandez (1985, p. 876).

2/ It is worth emphasizing that these are <u>ex-post</u> real interest rates, which may not be a good proxy for <u>ex-ante</u> real interest rates if, say, inflation falls more than expected.

good. [1] Therefore, e denotes what is commonly referred to as the real exchange rate. Real money balances in terms of traded goods are denoted by m; that is, $m = M/EP^*$, where M stands for nominal domestic money balances. [2] [3]

The consumer holds an internationally traded bond, b, which bears a constant real interest rate (in terms of traded goods) equal to r. Real financial wealth, a, is thus

$$(3) \qquad a_t = m_t + b_t.$$

The lifetime constraint faced by the consumer is

$$(4) \qquad a_0 + \int_0^\infty (y_t/e_t + y_t^* + r_t)\exp(-rt)dt = \int_0^\infty (c_t/e_t + c_t^* + i_t m_t)\exp(-rt)dt,$$

where a_0 denotes initial real financial wealth, y and y^* stand for output of home and traded goods, respectively; r denotes real transfers from the government; and i stands for the domestic nominal interest rate.

Equation (4) constrains the consumer's lifetime expenditure not to exceed lifetime resources. The consumer's expenditure includes the "rental" cost of real money balances, im. Substituting the cash-in-advance constraint (2) into the lifetime budget constraint (4) yields

$$(5) \qquad a_0 + \int_0^\infty (y_t/e_t + y_t^* + r_t)\exp(-rt)dt = \int_0^\infty (c_t/e_t + c_t^*)(1+\alpha i_t)\exp(-rt)dt.$$

The consumer's optimization problem consists in choosing optimal paths of c_t and c_t^* to maximize his lifetime utility (1) subject to the inter-

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[1] Equation (2) already incorporates the fact that the cash-in-advance constraint will hold with equality at an optimum given that the analysis will be restricted to equilibrium paths along which the nominal interest rate is positive.

[2] Unless otherwise noted, "real" means in terms of traded goods.

[3] Calvo and Végh (1990a) include foreign money in the cash-in-advance constraint (2) to capture the effects of currency substitution on stabilization policy.

temporal budget constraint (5), given his initial real financial wealth a_0 and the paths of y_t, y_t^*, r_t, and e_t. The first-order conditions are

(6) $1/c_t^* = \lambda(1 + \alpha i_t)$

(7) $c_t = e_t c_t^*$

where λ is the (time-invariant) Lagrange multiplier associated with constraint (5), which can be interpreted as the marginal utility of wealth. [1] [2] Equation (6) is the familiar condition whereby the consumer equates the marginal utility of consumption of traded goods to the marginal utility of wealth times the "price" of traded goods. In the present context, the relevant "price" of the traded good--which will be referred to as the _effective_ price--consists of the market price (unity) plus the opportunity cost of holding the α units of real money balances that are necessary to purchase the good, αi. Equation (7) indicates that the consumer equates the marginal rate of substitution between traded and home goods to the relative price of traded goods in terms of home goods (that is, the real exchange rate).

Perfect capital mobility implies that

(8) $i_t = r + \epsilon_t$,

so that the nominal interest falls one-to-one with reductions in the rate of devaluation.

The supply side of the economy is now introduced. The economy is endowed with a flow endowment of a tradable good, y^*. The supply of the home good follows the staggered-prices model of Calvo (1983). [3] Calvo (1983) shows that the _rate of change_ of the inflation rate is _negatively_ related to excess demand. Formally,

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1/ The expression "time-invariant," when applied to a given variable, means that, at points in time at which the path of the variable is continuous, the time-derivative is zero (i.e., the time profile is "flat"). Naturally, the variable may still jump discretely.

2/ To ensure the existence of a steady-state, it has been assumed that $\beta=r$.

3/ For simplicity, it is assumed that only the price of the home good is sticky. Alternatively, it can be assumed that both traded and home goods are produced by means of a neo-classical production function with labor as the only input, and that wages are subject to Calvo's (1983) staggering set-up. As shown in Calvo and Végh (1991), the same results would obtain. The present formulation, however, simplifies the analysis considerably.

(9) $\dot{\pi}_t = -\theta D_t,$

where $\pi(\ =\dot{P}/P)$ is the rate of inflation of home goods and D, a measure of excess demand in the home goods market, is defined as

(10) $D_t = y_t - \bar{y},$

where $\bar{y}$ can be interpreted as the "full-employment" level of output. In Calvo's (1983) set-up, firms set prices in a non-synchronous manner taking into account the expected future path of excess demand and of the average price prevailing in the economy. At any point in time, only firms that receive a random signal can change prices. This may reflect a situation in which it is too costly to change prices or it takes time to verify a change in the state of the market. The intuition behind equation (9) is as follows. The higher is excess demand at time t, the higher is the individual price set by those firms that revise their prices at time t. Hence, the higher will inflation be at time t. However, excess demand at time t will not be taken into account by those firms revising prices at time $t'(t'>t)$. Therefore, the higher is excess demand at time t, for a given excess demand at time t', the larger will be the fall in inflation at time t, which is what equation (9) asserts.

Imposing equilibrium in the home-goods market (i.e., $c_t = y_t$) and using equation (7), excess demand, given by equation (10), may be rewritten as

(11) $D = e_t c_t^* - \bar{y}$

Substituting equation (11) into (9) yields the dynamic equation

(12) $\dot{\pi}_t = \theta(\bar{y} - e_t c_t^*).$

Using the definition of the real exchange rate, $e=EP^*/P$, differentiation with respect to time yields (recalling that P^* is assumed constant)

(13) $\dot{e}_t = (\epsilon_t - \pi_t)e_t.$

For a given path of c^*, equations (12) and (13) form a dynamic system for π and e. 1/ 2/

To close the model, we need to consider aggregate resource constraints. Assuming that the government transfers back to the public interest on net foreign assets and revenues from money creation, it can be shown (see Calvo and Végh (1991)) that the economy's resource constraint is

$$(14) \qquad k_0 + \int_0^\infty y_t^* \exp(-rt)dt = \int_0^\infty c_t^* \exp(-rt)dt,$$

where k_0 denotes the economy's initial stock of foreign bonds. Equation (14) states that the present value of tradable resources must equal the present value of consumption of traded goods. Under the assumption that domestic credit just compensates the consumer for the depreciation of nominal money balances, the current account is given by

$$(15) \qquad \dot{k}_t = y_t^* + rk_t - c_t^*.$$

Consider now a permanent reduction in the rate of devaluation. Specifically, suppose that at time 0 (the "present"), policymakers announce that the rate of devaluation will be reduced immediately from ϵ^h to ϵ^ℓ. More importantly, the announcement is fully credible; that is, the public expects the rate of devaluation to remain at the lower level ϵ^ℓ forever.

At time 0, the nominal interest falls by the same amount as the rate of devaluation does, as indicated by equation (8). Because the policy is fully credible, the nominal interest rate is expected to remain at the lower level $r+\epsilon^\ell$ forever. This implies that the consumption of traded goods does not change. The reason is that, a constant nominal interest rate, no matter what the level is, implies, by first-order condition (6), that consumption of traded goods is constant over time. Even if the effective price of consumption is reduced, the fact that it remains constant over time implies that there are no incentives to engage in intertemporal consumption substitution. Since tradable resources do not change, consumption of traded goods must remain at the same level.

1/ The determinant of the matrix associated with the linear approximation of the system (12) and (13) is negative, which indicates the existence of saddle-path stability.

2/ The existence of an "inverse" Phillips-curve as a result of temporary changes in policy is emphasized by Calvo and Végh (1990c) in the context of a closed-economy.

From the system (12) and (13), it follows that, given that c^* is not affected by permanent changes in the rate of devaluation, a fall in π that exactly matches the fall in ϵ immediately moves the system to a new steady-state. Naturally, the (average) inflation rate of the economy, which is a weighted average of the inflation rate of home goods, π, and that of traded goods, ϵ, also falls instantaneously to its new level ϵ^ℓ. Therefore, <u>an exchange-rate-based stabilization program that is fully credible reduces the inflation rate instantaneously at no real costs</u>. 1/

It is worth emphasizing that, in spite of the fact that the price level is sticky and that individual prices are set in a staggered manner, there are no real effects associated with a reduction in the devaluation rate that is perceived as being permanent. This shows, as emphasized by Calvo and Végh (1991), that price level rigidity does not imply, by itself, stickiness in the inflation rate. The reason is that firms act in a forward looking manner. As will be discussed in Section VI, the presence of inflation rate stickiness in the present framework must be due to backward looking behavior. This is an important point to bear in mind because it is some-times argued that either backward indexation or staggered contracts will prevent the inflation rate to come down to zero if the nominal exchange rate is fixed. In the context of the present model, the tight link between the exchange rate and the inflation rate is indeed broken by the presence of backward-indexation (see Section VI) but is not affected by the presence of staggered-price setting, which does not prevent an abrupt halt to inflation. 2/

IV. Stopping Hyperinflation

Despite its simplicity, the exercise concerning the effects of a permanent reduction in the rate of devaluation just undertaken provides a useful conceptual framework to discuss the end of hyperinflations. There seems to be two distinguishing characteristics of hyperinflations that make it reasonable to identify--if only as a crude approximation--this analytical exercise with experiences stopping hyperinflation: the absence of backward-looking behavior and the presence of a high degree of credibility.

1/ The cash-in-advance specification of the model implies that real money demand does not increase as a result of the fall in the nominal interest rate. The re-monetization usually observed in actual episodes could be captured by introducing money as an argument in the utility function. In that case, a permanent reduction in the rate of devaluation would increase real money balances, while still leaving the consumption of either good unchanged (see Obstfeld (1985)).

2/ This need not be the case in other models of staggered contracts. For instance, in Fischer's (1986b) model, a permanent reduction in the rate of devaluation causes real effects, because the price established in the contract does not remain fixed during the life of the contract.

1. Absence of backward-looking behavior

The disappearance of long-term nominal contracts in hyperinflation episodes is a recurrent theme in the literature (see, for instance, Cagan (1989)). Furthermore, it is commonly argued that a key characteristic of hyperinflations is that there comes a time when all prices become indexed to the nominal exchange rate. Wage contracts, for instance, are renegotiated more frequently as inflation accelerates. At first, wage readjustments are based on a cost-of-living index. As the interval between readjustments becomes shorter, however, the cost-of-living index must be replaced by another index that is available on a weekly or even daily basis. The quotation of a foreign currency--usually, the dollar--provides such an index; the dollar quotation is available on a continuous basis and is widely circulated. As Dornbusch (1988, p.419) has suggested, "perhaps it is this shift to foreign-exchange-based pricing that is the ultimate element in the shift toward hyperinflation." Pazos (1972, p. 93) stresses that "the reduction of intervals [for setting wages and prices] to their shortest possible duration and the pegging of wage readjustments--both upwards and downwards--to the freely fluctuating quotations of a foreign currency give hyperinflation a mechanism entirely different from that of intermediate inflation." Sachs (1987, p. 281), in his analysis of the Bolivian hyperinflation of 1984-5, points out that

> "... by August 1985, the U.S. dollar and not the Bolivian peso was satisfying two of the three classic roles of money: the unit of account and the store of value (though it was not the medium of exchange for most transactions). Prices were set either explicitly or implicitly in dollars, with transactions continuing to take place in peso notes, at prices determined by the dollar prices converted at the spot exchange rate."

The de facto indexation of all prices in the economy to the foreign exchange implies that nominal contracts virtually cease to exist. Thus, all backward-looking behavior is eradicated from the economy. Based on this, it has been argued that fixing the exchange rate is sufficient to ensure price stability (see, for instance, Sachs (1987)). Furthermore, Sargent (1982) has argued that the halt in inflation should be achieved with negligible costs (Sargent (1982)), provided the change in policy is credible. Because one of the key features of the model presented in Section III is precisely the absence of backward-looking behavior, the model can be taken to apply to hyperinflation episodes.

2. Credibility

It has been argued, most notably by Kiguel and Liviatan (1988), that there are two characteristics of hyperinflationary processes that make a

stabilization attempt more credible than attempts to stop chronic inflation. 1/

First, the need for seigniorage (i.e., revenues from money creation) as the cause of high inflation comes across more clearly in hyperinflations than in chronic inflations. Because the fiscal nature of the inflationary process is more obvious, the public may become more easily convinced that closing the budget deficit is enough to ensure price stability. 2/ In the case of Bolivia, for instance, Table 2 indicates that the increase in inflation from 29 percent in 1981 to 1,281 percent in 1984 was accompanied by a rise in seigniorage from 1.6 percent of GDP to 15.9 percent of GDP. In contrast, in chronic-inflation countries, the relationship between inflation and revenue from money creation is less clear, which may raise doubts in the minds of the public as to whether a fiscal reform--even if successfully implemented--may be enough to halt inflation. 3/ In the case of Brazil, Table 2 shows how seigniorage as a percentage of GDP remained basically stable through the period 1979-85--it even declined somewhat--in spite of the fact that inflation increased four-fold. Thus, given that in hyperinflations the source of the inflationary process is easily identified and widely agreed upon, the announcement of a stabilization program that includes a fiscal reform should command a high degree of credibility.

The second factor that may increase the credibility of a stabilization program is that hyperinflation brings about such a chaotic social and economic environment that the public becomes convinced that the situation is unsustainable. This sense of urgency in tackling the problem is likely to lend more credibility to a stabilization program. In contrast, chronic inflation countries learn how to live with high inflation by adopting various indexation mechanisms. As emphasized by Kiguel and Liviatan (1988), an example of this ability to adapt to chronic inflation can be observed in

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1/ This issue should be distinguished from the argument over whether the existence of credibility at the moment the program is implemented is a necessary condition for a successful stabilization, which is discussed later in the section.

2/ Cagan (1956) and Sargent (1982) emphasize the need to finance expenditures in the difficult periods after the two World Wars as the clear cause of the European hyperinflations. Kiguel and Liviatan (1988) emphasize the case of Bolivia discussed in the text.

3/ In fact, the lack of a strong positive correlation between budget deficits and inflation played an important role in the policy discussions surrounding the heterodox programs of the 1980's in Argentina, Brazil, and Israel. It should be kept in mind, however, that the lack of contemporaneous correlation between budget deficits and inflation does not mean that budget deficits may not be the cause of inflation. As suggested by Drazen and Helpman (1990), the relationship between budget deficits and inflation will depend on how the budget deficit is expected to be closed in the future.

Table 2. Inflation, Revenues, and Seigniorage in Argentina, Bolivia, and Brazil

Country	1979	1980	1981	1982	1983	1984	1985
Argentina							
Inflation (percent)	159	101	104	165	344	627	672
Public sector revenues							
(percent of GDP)	29	31	32	28	29	31	32
Seigniorage (percentage of GDP)	5.9	4.8	3.5	7.8	8.6	7.1	6.5
Bolivia							
Inflation (percent)	20	47	29	133	269	1,281	11,750
Revenues of central government							
(percent of GDP)	9.4	9.6	9.4	4.6	2.6	2.6	1.3
Seigniorage (percentage of GDP)	1.1	3.2	1.6	12.1	10.0	15.9	8.8
Brazil							
Inflation (percent)	53	83	106	98	142	197	227
Total receipts of general government							
(percent of GDP)	28	28	31	34	32	30	33
Seigniorage (percentage of GDP)	3.3	2.0	2.0	2.1	2.0	2.7	2.7

Source: Kiguel and Liviatan (1988)

the behavior of real revenues from taxation. In hyperinflations, the Olivera-Tanzi effect drastically reduces real revenues from taxation. 1/

As illustrated by Table 2 real revenues in Bolivia declined from 9.4 percent of GDP to 2.6 percent of GDP in a three-year period (1981-83) as inflation accelerated from 29 percent to 269 percent. In Argentina, on the other hand, real revenues actually increased from 29 percent of GDP to 32 percent of GDP over the seven-year period (1979-1985) during which inflation increased from 159 percent to 672 percent. The sudden and explosive nature of hyperinflations usually implies that either those mechanisms cannot be created in time or, if they are, they are not effective. For instance, in 1945 Hungary introduced a scheme to collect taxes in a constant-purchasing-power unit of account, but the experiment was only temporary successful (see Nogaro (1948)).

In summary, the idea is that the inability of an economy to cope with a sudden and explosive burst of inflation makes an attempt to stabilize more credible. In chronic-inflation countries, the economy keeps functioning in spite of high inflation, which makes the public believe--probably correctly--that the incentives to go through a stabilization program are not as high so that, at the slightest sign of political or social pressures, the program will be abandoned. Therefore, one may consider an exercise that assumes full credibility on the part of the public as a reasonable first approximation to studying stabilization in episodes of hyperinflation.

3. Matching theory with evidence

Having argued that the analytical experiment undertaken in Section III may be suited to understanding stabilization programs designed to stopping hyperinflations, we now proceed to try to match the predictions of the model with the available evidence.

If full credibility is assumed, the model predicts that the stabilization program should lead to an abrupt halt in inflation at negligible costs. What does the evidence show? As regards the sudden and abrupt halt to inflation in hyperinflations, the evidence seems to support rather clearly this contention. As Sargent (1982), among others, has noted, the hyperinflation in several European countries in the 1920's ended abruptly. After having risen dramatically in the months before the stabilization plans were introduced, the price level stabilized immediately in Austria

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1/ In his paper on the European hyperinflations, Cagan (1956, p. 85)) already emphasized this point. In his words, "as the rate of price increase rose ... the real value of whatever funds were raised by other taxes undoubtedly diminished, and during the later stages of hyperinflation these funds must have become nearly worthless owing to delays in collection them." The Olivera-Tanzi effect is named after Olivera (1967) and Tanzi (1977); see also Aghevli and Khan (1978) and Dixit (1990).

(September 1922), Hungary (March 1924), Poland (January 1924), and Germany (November 1923). Similarly, the Hungarian hyperinflation ended abruptly in August 1946 (Siklos (1989)). The same is true of the Bolivian hyper- inflation, where inflation was halted within ten days of the announcement of the stabilization program, on September 29, 1985. 1/ There seems to be enough evidence to conclude that the prediction that inflation can be stopped abruptly has been observed in practice.

The picture that emerges from the output costs of stopping hyper- inflations is less clear-cut, but the consensus seems to be that hyper- inflations have been stopped at relatively small costs. Sargent (1982) suggests that although there were unemployment losses in Austria, Hungary, Poland, and Germany, these costs were small compared to estimates of stopping inflation in the U.S. circulating at the time. 2/ Sargent's (1982) suggestion, however, has not gone unchallenged. Garber (1982, p. 12) concludes that "there is substantial evidence of large-scale negative real effects in the aftermath of the German hyperinflation." Wicker (1986) argues that unemployment rates in Austria, Poland, and Hungary reached substantial levels. In the Bolivian case, Kiguel and Liviatan (1988) suggest that the stabilization did not have any discernible effect on output (see Figure 5). 3/

4. Ex-ante versus ex-post credibility

An important discussion that has arisen in the context of terminating hyperinflations is related to the role of credibility. In the model presented in Section III, credibility is viewed as an exogenous event; credibility is either present (that is, the public perceives the reduction in the rate of devaluation as permanent) or it is absent (the public views the reduction in the rate of devaluation as temporary). The model therefore does not address the issue of why credibility may or may not be there, which is certainly an area that warrants further research. More pertinent to our discussion is the fact that credibility is viewed as something unrelated to what will happen after the stabilization plan is implemented. This school of thought will be referred to as "ex-ante credibility"--as opposed to "ex- post" credibility--to stress the fact that credibility is viewed as a factor that must precede the actual implementation of the plan. Furthermore, the

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1/ Not all attempts to stop hyperinflation have been successful though. The most notable exception is Greece after World War II, where two attempts failed (see Makinen (1984)).
2/ Sargent (1982, p. 42) argues that "an implication of [the rational expectations] view is that inflation can be stopped much more quickly than advocates of the "momentum" view have indicated and that their estimates of the length of time and the costs of stopping inflation in terms of foregone output (220 billion of GNP for one percentage point in the inflation rate) are erroneous." The expression "momentum" view refers to the presence of inflation inertia.
3/ Morales (1988) takes a less sanguine view.

success or failure of the plan hinges entirely on whether credibility is there or not. Sargent's (1982) paper clearly reflects this position. His argument is basically that a necessary and sufficient condition for a successful stabilization is that there exist a change in policy regime, in the sense that there must be an "abrupt change in the continuing government policy, or strategy, for setting deficits now and in the future that is sufficiently binding so as to be widely believed" (p. 42). Sargent (1982, p. 89) concludes that

"... the essential measures that ended hyperinflation in each of Germany, Austria, Hungary, and Poland were, first, the creation of an independent central bank that was legally committed to refuse the government's demand for additional unsecured credit and, second a simultaneous alteration in the fiscal policy regime... In each case that we have studied, once it became widely understood that the government would not rely on the central bank for its finances, the inflation terminated and the exchanges stabilized."

Unfortunately, because "credibility" cannot be observed, Sargent's (1982) main proposition--a credible regime change leads to an abrupt and almost costless stop in inflation--cannot be tested. More importantly, it does not provide any policy guidance because it cannot be established a priori how credible announcements will be.

In contrast to Sargent's (1982) position, it has been argued by Dornbusch (1988) and Sachs (1986, 1987) that credibility is neither a necessary nor a sufficient condition for a successful stabilization. In this section, we deal with the notion that credibility is not a necessary condition. 1/

The view of Dornbusch and Sachs will be referred to as "ex-post" credibility, because it emphasizes the fact that, in stopping hyperinflations, credibility can be established after the program has been implemented. Dornbusch (1988, p. 410) argues that

"... the central weakness of the Sargent position is to present "credibility" as some objective, unquestionable fact--as if passing a budget law or instituting an independent central bank is by itself enough to ensure that these institutions will in fact become what they represent on paper... We argue that exchange rate and interest rate policy in the transition have traditionally formed the vehicle for establishing that credibility by a de facto stabilization. De facto stabilization in turn pays an immediate dividend via the recovery of the real tax yield, thereby creating the potential for a virtuous cycle."

1/ That credibility is not a sufficient condition will be dealt with in Section VI, where the effects of inflation inertia arising from backward indexation will be discussed.

Sachs (1986) argues that two pieces of evidence support the proposition that, in the successful Bolivian stabilization, <u>price stabilization preceded the credibility of the program by several months</u>. First, interest rates on peso-denominated loans remained much higher than comparable dollar-denominated loan rates in the months after the stabilization. Second, real money balances recovered only gradually after inflation had been stopped. While Sachs (1986) stresses that a fundamental change in fiscal policy is needed for the program to be sustainable in the long run--along the lines of Sargent (1982)--Sachs (1986) views the exchange-rate pegging or stabilization as the key feature of the program in the short run. The difference with chronic-inflation countries, in Sachs's (1986) view, is that because of backward indexation or staggered-price contracts, immediate disinflation does not result from fixing the exchange rate, as in Chile during 1979-81.

Another important difference between Dornbusch and Sachs, on the one hand, and Sargent, on the other, is that while Sargent does not believe that the presence of inflation inertia should prevent an economy that undertakes a credible and fundamental change in regime from achieving a costless disinflation without any costs, both Dornbusch and Sachs view the elimination of inertia through hyperinflation as the key feature that allows disinflation without major costs.

V. Temporary Reduction in the Devaluation Rate

This section examines the effects of a temporary reduction in the rate of devaluation. The way in which we wish to interpret this experiment is as if the government announced a <u>permanent</u> reduction in the rate of devaluation, but the public believed that the stabilization will be eventually abandoned. 1/ Suppose that initially (that is, prior to time 0), the rate of devaluation is ϵ^h and is expected to remain at that level forever. At time 0, policymakers announce the following policy:

1/ It should be said at the outset that there is no theory of credibility in the model. The lack of credibility--the fact that the public does not believe that the reduction in the rate of devaluation will last indefinitely--is taken as exogenous. Therefore, the purpose of the model is to show the effects of lack of credibility, rather than to explain how it is generated. However, it can be argued that the credibility enjoyed by a program has an exogenous component in the sense that, first, the memory of many previous failed attempts influences the expectations of how successful the new program will be, and, second, credibility is heavily influenced by measures that accompany the reduction in the inflation rate and thus make more credible the government's commitment. To the extent that this exogenous component of credibility plays an important role--as opposed to credibility that may be gained or lost <u>after</u> the program has been implemented--the model should provide a useful benchmark.

(16a) $\epsilon_t = \epsilon^\ell$,   for $0 \leq t \leq T$,

(16b) $\epsilon_t = \epsilon^h$,   for $t \geq T$,

where $T>0$ and $\epsilon^h > \epsilon^\ell$. The rate of devaluation is reduced at time 0 but increases back to its original level at time T.

The lower rate of devaluation during the period $[0,T)$--hereafter referred to as the "transition"--implies, by the assumption of perfect capital mobility (10), that the path of the nominal interest rate is given by

(17a) $i_t = r + \epsilon^\ell$,   for $0 \leq t \leq T$,

(17b) $i_t = r + \epsilon^h$,   for $t \geq T$.

Since the nominal interest rate is time-invariant (that is, its time derivative is zero), the first-order condition (6) indicates that consumption of traded goods is time-invariant, even though its level may change. Because the nominal interest rate is lower during the transition than it is after T, equation (6) shows that consumption of traded goods is higher during the transition than afterwards (recall that λ does not change at T). The reason is that the effective price of consumption is lower during the transition. Because the resource constraint (14) must be satisfied for any equilibrium path, consumption of traded goods during the transition will be above initial permanent income of traded goods, while consumption of traded goods after T will be below initial permanent income of traded goods. 1/ Otherwise, the resource constraint would be violated. 2/

The path of consumption of traded goods is illustrated in Figure 14, Panel A. The current account path, which follows from the consumption path just described and equation (15), is illustrated in Figure 14, Panel B. At time 0, the current account jumps into deficit because of the sudden increase in consumption of traded goods. During the transition--that is, between time 0 and time T--the current account deteriorates. Although the gap between consumption of traded goods and the (constant) flow endowment of traded goods remains constant, interest income on net foreign assets decline throughout this period. At time T, the current account jumps into balance.

1/   Initial permanent income is given by $y^* + rb_0$.
2/   An explicit solution for the consumption path can be derived along the lines of Calvo and Végh (1990b).

Figure 14, Panel C, illustrates the time path of inflation of home goods that results from a non-credible reduction in the devaluation rate. 1/ There are two effects on the inflation rate on impact. The first is the effect of the lower rate of devaluation that tends to lower the inflation rate. The second is the increase in aggregate demand (note from equation (6) that, since e is given on impact, the increase in consumption of traded goods must be accompanied by a corresponding increase in consumption of home goods), which tends to increase inflation. In the absence of the aggregate demand effect, inflation would fall one-to-one with the rate of devaluation. However, because of the aggregate demand effect, the rate of inflation falls by less than the rate of devaluation and could even increase. Inflation falls over time at the beginning of the program but later begins to rise in anticipation of the expected future inflation.

Panel D in Figure 14 illustrates the behavior of the real exchange rate. The real exchange rate falls during the transition, because the inflation rate of home goods is always above the rate of devaluation. At time T, when the rate of devaluation increases back to its original level, the real exchange rate begins to depreciate.
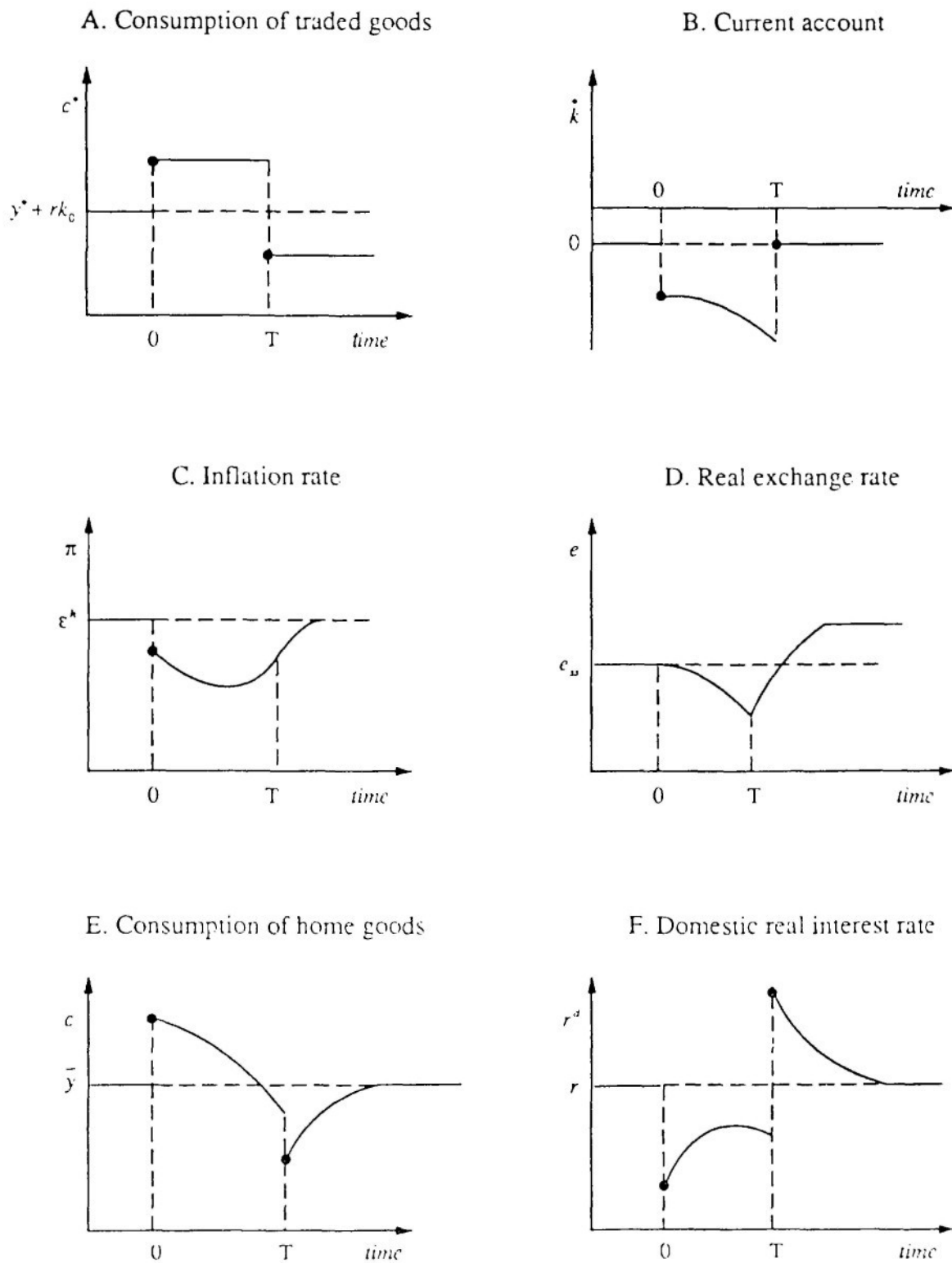
The inflation rate of the economy is a weighted average of the inflation rate of traded goods, ϵ, and the rate of inflation of home goods, π, the weights depending on the weight of traded and home goods in the utility function. Therefore, the inflation rate decreases during the first phase of the transition and rises later. The inflation rate falls more on impact than the inflation of home goods does because, by definition, the inflation of tradable goods falls one-by-one with the rate of devaluation. At T the inflation rate will jump upwards due to the increase in the rate of devaluation. As explained in Calvo and Végh (1991), the lower is T (that is, the less credible is the stabilization program), the smaller is the fall in the inflation rate of home goods. Therefore, if a program has almost no credibility, the model would predict that inflation of home goods remains basically unchanged, or it could even increase. However, the inflation rate of tradable goods always falls one-for-one with the rate of devaluation. Therefore, the fall in the average inflation rate will depend both on the credibility of the program and on the degree of openness of the economy.

Consider now the time path of consumption of home goods illustrated in Figure 14, Panel E. On impact, as already noted, consumption of home goods increases as follows from equation (6) and the increase in c^*. Intuitively, since the relative price of home goods in terms of traded goods has not changed, the consumer wants to keep the ratio of consumption of the two

1/ For a formal derivation, see Calvo and Végh (1991).

Figure 14

Temporary Reduction in Devaluation Rate

A. Consumption of traded goods

B. Current account

C. Inflation rate

D. Real exchange rate

E. Consumption of home goods

F. Domestic real interest rate

goods constant. 1/ Because the real exchange rate appreciates during the transition, consumption of home goods falls during the transition. The reason is that the appreciation of the real exchange rate implies that home goods become more expensive relative to traded goods. Therefore, consumption of home goods must decrease relative to consumption of traded goods-- which remains constant. If T is large enough, the economy enters into recession (i.e., output falls below its full-employment level) before the plan is expected to be discontinued. For a small T, output will remain above its full-employment level during all of the transition. At time T, consumption of home goods jumps downwards because consumption of traded goods jumps downwards. After T, the real exchange rate depreciates and therefore consumption of home goods increases.

Consider now the time path of the domestic real interest rate (that is, $r^d = i - \pi$), which is illustrated in Figure 14, Panel F. The inflation rate of home goods falls by less on impact than the nominal interest rate does; therefore, the domestic real interest rate falls on impact. During the transition, the domestic real interest rate stays below its initial level, decreasing at first and rising later. At time T, the domestic real interest rate jumps upwards due to the sudden increase in the nominal interest rate. The domestic real interest rate falls afterwards towards its unchanged steady-state value, given that inflation increases.

As suggested earlier, we wish to interpret a temporary reduction in the rate of devaluation as resulting from lack of credibility in the program. If policymakers announce at time 0 that the rate of devaluation will be permanently reduced, but the public believes that at time T the devaluation rate will go back to its initial higher level, the same dynamics as those just studied obtain. Moreover, the dynamics during the transition do not depend on what policymakers actually do when time T arrives. Put differently, the real effects during the transition do not depend on the ultimate success or failure of the program; that is, on whether policymakers actually increase the rate of devaluation when time T arrives--thus validating the beliefs held by the public--or stick to the anti-inflationary policy. In fact, only nominal variables will be affected if, when time T arrives, policymakers decide to stick to the lower rate of devaluation and the public now believes that the lower rate of devaluation will last forever. As shown in Calvo and Végh (1990a), if the rate of devaluation is kept at ϵ^ℓ at time T, inflation of non-tradables falls by the amount $\epsilon^h - \epsilon^\ell$, and then increases towards ϵ^ℓ. 2/

1/ The initial expansion in the home-goods sector would also occur even if the expansion in the traded-goods sector is prevented by, say, the presence of binding quotas or capital controls (see Calvo and Végh (1991)). Therefore, the increase in traded-goods consumption is not a necessary condition for an expansion in the home-goods to occur.

2/ In other words, a permanent change in the devaluation rate is everywhere superneutral; that is, it only affects nominal variables even if the change happens when the system is outside the steady-state.

To summarize, the main predictions of the model regarding a non-credible stabilization attempt are the following:

a.   The inflation rate falls at the beginning of the program, continues to decline for a while, and then increases back to its original level. If credibility is very low, however, inflation of home goods may go up on impact.

b.   The real exchange rate goes through a steady appreciation throughout the program and depreciates afterwards;

c.   The current account goes into deficit at the beginning of the program, continues to deteriorate during the program, and improves afterwards;

d.   There is a boom in the home-goods sector at the beginning of the program. Towards the end of the program, the economy enters into recession. The recession may occur before the program is discontinued or at the time it is discontinued.

e.   The domestic real interest rate falls abruptly at the beginning of the program, remains below its original value throughout the transition, and increases sharply at the end of the program.

We can now compare the predictions of the model with stylized facts concerning stabilizations. The results rest on the assumption that the program is not credible. As argued earlier, stabilization attempts in chronic-inflation countries are likely to suffer from lack of credibility. As Díaz-Alejandro (1981) put it,

> "... A plausible hypothesis is that, ceteris paribus, the longer the history of failed stabilization plans, the smaller the chances of success (and/or the greater the costs of success) of any new plan. Besides reading daily newspapers, economic agents carry in their heads an economic history inducing them to discount any claim that 'inflation will be down to zero within a year,' regardless of how fiercely those claims are backed up."

The evidence summarized in Section III is consistent with the first four predictions of the model. Consider as an example the "tablita" in Argentina (Figure 8). The program was announced on December 20, 1978. Inflation actually increased in the beginning of the program, and decreased thereafter (Figure 8). GDP grew at the beginning of the program and began to fall towards the end. The real exchange rate appreciated throughout the

program and depreciated thereafter. 1/ The trade account deteriorated throughout the program after improving briefly at the beginning. It should be noted that these stylized facts are, according to Kiguel and Liviatan (1990), independent of whether the program ultimately proved to be successful or not. This is consistent with the predictions of the model since, as argued above, the dynamics during the transition do not depend on the eventual decision of policymakers to either validate the expectations of a return o high inflation or to stick to the disinflationary policy.

The predictions of the model with respect to the behavior of the real interest rate seem to hold for the Southern Cone programs but not for the rest of the programs. For the case of the Uruguayan "tablita", Figure 10 shows that the real interest rate fell in the first two quarters of the program and began to increase thereafter, which is consistent with the prediction of the model (see Figure 14, Panel F).

VI. Policy Implications and Conclusions

The analysis of the previous sections has provided a conceptual framework that should prove useful in understanding exchange rate-based stabilizations. We now turn to the main messages and policy implications of the analysis. The most obvious lesson is the importance of credibility in an exchange rate-based stabilization program. Even the best conceived program is bound to fail if the public is not convinced that policymakers will stick to the lower rate of devaluation, since lack of credibility may become a self-fulfilling prophecy. The reason is that the less credible is the program, the smaller is the fall in the inflation rate of home goods--it could even increase--and the more pronounced are the real effects. The lack of response of inflation of home goods to the reduction in the rate of devaluation results in a substantial real exchange rate appreciation, which in turn fuels speculation that the nominal exchange rate target is not sustainable. The resulting balance-of-payments crisis marks the end of the program.

Naturally, credibility cannot be legislated and there is no obvious way in which credibility can be achieved overnight. Furthermore, in countries that have a history of failed stabilization attempts, history will certainly weigh heavily against the success of any new program. Credibility can certainly be helped, however, by providing clear signals, especially on the fiscal side. Specifically, the fiscal adjustment that is usually part of the stabilization plan should be viewed by the public as permanent. If the budget is balanced by means of measures that the public perceives as being

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1/ It should be noted that the real exchange rate illustrated in Figures 5 through 13 may not coincide exactly with the definition of the real exchange rate used in the model. In general, however, different definitions of the real exchange rate during stabilization programs exhibit similar behavior.

temporary, the anticipation of the reversal of such measures is probably
enough to make the plan fail. It may also be useful, as in the Mexican
case, to carry out the fiscal adjustment before the anti-inflationary plan
is put into place, because it may give policymakers a chance of establishing
credibility. Institutional changes, such as providing more independence to
the Central Bank, may also help in rendering the program more credible.

Even if it is fully credible, an exchange rate-based stabilization will
provoke a recession and inflation will be slow to come down if there is
widespread backward indexation that causes the inflation rate to be sticky,
as shown by Calvo and Végh (1991).1/ Thus, backward indexation may render
very costly a fully credible stabilization attempt. The use of price and
wage controls has usually been advocated on the belief that it would help
fighting inflation inertia. This was undoubtedly a key motivation in the
heterodox programs of the mid-80's discussed above. The jury is still out
as regards the effectiveness of such controls. It has been argued that
imposing price controls may contribute to making the program more credible.
Edwards (1990) attributes the relative ease with which Mexico brought down
inflation beginning in 1988--as compared to the Chilean case--to the
presence of price and wage controls. However, the short-run benefits of
price and wage controls may be more than offset by the resulting distortion
of relative prices and problems with the "flexibilization" stage (i.e., the
issue of "when" and "how" to remove controls). Too early a removal of price
controls may unleash the same credibility or inertia problems that such
controls were supposed to address in the first place. Too late a removal
may result in highly distorted relative prices with the ensuing real costs.

It seems fair to conclude that, following an initial euphoria as a
result of the success of the Israeli and (though short-lived) of the Austral
plan, the use of price and wage controls has been put once again into
perspective. They may certainly help in combatting inertial elements at the
beginning of a program, but these benefits should be weighed against the
costs in terms of distorted relative prices and the risks associated with
the "flexibilization" stage. More fundamentally, though, the use of price
and wage controls does not seem to alter the dynamic adjustment of an
economy to an exchange-rate-based stabilization: both orthodox and heterodox
plans have shared similar characteristics, as discussed in Section II. This
suggests that price and wage controls cannot solve the underlying
fundamental problems relating to lack of credibility. The case of Israel
has been particularly revealing because the recession at a late stage in the
program could not be avoided in spite of being a highly successful heterodox
program. Thus, one is left with the impression that even if one were to
agree that price and wage controls are a good policy measure--which in

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1/ Pazos (1972) and Dornbusch and Simonsen (1987) discuss the notion of
inflation inertia arising from backward indexation. Barbosa and McNelis
(1990) provide empirical evidence linking the wage indexing system with
increasing inertia in the inflationary process in Brazil. Edwards (1990)
discusses the role of backward indexation in Chile.

itself is arguable--the benefits from imposing them has probably been
overstated. Rather than resorting to price controls, the best hope is
probably to be able to switch from backward-looking to forward-looking
indexation; that is, to adjust wages at the beginning of the program
according to expected inflation, rather than look to the past.

Unfortunately, even if the problem of backward indexation does not
arise, the road to price stability may prove to be very bumpy in the
presence of lack of credibility. The model suggests that undesirable
outcomes may not necessarily reflect the fact that the program has been
badly designed but simply that it is non-credible. Although the model does
not capture the presence of risk premia in nominal interest rates, a large
divergence between domestic nominal interest rates and world nominal
interest rates plus the rate of devaluation is probably a clear indication
that the program is collapsing. The model suggests that the cost of
embarking on a stabilization program that is likely to be highly non-
credible may be substantial.

The main message of the analysis is that exchange rate-based
stabilization is a risky proposition: if it is fully credible, the payoff
may be instantaneous; if it is highly non-credible, real effects may be
substantial. Therefore, the evaluation of how credible a program will be is
critical under exchange rate-based stabilization. In contrast, the effects
of lack of credibility under money-based stabilizations (i.e., stabilization
programs based on the control of the rate of growth of the money supply) are
markedly different. As suggested in Calvo and Végh (1990a), lack of
credibility under money-based stabilization is much less dramatic than under
exchange rate-based stabilization. A fully credible money-based program
will reduce inflation at the cost of an initial recession. A non-credible
money-based stabilization plan reduces inflation by less, but the recession
is also less pronounced. In other words, lack of credibility gets reflected
on both smaller gains and costs. This suggests that in the presence of a
highly skeptical public, money-based stabilization may be preferable.

In conclusion, a unified theoretical framework has been used to
interpret the main stylized facts associated with stopping both
hyperinflation and inflation in chronic-inflation countries. The model
predicts that, in the absence of backward indexation, a credible
stabilization program should stop inflation abruptly with no real effects.
This experiment was taken as a reasonable first approximation to a hyper-
inflationary situation. While the evidence regarding the output costs of
stopping hyperinflation is a matter of controversy, it is generally agreed
that inflation has in fact been stopped suddenly with no major costs.
Furthermore, in the absence of backward indexation--a reasonable assumption
in hyperinflation--it is not obvious, from an analytical point of view, how
a recession would be generated by an exchange-rate-based stabilization. As
the analysis makes clear, there are expansionary, rather then recessionary,
forces that come into play.

A non-credible reduction in the rate of devaluation has been used to interpret stabilization in chronic-inflation countries. The model predicts a boom-recession cycle in the home goods sector, a current account deficit, and real-exchange-rate appreciation. This is consistent with the stylized facts. The model also predicts a fall in domestic real interest rates upon implementation of the program. This prediction is borne out in some episodes (i.e., the Southern-Cone stabilization programs), but in others real interest rates have risen.

The model used in this paper, due to Calvo and Végh (1990a,b), would seem to offer a reasonably good description of reality and should prove useful as a benchmark for understanding stabilization programs. Naturally, many issues remain to be further analyzed, but, in our view, two stand out.

First, the behavior of real interest rates has usually been neglected in the literature. However, this is a key issue in practice. The fact that it seems hard to generate high real interest rates in models of the type studied in this paper only adds to the analytical puzzle.

Second, the role of credibility needs to be endogeneized. The model analyzed in the paper takes the existence of credibility, or the lack thereof, as exogenous to the model. As long as credibility has an exogenous component--given, for instance, by past experiences--the thrust of the model should not change. Common sense suggests, however, that credibility is gained or lost as a program evolves. Sachs (1986) has made the argument that in the Bolivian hyperinflation, stabilization preceded the gain of credibility. The large appreciation of the real exchange rate in the Southern Cone programs generated loss of credibility in that it was perceived as a signal of the unsustainability of the program. In the model analyzed in this paper, real exchange appreciation is a consequence of an initial lack of credibility. If the real exchange appreciation were, in addition, to cause an "endogenous" loss of credibility along the way, the failure of the program would become a self-fulfilling prophecy. This point illustrates the importance of modelling credibility to better understand actual episodes, since experience suggests how critical credibility is to understanding the inflationary process and stabilization.

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