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STABILIZATION IN HIGH INFLATION COUNTRIES;
Analytical Foundations and Recent Experience

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STABILIZATION IN HIGH INFLATION COUNTRIES:
Analytical Foundations and Recent Experience[1]

by

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I. Introduction

Consider an economy, such as Argentina or Israel in the early 1980s, which has the following characteristics:

(i) There is a high rate of inflation at a three-digit annual level that has prevailed for several years.

(ii) There is widespread use of formal and informal indexation.

(iii) There is a relatively large stock of public debt, and a large budget deficit (over 10 percent of GDP).

(iv) There is a statistically weak link between the budget deficit and the inflation rate.

(v) There is an accommodative monetary policy.

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(vi) The government has an important role in setting key nominal variables, such as prices of public-sector utilities and of subsidized food products.

(vii) It is commonly understood that adopting policies that markedly increase the rate of unemployment is politically infeasible.

(viii) There is a relatively large stock of foreign debt and a balance of payments deficit.

(ix) There have been several past attempts to disinflate, none of which succeeded. In fact, these attempts often ended with an acceleration of inflation in subsequent periods.

Now suppose that the authorities choose the goals of immediately reducing the inflation rate to below 20 percent per year on a permanent basis and of improving the economy's external position. Conventional macroeconomic theory suggests that in order to achieve these goals, a set of contractionary fiscal and monetary policies have to be adopted, and that for these policies to affect expectations, it is important that they be perceived by the public as credible and sustainable. There are at least two potential difficulties with adopting such policies that were envisioned by policy makers and their economic advisors in some of the countries under consideration. First, the policies are likely to result in an increase in the rate of unemployment due to downward wage rigidity (see (vii) above). Second, in order to effect a fiscal contraction, it is typically necessary to sharply increase prices of the public utilities sector, with the objective of reducing the losses of public sector enterprises, and to reduce the extent of product subsidization. At the same time, balance of payments developments require a devaluation of the domestic currency (which is overvalued). If indeed implemented, the nominal adjustments and alignment of relative prices would lead to an immediate price increase, which would then be transmitted, through indexation, into wage increases and increases in other nominal variables. These, in turn, will increase inflationary expectations and result in higher inflation.

Given these perceived difficulties, as well as political resistence to cutting budget deficits, it is perhaps not surprising that policies of this type have not been commonly observed. Instead, most previous anti-inflation policies have consisted of managing the exchange rate and other nominal variables (such as public sector tariffs and wages) so as to achieve a given target for the inflation rate. Although in some cases these policies were planned to be accompanied by fiscal and monetary restraint, this did not materialize, and so the end result was a failure to reduce inflation (e.g. Israel in 1982-83 and Argentina in the late 1970's). Moreover, since these policies resulted in distortions in the structure of relative prices (e.g. overvaluation of the domestic currency and low prices of food products), they typically ended with the introduction of sharp corrective adjustments in the previously managed nominal variables.

Against this background, a new set of disinflation policies were adopted from 1985 on by several high-inflation countries. These new disinflation strategies (referred to as "heterodox") are based on the following main ingredients:

(i) The public sector takes a series of measures to reduce the size of its budget deficit to a level below 5 percent of GDP.[2] This is achieved primarily by imposing higher and new taxes and by experiencing an increase in real tax revenue (in the presence of time lags in the process of tax collections) as a result of the decrease in the inflation rate (the so called 'Tanzi-effect'). In the longer run, the government intends also to reduce its spending as well as the size of the public sector. Monetary policy is planned to be restrictive, though some monetization of the economy is expected following the reduction in the inflation rate.

(ii) At the time of implementing the program, there is a discrete adjustment of the exchange rate, wages, prices of subsidized commodities and public-sector tariffs. These are effected so as to align previously distorted relative prices to levels that seem sustainable for a period of at least several months. Following these one-shot adjustments, nominal variables are frozen (through administrative controls) at their new levels[3]. These controls are imposed for a limited period of time, and it is announced that they will be gradually lifted thereafter (though the exact date for their lifting is not known ahead).

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[2]Sargent (1982) emphasizes the role of budget deficit reductions in ending hyperinflations of the 1920's.

[3]Dornbusch (1982) provides arguments in support of combining wage-price controls and exchange rate targeting with the more conventional measures of monetary and fiscal restraint as integral components of stabilization policies in developing countries. Interestingly, the use of price and wage controls as an ingredient of stabilization plans in high inflation economies is new; controls were not used in stopping previous hyperinflations (see Dornbusch and Fischer (1986)).

(iii) Upon adoption of the program, many existing indexation arrangements are abolished, at least temporarily. Thus, there is no automatic compensation for the initial jumps in the exchange rate and prices. Instead, it is stipulated that wages will be allowed to increase only after agreements to that effect are reached between government, private sector employers, and labor trade unions. These agreements together with the government's future adjustment of prices and exchange rates are to shape the path of key nominal variables in a synchronized way, that will avoid large fluctuations in relative prices.

The main objectives of this paper are to review the recent plans and their actual implementation[4], and to explore analytical foundations of four sets of issues which are at the heart of the new programs:

(i) the connection between budget deficits and the rate of inflation;

(ii) the role of exchange rate management in an anti-inflation plan and its connection with budgetary policies;

(iii) the available policy options for disinflating economies that feature wage and price inertia and monetary accommodation;

(iv) the role of wage and price controls in the disinflation process.

While we are not able to provide a complete analysis of these issues, our discussion imposes some analytical discipline on recent controversies. This helps to clarify important issues and to identify directions for further research.

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[4] For previous discussions of the recent plans, see Dornbusch and Fischer (1986), Knight, McCarthy, and van Wijnbergen (1986), Blejer and Liviatan (1987) and Dornbusch and Simonsen (1987).

Section II provides a review of the disinflation plans adopted in four countries: Argentina, Israel, Brazil, and Bolivia. Given the great similarity of the comprehensive plans implemented in Argentina and Israel, we focus most of our discussion on these two countries. Section III deals with the connection between budget deficits and inflation. Section IV considers open economy issues, and in particular the role of exchange rate management in the disinflation process. In Section V we discuss the phenomenon of inflationary inertia, which is widely believed to exist in these economies, and examine the implications of wage indexation and nonsynchronized wage- and price-setting rules. We characterize macroeconomic policies that can disinflate such economies. The role of wage-price controls is also discussed in this context. Section VI concludes the paper.

II. Recent Anti-Inflation Plans

In this section we review policy measures that were included in recent disinflation plans, and discuss the resulting macroeconomic performance. The plans are presented together with the views about the functioning of the economies that stood behind their formation. Our assessments are provided in the analytical sections that follow. We deal with Argentina, Bolivia, Brazil and Israel, but focus our discussion on the plans adopted by Argentina and Israel in 1985.

A. The Austral Plan

Argentina's inflation history for 1960-1986 is depicted in Chart 1. It can be seen that three-digit annual inflation rates persisted continuously from the mid-1970's. The Austral Plan, named after the new currency, was adopted on June 14, 1985. The main goal was to drastically reduce the inflation rate, which reached a level close to 2,500 % annually in May 1985. Table 1 presents quarterly data on the development of key macroeconomic variables before and after the adoption of the plan.

[Chart 1 and Table 1]

Policy Measures

The most salient policy goals and measures that were included in the Austral Plan are as follows:[5]

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[5] Some of the sources for our discussion are: Novedades Economicas (a monthly publication by the Fundacion Mediterranea, Cordoba, Argentina), Central Bank and IMF publications and reports, and reports appearing periodically in International Currency Review. See also the papers mentioned in fn. 3.

(i) Fiscal Policy : the fiscal goal was set to reduce the combined deficit of the nonfinancial public sector and the central bank from a level of about 12 % of GDP to a level of no more than 2-3% of GDP. It was estimated that a deficit of this magnitude would be fully financed by foreign capital inflow and thus would eliminate altogether the need for credit expansion by the central bank to finance the public sector deficit. To achieve the fiscal goal, several specific measures were adopted, which were supposed to result in an increase in tax collections in the order of 6 % of GDP, a decrease in government spending of about 0.5 % of GDP, and a decrease of 3.5 % of GDP in the operating losses of the central bank. The planned increase in tax receipts reflected an increase in specific taxes as well as an increase in the real value of tax collections that arises when there are nonnegligible collection-lags and the inflation rate is drastically reduced. Amongst the taxes that were imposed or raised under the plan, we can list those affecting: exports, gasoline, imports, and bank transactions. The plan, then, substituted explicit taxes for the inflation tax.

(ii) Monetary Policy : initially, monetary policy was based on the assumption of zero inflation, and thus included a commitment of no money printing to finance public sector deficits. First, a monetary reform was introduced with one unit of the new currency (Austral) being equal to 1000 existing Pesos. In order to avoid large profits or losses to debtors and creditors that engaged in previously-set contracts, a system of de-indexation of contracts denominated in Pesos was established. The system consisted of a table of "disagio" that provided daily conversion rates from Pesos to units of the new currency. This table was applied to rental contracts, to saving deposits, and to borrowing and lending agreements. Second, there was a restructuring of interest rates by the central bank. In particular, it was planned that nominal interest rates would be set at levels that ensure positive expected real interest rates for both deposits and loans. Third, the central bank imposed ceilings on the levels of credit to the private sector. It also planned to use more intensively open market operations as its policy instrument, and to reduce its high degree of intervention (as well as the government's) in the process of financial intermediation.

(iii) <u>Wage, Price, and Exchange Rate Freeze</u>: the plan included a series of controls on prices and wages, as well as the fixing the austral/dollar exchange rate. Prior to setting wages, prices, and the exchange rate, at the levels to be subsequently frozen, it was necessary to adjust them to levels that seemed to be sustainable over a considerable period of time. Specifically, the following alignments were made. Right before the adoption of the plan, in June 1985, the government announced a wage increase of 22.6 % and an increase of 25.1 % in retirement pensions . Public sector prices (e.g. public transportation and electricity) were considerably increased in May and June 1985, in order to catch up with previous inflationary developments. The domestic currency was devalued by 18 % against the dollar on June 11, 1985. All prices, wages, salaries and other forms of compensation were frozen at their levels as of the date of the plan's implementation, and maximum prices were decreed on about 80 popular consumption items. The new exchange rate was set at 1 dollar = 0.8 austral, and was announced to remain at this level for a considerable time period. The authorities also announced that these controls were to be gradually eliminated, through a series of sectorial agreements and negotiations, at some point in the future -- yet provided no specific date for such a change.

Developments

In terms of the policies implemented and the results obtained , the period following the adoption of the Austral Plan can be divided into three subperiods : (i) June 1985 to February 1986 ; (ii) March 1986 to August 1986 ; and (iii) September 1986 to the present. Our discussion relies on the quantitative evidence provided in Table 1.

The first subperiod shows a marked reduction in the monthly inflation rate, from 32 percent in June 1985 to 6 percent in July and to a monthly average of 2.5 percent over the period August 1985 - February 1986. During most of this period, the controls on prices, wages, and the dollar exchange rate were maintained at the original levels set in the plan. However, the sharp decrease in real wages that occurred after its adoption led to a series of wage demands that brought about nominal wage increases over this period. Moreover, as the economy's production began to recover in late 1985 and early 1986, labor employment increased, and associated with it there were wage increases in the private sector. These increases also contributed to higher wage demands by public sector employees. Most prices of public utilities were maintained constant over this period, and so was the austral/dollar exchange rate. This resulted in a real appreciation of the domestic currency, which would have been larger were it not for the depreciation of the dollar in international currency markets that took place at that time. Price controls were not followed by the emergence of important shortages. Amongst the controls, those on wages were the least effective.

While the first stage of the Austral Plan exhibited some success in disinflating the economy, the monetary-fiscal policies that were actually adopted were not entirely supportive. On the fiscal side there was no reduction in the size of the public sector, and the deficit was reduced only to about double the level that could be financed from abroad. The failure to achieve the plan's fiscal goals was mainly due to lack of control over spending by the public sector. For example, social security payments and salaries to military personnel increased over this period over and above what was originally planned. Monetary policy was quite expansionary, resulting in average increases in real money balances of about 10 percent per month. While part of this monetization reflected increased money demand and foreign capital inflow, as originally conceived, a substantial portion (about 60 percent of money creation) can be attributed to deviations from the plan's goals, and this part materialized mostly in the form of rediscounts by the central bank to public sector entities. Despite increased monetization in the economy, the ex-post real interest rate showed a marked increase to about 5 percent per month in the early stages of disinflation.

The second stage of the Austral Plan represents an attempt to re-align some of the key nominal and relative prices that were "distorted" during the first stage. A leading example is the austral/dollar exchange rate which was maintained fixed until April 1986. Given the observed real appreciation of the austral relative to the dollar, the authorities began devaluating the domestic currency in order to regain competitiveness, and this was achieved through a series of mini-devaluations that took place in the following months. At the same time there was an upward adjustment of public sector tariffs (to avoid increasing losses of public enterprises) and wage pressures were continuously growing. For example, in July 1986, the government agreed to have wage increases of up to 25 percent for the rest of 1986. Although initially these were presented as "corrective" measures, the general perception was that the government had decided to stop fixing the exchange rate and public tariffs as anti-inflation measures, and moved instead to a policy of mini-devaluations and gradual increases in wages and other prices. Monetary and fiscal policies were more contractionary in this period than in the previous one, but they were still too expansionary compared to the authorities' goals.

The result of the above developments was a noticeable increase in the inflation rate, which tripled relative to its previous level, to an average of about 7 percent per month over this period. Aggregate economic activity showed an upward trend.

The resurgence of relatively high inflation prompted the third stage of the plan, which started in late 1986. This stage consists of an attempt at combating inflation again, though this time with a much more contractionary fiscal and monetary policy. As far as fiscal policy is concerned, the goal is similar to that included in the original plan, and the available evidence indicates that this goal is being achieved since September 1986 (mostly through higher taxes). Moreover, the authorities seem committed to reduce the number of public sector employees by at least 10 percent during 1987. Regarding monetary policy, the central bank has reduced its rediscounting and has imposed effective ceilings on credit to the private sector. The authorities' goal is to have monthly increases of the money supply in the order of 4-5 percent, which is about 40 percent lower than the average monthly increases over June 1985-September 1986. These monetary policies have resulted in an increase in real interest rates and a credit squeeze to the private sector, which may result in a slowdown in economic activity .

Together with these monetary and fiscal policies, the authorities are gradually devaluating the domestic currency and are also allowing increases in wages and public sector prices within governmentally-decreed authorized "bands". Thus, the policy of fixing the exchange rate at a certain level, and then waiting for a few months until this level is adjusted again, has been substituted by a policy of mini-devaluations. While the official goal is to have an inflation rate not higher than 3 percent per-month, most Argentine analysts seem to agree that a monthly rate in the order of 4 or 5 percent is a more realistic forecast for 1987.

Summing up, although the original goal was the eradication of inflation, the updated goal seems to be to maintain inflation at the two-digit level, preferably below 50 percent per year. While the plan had some initial success in disinflating the economy, the accompannying fiscal and monetary policies were too expansionary to be consistent with the nominal prices imposed by official controls. Thus there was a lack of coordination between the price-controls policy and fiscal and monetary policies. Some of the price and wage controls were not effective, and key relative prices began to move in what were commonly thought to be unsustainable directions. This created the need for corrective measures that were implemented in the second stage of the program. The current stage of the Argentine stabilization effort features a combination of more contractionary fiscal and monetary policies together with an attempt to control and synchronize from month to month the rates of increase of wages, the exchange rate, and prices.

B. The Israeli Stabilization Plan

As shown in Chart 2, three digit annual inflation is a relatively recent phenomenon in Israel, dating from the end of the 1970's. Israel's Plan was announced on July 1, 1985. Its main target was to reduce inflation from the previous level of 10-15 percent per-month to a level of less than 2 percent per-month. The plan was also intended to bring about an improvement in Israel's balance of payments. Macroeconomic developments for periods before and after the adoption of the plan are summarized in Table 2, which is used as the basis of our following discussion.

[Chart 2 and Table 2]

Policy Measures

The specific policy measures and goals were as follows:[6]

(i) Fiscal and Monetary Policies: at the time of adoption of the plan, Israel featured one of the world highest ratios of public sector debt to GNP: about 2. Accordingly, the main fiscal goal was to reduce the budget deficit of the public sector to a level that would ensure no further growth in real domestic and external debt. This implied that the domestic budget deficit had to be reduced from its prevailing level of close to 15 percent of GDP to no more than 5 percent of GDP. A number of fiscal measures were taken in order to achieve this target, most of which concentrated on raising net tax revenue. Specifically, new taxes were imposed (e.g. on cars, property, and travel abroad), and there was a substantial cut in subsidies to basic goods such as food and transportation (e.g., there was a 75 percent increase in the price of bread, and a 27 percent rise in fuel prices). At the same time, Israel received emergency aid from the U.S. government amounting to a total of $1.5 billion to be spread evenly over 1985 and 1986 (this figure represents about 6 percent of Israel's yearly GNP), which further contributed to the reduction in the budget deficit.

Concerning monetary policy, measures were taken to limit credit expansion to the private sector and to reduce the effective degree of liquidity of bank deposits that were linked to foreign exchange. In addition, the authorities

[6] The following discussion is based on various reports and publications of the Treasury and the Bank of Israel, as well as on Bruno (1986,1987). See also the papers mentioned in fn. 3.

planned to take measures to ensure a more intensive use of open market operations in the implementation of monetary policy.

(ii) Fixing the Exchange Rate: the plan envisioned the nominal exchange rate of the dollar as being a key anchor for other nominal variables. After an initial devaluation of 19.1 percent, the dollar exchange rate was fixed at 1.5 shekels per dollar.

(iii) Wage and Price Freeze: the view was that given the substantial price shocks that were induced by the devaluation and the cuts in subsidies, the maintaining of existing wage indexation agreements would have resulted in a new round of inflationary-spiral effects. In order to avoid this development, and in order to help disinflate the economy, the plan included a temporary (three months) suspension of existing indexation arrangements. Since in the absence of other measures this suspension would have resulted in a sharp cut in real wages, the trade union demanded compensation which materialized in the following planned wage increases: 14 percent of gross wage, to be paid on August 1, a one-time 12 percent payment on September 1, and 4 percent to be paid at the beginning of each one of the first three months of 1986. In addition, formal indexation in the form of 80 percent compensation for previous month's inflation rate was re-established beginning December 1, 1985, only if inflation exceeded 4 percent per month (to be contrasted with 12 percent before the adoption of the program). April 1986 was determined as the date at which wage negotiations would resume. Indexation of financial assets remained unaltered.

After the initial devaluation and the upward adjustment of prices, the government legislated a full price freeze for a period of three months. For the period thereafter, the authorities announced their intention to gradually eliminate price controls, though their exact timing and magnitude remained uncertain.

Developments

Analysis of the economy's performance under the Plan can be subdivided into two main periods: before and after January 1987. Before the adoption of the new policy measures, monthly inflation was typically in the 10-15 percent range. Upon implementation of the plan, the inflation rate increased in July 1985 to 27.5 percent, reflecting the stepwise alignment of the exchange rate and other prices, and a marked gradual deceleration thereafter. The rate of inflation was 2 percent per month during the last quarter of 1985, and 1 percent per month during the first quarter of 1986. By the end of 1986 the inflation rate was about 2-2.5 percent per month.

Perhaps equally impressive is the performance of the public sector domestic deficit. From domestic deficits of more than 10 percent of GDP before July 1985, the public sector budget went into a surplus. Three key factors were responsible for this development: an increase in government tax collections, a decrease in government payments in the form of subsidies, and the arrival of U.S. emergency aid. Even though the figures show a sharp fiscal adjustment, some of its components (as e.g. U.S. emergency aid) are of a temporary nature (see below).

Turning to the behavior of key relative prices, consider first the real exchange rate of the shekel against the U.S. dollar and against a basket of foreign currencies (including the dollar). Following the devaluation of the shekel at the initial stage of the plan, both real exchange rates increased (i.e., the domestic currency depreciated) during the third quarter of 1985. However, from that time on there is a marked real appreciation of the domestic currency--primarily against the U.S. dollar. This appreciation is just a result of combining the fixed exchange rate policy, that was maintained up to January 1987 (see below), with some positive domestic inflation. At the same time that the shekel/dollar exchange rate was maintained fixed, the dollar depreciated in world currency markets, so that effectively the shekel <u>depreciated</u> against foreign currencies other than the dollar. Moreover, the observed declines in international prices of oil and commodities represent additional external developments that helped maintain the fixed-exchange-rate policy. The real appreciation with respect to the basket was milder than with respect to the dollar. In any case, the inverted-U shapes exhibited in the charts indicate that while the competitiveness of Israeli products was relatively high at the start of the period, it continuously deteriorated over time. In August 1986 the authorities decided to peg the exchange rate to a basket of foreign currencies rather than to the dollar. And towards the end of 1986 pressure was mounting to have a devaluation that would offset the existing trends.

Second, we turn to real wage behavior. It can be seen in Chart 3 that the plan initially strengthened a downward trend in real wages in the private sector that prevailed in early 1985. The same holds for real wages in the public sector. Real wages in public and private sectors reached their lowest levels in the six months following the adoption of the plan. However, both these variables have shown marked increases from the end of 1985, with public sector wage increases typically lagging behind those of the private sector. Both real wages show a U-shape, and after a temporary erosion have come back to their average (or even higher) levels before the plan. Regarding the indexation arrangements, in April 1986 a two year agreement was signed, stipulating a cumulative threshold inflation rate of 7 percent (below which indexation payments are not yet made) and an indexation coefficient ranging from 70 to 90 percent, depending on the actual inflation rate. Under this agreement a monthly average inflation rate of 1.5 percent would result in an indexation adjustment of 70 percent of cumulative inflation once every four or five months (see Bruno (1986)).

[Chart 3]

Third, we turn to controled prices and their relation to the overall CPI. Upon looking at past periods, it can be seen that the policy of slowing down the monthly rate of increase of governmentally-determined prices adopted in 1982-1983 resulted in a very low ratio of these prices to the CPI. The 1985 plan begun with a marked upward adjustment of these prices, which was subsequently partially offset, yet leaving the ratio of controlled prices to CPI at a higher level in 1986 than before the plan. The controls did not lead to shortages in the economy, and by the end of 1986 many controls were removed.

Monetary policy was only initially conducted in a way consistent with disinflation. Towards the second half of 1986 credit and money aggregates expanded very fast, in considerable excess of their targets. The sharp disinflation was associated with high ex-post real interest rates on the free part of bank borrowing, in the order of 6-7 percent per-month, up until the last part of 1985. However, these credit lines constituted a small fraction of total credit, with much lower interest rates applying to the larger government directed credit component. Real interest rates have decreased since then, and by the end of 1986 they were at the 1.7 percent monthly level.

The Israeli disinflation did not lead to a marked decrease in employment or real output. As shown in Chart 4, initially employment continued a downward trend that existed at the beginning of 1985. However, since the end of 1985 there is a marked increase in employment and in economic activity, which have either returned or passed their average levels before July 1985. The rate of unemployment increased in the third quarter of 1985 and the first quarter of 1986, but from then on it is continuously decreasing.

[Chart 4]

The plan resulted in an initial improvement in the trade account, but this proved to be a temporary phenomenon. Rising real wages and activity together with the real appreciation of the shekel seem to have led to increases in imports and a smaller growth in exports that have brought the trade deficit to its pre-plan level. Since U.S. emergency aid was received over the 1985/86 period, the unfavorable developments in the trade account did not manifest themselves in the form of reserve losses or increased foreign borrowing--so that the overall balance of payments brought about a decline in foreign indebtedness.

Last, Chart 5 describes a U-shaped behavior of private consumption, which decreased in the quarter following the implementation of the plan (and thus continued a trend from the previous quarter), but then increased continuously starting with the last quarter of 1985. In fact, private consumption has reached a peak level during 1986.

[Chart 5]

Towards the end of 1986 the marked real appreciation of the shekel and increases in real wages, which resulted in a loss of competitiveness, raised serious doubts about the desirability of maintaining the prevailing exchange rate level. Accordingly, on January 13, 1987 a new package of policy measures was adopted, one that represents an updating and correction of previous measures. Specifically, the new package contains the following main ingredients: (i) a devaluation of 10 percent of the shekel, resulting in a new exchange rate of 1.65 shekels per dollar. The authorities emphasized once again their intention of maintaining a fixed exchange rate with respect to the basket of currencies; (ii) an upward adjustment of prices of subsidized products. For example, the price of bread was increased by 20 percent and that of milk by 14 percent; and public transportation fares are scheduled to increase by 30 percent in April. The government returned to statutory price controls for a period of one year, up to April 1988; (iii) a new tripartite agreement between government, the trade union, and the employers stipulated a postponement of 2.7 percentage points out of the next indexation payments, and the Treasury decreed a decrease of 2.7 percent in national insurance payments made by employers. The latter agreed to abstain from passing over cost increases that will result from the devaluation, and from other price adjustments, into prices of manufactured products.

While the official forecasts are that due to these adjustments inflation will accelerate during the first quarter of 1987, the overall outlook for economic policy during 1987 is uncertain. The reason is that there are signs that the public sector budget deficit will be higher than the level that seems consistent with inflation rates in the order of 2-3 percent per month. Government spending is forecasted to increase, U.S. emergency aid will not be forthcoming in 1987, and the government has introduced a tax reform package that effectively reduces marginal income tax rates which will result in lower tax revenue. The net outcome is likely to be a public sector budget deficit of about 6 percent of GDP for the present year.

Comparing the economy of Israel at the present time with that before the adoption of the plan suggests that most real economic variables have not changed noticeably (recall the U-shapes that characerize the behavior of several of these variables, such as the real wage rate, employment and private consumption). In fact, disinflation during 1986 has been accompanied by booming real wages and private consumption. The most striking change is the decrease in the size of the government budget deficit.

C. Other Stabilization Plans

We now discuss the policies adopted by Brazil and Bolivia.

C.1 The Cruzado Plan

During most of the 1980's, Brazil featured annual inflation rates at three-digit levels. (See Chart 6, which gives quarterly inflation rates expressed in percentages per month). In 1984 and 1985 the annual inflation rate settled on 220 percent, and in early 1986 there seemed to be an acceleration of inflation to an annual level of about 400 percent. Under these circumstances, the authorities decided to attack inflation, and on February 28, 1986 they adopted a set of policy measures that form the Cruzado Plan. Brazil's initial conditions seemed more favourable than those of Argentina and Israel, in that they featured a continuous trade surplus, high growth of GDP, and a budget deficit not larger than 4 percent of GDP.

[Chart 6]

The basic idea underlying the plan was that Brazil's inflation is mostly inertial, and that as such it can be eradicated by using statutory wage and price controls without necessarily requiring fiscal and monetary contraction. The main policy measures included the following[7]: (i) prices were frozen at their prevailing levels for an indeterminate time horizon; (ii) the exchange rate was fixed at the level of 13.80 cruzados per dollar; (iii) wages were frozen at a new level in cruzados. This level was determined according to the average purchasing power of wages during the previous six months plus a wage increase of 8 percent. These steps brought about an effective large increase in real wages right at the start of the program. Wage indexation was suspended as long as inflation does not go beyond 20 percent; (iv) indexation of government bonds was suspended for one year, and a table was announced for converting old currency units into new ones.

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[7] Some of the sources for our discussion are: Indicadores de Cojunctura (various issues), reports appearing in International Currency Review (various issues), and IMF publications and reports. See also the papers mentioned in fn. 3.

The Cruzado Plan has not succeeded in reducing inflation on a permanent basis. Even though inflation was reduced to about 1-1.5 percent per month within the first six months, inflationary pressure has been gradually accumulating, and it erupted by the end of 1986 and the beginning of 1987--inflation running at an annual rate of 500 percent for the first quarter of 1987. There are at least two weak points with the plan and its implementation. First, instead of aligning relative prices and reducing real wages before establishing price controls (as was the case in Argentina and Israel), the plan began with a sharp increase in real wages and the authorities froze prices at their existing levels as of February 1986. For some products, like beef, milk and some consumer durables, this implied very low relative prices. The latter were maintained, in many cases, only through increased subsidies from the government to producers. Acute shortages and black markets developed for these products, with sellers typically asking buyers to pay agios (surcharges) well above official prices, and an environment of suppressed inflation developed. Faced with extremely distorted relative prices, many producers shut down their lines of production, thus further contributing to the shortages. Second, while the Plan contained a forecast for the budget deficit of the public sector in the order of 0.5 percent of GDP, the actual figure for 1986 turned out to be 10 times larger, namely 5 percent of GDP. Lower tax revenues, higher government spending, increased losses of public enterprises, and increased subsidies all contributed to this development. In addition, monetary policy turned out to be much more expansionary than initially forecasted by the authorities.

Output growth continued at a relatively fast pace, and the trade account showed continued surplus though at remarkably lower levels than before the plan, reflecting increased imports and decreased exports. These developments enhanced Brazil's difficulties in effecting interest payments on foreign debt, and in the first quarter of 1987 the government announced a temporary suspension of these payments.

The combination of generalized shortages and expansionary fiscal and monetary policies were viewed towards the end of 1986 as signalling an imminent collapse of the policy. Accordingly, on November 21, 1986 (following elections to Congress) the authorities adopted a second set of packages (the Cruzado II Plan) which mostly included stepwise upward price adjustments for numerous products; for example, electricity prices were increased by 40 percent, water tariffs by 45 percent, and mail service by 80 percent. These adjustments have continued during the first months of 1987 and will obviously lead to higher recorded inflation for that period--though, to the regret of wage earners, some of these adjustments were defined as "surcharges" and as such will not be included in the inflation rate used for wage indexation payments. Rather than have a zero inflation target as in the original plan, the authorities seem to attempt to stabilize the inflation rate for 1987 at the level of 50-60 percent.

C.2 Bolivia's New Economic Policy

Perhaps the most remarkable attempt to combat inflation in the 1980's is that of Bolivia[8]. During the first half of 1985 this country had an inflation rate of 20,000 percent per year, and in the summer of the same year the monthly inflation rate was around 60 percent (see Chart 7). Money creation, and thus inflation, was the method used by the government in financing its budget deficit of about 30 percent of GDP--at a time that explicit tax revenue amounted to less than 5 percent of GDP. Other initial conditions included trade account deficits, generalized use of price controls and rationing, large operating losses of public enterprises, and a continued trend of decreasing output per capita--the latter decreased by 30 percent from 1980 to 1985.

[Chart 7]

The New Economic Policy was introduced on August 29, 1985. Its main objectives were to reduce inflation to a single digit level, to restore external balance, and to lay the basis for a growth recovery. The policy consisted of the following main measures: (i) a dismantling of controls on prices, interest rates, and exchange rates. The exchange rate was initially floated, following a devaluation of about 90 percent, and later on replaced by a managed exchange rate. A general approach of market liberalization was adopted; (ii) the imposition of strict controls over public finances aimed at sharply reducing the budget deficit. To this aim, the program stipulated cuts in government spending in the form of support to public enterprises and subsidies to production, and a tax reform establishing well defined

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[8] For an extensive discussion of the Bolivian case, see Sachs (1986). See also IMF Survey, January 26, 1987.

value-added, income and property taxes that would substitute for the inflation tax. In addition, to further enhance the fiscal contraction, wages in the public sector were frozen for periods of several months, and the government eliminated more than 15,000 jobs in the public sector; (iii) the adoption of several structural and institutional measures, such as a process of rationalization of state enterprises and of reduction of the size of the public sector.

The results are so far impressive. The inflation rate for 1986 was less than 2 percent per month and a similar forecast holds for 1987. Most of the measures included in the Plan materialized in reality. Specifically, the authorities freed goods, financial and labor markets; raised prices of public utilities (e.g. the price of gasoline was raised from $0.04 per liter to $0.30); and started a restructuring of state enterprises (especially the state mining company). In May of 1986 the government introduced a comprehensive tax reform that included taxes on net worth of enterprises, on landholdings and other assets, a 10 percent value added tax, and a 10 percent complementary income tax. As a result of the tax reform and cuts in government spending, the budget deficit of the public sector has settled at 6 percent of GDP out of which 5 percent are externally financed. The main unresolved issue is the continued trend of decrease in output (which declined in 1986 by 3 percent), strengthened in 1986 by a deterioration in the country's terms of trade associated with the marked decline in prices of tin and hydrocarbons in international markets. In addition, there has been a widening in the current account deficit in 1986, due to increased imports and reduced exports.

Despite this, there has been a significant repatriation of capital which has more than offset the current account developments, thus resulting in an increase in the country's international reserves.

The evidence so far indicates that Bolivia has succeeded in stopping an acute and chronic hyperinflation by using a combination of contractionary fiscal-monetary policies and a package of institutional and structural reforms. In contrast to the other countries discussed above, Bolivia's anti-inflation policy did not include price and exchange rate controls--just the opposite, the stabilization plan dismantled previously existing controls and proceeded to liberalize markets in the economy.

III. Budget Deficits and Inflation

During the public discussion that preceded the design of recent stabilization programs, a major argument in favor of unorthodox measures was that the inflationary process in Argentina, Brazil and Israel is not of the "textbook" type, and it should, therefore, not be combated by means of traditional measures. This argument was, of course, not new--it was at the heart of the thinking that led to disinflation attempts by means of exchange rate management in Argentina (1978-1981), Chile (1978-1982) and Israel (1982-83) (see Helpman and Leiderman (1987a)), and the thinking that lead to the "package deal" policies in Israel (1984-85) that relied on price-wage agreements and controls. An important justification of the search for new explanations of the inflationary process and their policy implications was the observation that budget deficits did not seem to be strongly and positively correlated with the rate of inflation. Therefore, it was argued, the major source of inflationary pressure was not the budget deficit. For example, Liviatan and Piterman (1986) stress that while the domestic deficit to GNP ratio followed over time an inverted U-shape (increasing from 4.1 percent in 1963-72 to 22.1 percent in 1973-77 and then down to 13.2 percent in 1978-83), the inflation rate was continuously rising (from 7.4 percent per year in 1963-72 to 32.8 percent in 1973-77 and to 107.5 percent in 1978-83).[9] This

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[9]Furthermore, the correlation coefficients between quarterly movements in inflation and in the budget-deficit to GNP ratio are 0.47 and 0.41 for Israel and Argentina, respectively, over the three years that preceded the disinflation plans.

argument was of major importance in the Israeli debate, and it was used to justify earlier attempts to disinflate without a fiscal adjustment.

Whatever merits explanations of the inflationary process that do not rely on budget deficits might have (we will discuss them at a later stage), it is important to understand that even in those cases in which the budget deficit is the sole source of inflationary pressure, one may observe periods in which this correlation is weak. Hence, the lack of a strong correlation of this type cannot be used on its own to reject the conventional approach. The importance of fiscal discipline is also apparent from the fact that programs that were implemented without restraining the budget deficit did not succeed.

The usual view that budget deficits and inflation are positively correlated rests on a steady state analysis of the type presented in Figure 1. Curve I describes the functional relation between the inflation rate π (with the inflation rate being equal to the rate of money growth μ) and the inflation-tax revenue $\pi L(r+\pi)$, where $L(\cdot)$ is the demand for real balances, and r is the real interest rate. Curve II describes the budget deficit that has to be financed by the inflation tax. That is, $\pi m=d$, where d is the budget deficit which is equal to $rb^G+g-\tau$ (b^G is the real value of government debt, g is real spending and τ is real net taxes) and m denotes real balances; $m=L(r+\pi)$ in equilibrium.[10] Standard demand functions for money, such as the Cagan type, imply that the two curves have two intersection

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[10]Curve II in Figure 1 is drawn under the assumption that real taxes τ do not depend on the inflation rate. If tax revenue declines with increases in inflation, the curve is upward sloping, which does not change the arguments in the text.

points, such as A and B in the figure, which correspond to low and high inflation equilibria. Assuming that by controlling the rate of money growth the government drives the economy to the low inflation equilibrium, point A is actually observed.[11]

[Figure 1]

Now suppose that the budget deficit increases. Then curve II shifts to the right and the equilibrium shifts from A to A' (the largest budget deficit that can be financed by the inflation tax is represented by curve II', which represents Friedman's maximum inflation tax). Hence, a higher budget deficit is associated with a higher inflation rate and lower real balances. The higher budget deficit may result from lower taxes, higher spending, or higher debt. Higher debt may result from an attempt to temporarily reduce the rate of money growth so as to combat inflation, which will eventually lead to a larger budget deficit as a result of larger outlays for debt servicing, and thereby to higher inflation. Hence, without a fiscal adjustment it may be possible to trade off lower inflation in the near future for higher inflation in the distant future. This is the essence of Sargent and Wallace's (1981) monetarist arithmetic.

The difficulty with the direct application of this analysis to the countries under discussion is that a steady-state analysis is quite inappropriate for these episodes (there also exists the problem that the

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[11] The answer to the question which of the two possible long-run equilibria will actually be observed depends on the nature of government policy out of steady state and on the formation of expectations. This issue has been treated in Sargent and Wallace (1987), Bruno (1987) and Bental and Eckstein (1987).

analysis is for a closed economy while these countries are rather open, but this is inconsequential for the problem at hand as long as the exchange rate is more or less floating). That this is the case, is illustrated by the data for Israel and Argentina in Tables 3 and 4, which describe the evolution of budget deficits and their financing. It is seen from these data that most of the financing of budget deficits was done by means of debt issues which have been raising the debt income ratio. In Israel the debt income ratio was about two just before the implementation of the program. It is also clear from these data that despite the acceleration of inflation in the eighties, revenue from base money creation did not change much, contrary to the prediction of the steady-state model. Some may argue (see e.g. Bruno (1987)) that the latter represents a move from a low to a high inflation equilibrium, such as from point A to B in the figure. However, the evidence on the evolution of public debt seems to be inconsistent with this interpretation.

[Tables 3,4]

A possible interpretation of what has happended relies on the observation that these countries have been pursueing macroeconomic policies which were unsustainable in the long-run, a feature that was manifested in large budget deficits and growing public debt. Consequently, it was expected that a major policy change will take place. Under these circumstances expectations of a future policy change have major implications for current macroeconomic behavior, in particular when there is uncertainty about the timing of the policy change. This raises the question of whether such expectations cannot alter the positive relation between budget deficits and inflation that emerges from steady-state analysis. It turns out that the answer to this question is in the affirmative, at least for some forms of expected policy changes. We know of no empirical study that has explored this issue in detail, and will, therefore, present the theoretical arguments.

Consider an economy in which a representative individual maximizes the discounted flow of utility:

$$\int_0^\infty e^{-\beta t}[u(c,\ell) + v(M/P)]dt,$$

where β is the subjective discount rate, c is consumption of the single available good, ℓ is leisure, M is the stock of money holdings, and P is the price of the consumption good (the arguments of u(·) and v(·) are time dependent). The individual faces a standard intertemporal budget constraint, which reflects the existence of a perfect capital market in which a bond issued by the government is traded. The bond is denominated in terms of the consumption good and it pays a real interest rate r. The individual pays a lump-sum tax τ in each period and a tax on labor income at the rate λ. The evolution of government debt is given by:

(1) $$\dot{b}^G = rb^G + g - \tau - \lambda(1-\ell) - \mu m,$$

where $1-\ell$ is labor supply and the real wage rate is equal to one.

Now consider a situation in which current policy consists of fixed values of (g,τ,λ,μ), such that initially public debt is growing over time. Assuming perfect foresight, it can be shown that in this case the equilibrium real interest rate is equal to the discount rate β, and debt grows faster than the rate of interest. Hence, there can be no equilibrium without a policy change, because this requires private bond holdings to grow in the limit faster than the rate of interest, thereby violating the individual's transversality conditions. In this sense the initial macroeconomic policy package is unsustainable in the long-run.

Suppose therefore that it is expected that the government will change its policy. First, suppose that it is known with certainty that the policy change will take place at time T, and that it will bring the economy at once to a steady state. It is shown in Helpman and Drazen (1986) that if the public believes that lump-sum taxes will be used for stabilization, then real balances will be constant over time and so will be the inflation rate, which will be equal to the rate of money growth. If the public believes that the policy switch will consist of raising the rate of money growth, then real balances will decline over time and the rate of inflation will increase over time. The same pattern emerges when the public believes that stabilization will be effected by an expenditure cut, provided the elasticity of demand for money with respect to the interest rate is smaller than one--the usual case. Here the demand function for money is implicitly described by the equilibrium requirement:

(2) $$v'(m)/\theta = r + \pi,$$

where θ is the marginal utility of consumption, which can be shown to remain constant at all points in time before the policy switch date and the right hand side is equal to the nominal interest rate. This implies a negative relationship between the inflation rate and the real stock of money on the adjustment path. However, when the public expects stabilization to be effected by an increase in the labor tax rate, real balances are rising over time and the inflation rate is declining over time. In all cases the budget deficit is rising over time, with the basic deficit $g-\tau-\lambda(1-\ell)$ being constant (the rising overall deficit results from increases in government debt).

These results indicate that indeed when money financing is considered to be the long-run option, the rate of inflation will be rising and so will the budget deficit, thereby generating a positive association between them. However, when a fiscal correction is considered to be the long-run option, then a rising deficit can be associated with a rising, a constant, or a declining rate of inflation, depending on whether a budget cut, a lump-sum tax increase, or an increase in labor taxation are believed to be the corrective instruments.

This analysis rested on the assumption that the timing of stabilization is known with certainty. The more realistic assumption that there is uncertainty about the timing of stabilization further weakens the link between budget deficits and inflation. This issue is studied in detail in Drazen and Helpman (1986). Consider first the case in which stabilization will be effected by money financing. In this case the real interest rate will still be equal to the private discount rate, but the nominal interest rate will include a risk premium which compensates holders of nominal assets for the prospect of a price level jump in the event stabilization takes place (unexpectedly). This risk premium can be positive or negative, depending on whether an upward or a downward price jump is expected. In any case real balances will be falling over time and the nominal interest rate will be rising over time, just like in the certainty case. The budget deficit will also be rising over time as in the certainty case. However, now, due to the existence of the risk premium, a rising nominal interest rate does not reflect a rising rate of inflation. The rate of inflation is equal to the nominal interest rate minus the real interest rate $r=\beta$, minus the risk premium. Hence, if the risk premium rises sufficiently fast, the rate of inflation may be declining despite the rising budget deficit. Figure 2 shows a simulated time pattern of inflation for a simple nonpathological example reported in Drazen and Helpman (1986). In this example the budget deficit is rising over time while inflation is rising initially and declining thereafter.

[Figure 2]

The foregoing discussion shows clearly that there is nothing odd about finding a weak relation between inflation and budget deficits, as in the Israeli data, even if one thinks that the budget deficit is the major source of inflationary pressure. Naturally, in this framework a constant deficit that is financed by means of an inflation tax implies a constant rate of inflation. It is also shown in Drazen and Helpman (1986) that uncertainty about the timing of a stabilization to be effected by a budget cut can generate cyclical movements in real balances and in inflation rates. This strengthens the case for the lack of a strong link between inflation and budget deficits. Hence, the lack of such a link in the data should not necessarily lead one to conclude that it is possible to disinflate without a fiscal adjustment.

Theory suggests that immediate budget balance is not necessary for an immediate ending of an inflationary process. What is rather required is an assurance that, if sustainable budget balance is not achieved on impact, it will be achieved in the future, so that there will be no need to rely on the printing press. The difficulty is, of course, to generate this assurance, and immediate reductions in the the budget deficit help to build up credibility in the new policy. This point has been emphasized by Sargent (1982), and also by Dornbusch (1982) who holds a different view on efficient stabilization methods. However, the necessity of budget balancing was not generally accepted in the countries under consideration before 1985, and it was rejected in Brazil even as late as 1986.

Although plausible, the argument that links current budgetary performance to the formation of expectations has not been made precise. On the other hand, it is the case that programs which did not pay due attention to budget deficits have failed. One may therefore conclude that there is a clear case for long-term budget balancing, and that an immediate reduction of the budget deficit is most helpful, both because it has a favourable effect on expectations and because it makes easier the adjustment of fiscal policy to the long-run goal. These arguments are supported by the evidence from Israel, Argentina and Brazil. Indeed, in Israel, which made the largest budgetary adjustment, inflation remained low for the largest span of time, second in this ranking is Argentina which made a moderate budgetary adjustment and had some reduction in inflation, and last stands Brazil which made no budgetary adjustment and its plan has collapsed.

Although in this section we have stressed the role of budget deficits, we do not wish to argue that they were necessarily the sole source of inflationary pressures. We will deal with other possibilities, and with their relation to budget deficits, in the sequel.

IV. Exchange Rate Management

A major ingredient of recent stabilization programs is a fixed exchange rate during the first phase. The use of exchange rate management for disinflation purposes is not new--it has been used, for example, in the German program of 1923 and in the French program of 1926, as well as in the Argentine and Chilean programs of the late 1970's and the Israeli program of 1982-83. What is different in recent programs is the composition of policies; in Argentina, Brazil and Israel the exchange rate freeze was accompanied by price and wage controls. The effects of price and wage controls will be analyzed in the next section, where we will also discuss the use of an exchange rate freeze in that context.

One rationale that was suggested for exchange rate management, such as a fixed exchange rate, as a component of a stabilization package has to do with its relative efficiency in disinflating with smaller output losses as compared to monetary policy. It is well known that in an economy with complete information and no distortions or rigidities, exchange rate targets or monetary targets are equivalent policies. However, this equivalence need not hold in the presence of incomplete information, distortions, or rigidities. For example, Fischer (1986) has demonstrated that in an economy with multiperiod wage contracts, in which policy fundamentals have been adjusted for disinflation purposes, exchange rate targets dominate monetary targets under some configurations of the underlying parameters, but are dominated under other configurations. His overall conclusion was, however, that the former possibility is more likely. The question raised in this analysis is an extremely important one. However, given the particular model used to answer it, the robustness of the result remains an open issue.

Notice that the foregoing analysis relied on the assumption that fundamentals, such as budgetary policy, have already been brought in line with the inflation target. Yet this was not always the case, and it is certainly not always apparent from government actual performance at the beginning of a stabilization program. This raises the issue of sustainability of exchange rate management. Accordingly, we analyze in this section the relationship between exchange rate and budgetary policies.

It is indeed the case that an exchange rate freeze together with a fiscal package that makes it sustainable in the long-run brings inflation at once to foreign levels, provided the economy settles on a steady state. This is easily seen for an economy with traded goods only, in which the domestic price level P is equal to the foreign price level P^* times the exchange rate ϵ. In this case the rate of inflation π is equal to the foreign inflation rate π^* plus the the rate of currency devaluation $\dot{\epsilon}/\epsilon$. Hence, if the exchange rate is constant, $\pi=\pi^*$. In the somewhat more complicated case in which there also exist nontraded goods, this point can be seen as follows. In a steady state the relative price of traded goods, often defined as the real exchange rate, i.e., $p=\epsilon P^*/P_N$, where P_N is the price of nontraded goods, is constant. Assume also for the rest of this section that the foreign price of traded goods P^* is constant (the modifications required in order to allow for changing P^* are trivial). Hence, if the exchange rate is constant, then the price of nontradeables is also constant. Therefore, the price of tradeables ϵP^* and the price of nontradeables P_N are constant, and so is every price index that is built on them.

The assumption that the economy is in a steady state is essential for this conclusion as long as there are nontraded goods. For suppose the economy is not in a steady state. In particular, suppose that aggregate spending is rising over time, bringing about a declining real exchange rate p (as has happened in Israel in 1986). This real exchange rate appreciation holds in terms of both p and another commonly used index of the real exchange rate $q=\epsilon P^*/Q$, where Q is a price index which is a linear homogeneous function of the price of traded and the price of nontraded goods (here q is an increasing function of p). In this case

$$\dot{Q}/Q = \dot{\epsilon}/\epsilon + \dot{P}^*/P^* - \dot{q}/q = - \dot{q}/q,$$

so that the rate of inflation in terms of the price index Q is positive, despite the exchange rate freeze. It is apparent from this discussion that an exchange rate freeze can bring inflation to a halt only if the accompannying policies make the freeze sustainable and bring about stability of the real exchange rate. It is also clear from the data presented in Section II that the second condition was not satisfied, because inflation was not brought to a halt, nor was it reduced to relevant foreign levels (by pegging the exchange rate to the dollar the inflation rate declines to dollar price inflation of traded goods if the second condition is satisfied). Whether the first condition was satisfied is to some degree a matter of judgement. It was clearly violated in Argentina and Brazil, and in our judgment it was also violated in Israel, if one projects budgetary policy from past experience. This raises two questions. First, what other policies are required in order to support a given exchange rate policy in general and an exchange rate freeze in particular? And second, what are the real effects of exchange rate management?

In order to answer the first question it is necessary to consider the budgetary implications of exchange rate management. For this purpose the relevant budget is the consolidated budget of the government and the central bank. While typically the central bank manages foreign exchange reserves and the treasury manages government debt, quite often the ability to rebuild depleted reserves depends on the size of government debt. It is most convenient to think in terms of the simplest case in which foreign exchange reserves and government debt bear the same real interest rate. In this case exchange rate management affects the evolution of net debt through the induced movements in reserve holdings. Naturally, reserve movements do not depend only on the exchange rate. For example, they depend also on other factors that determine the demand for money, such as income and interest rates. Some of these variables, on the other hand, depend on the degree of control on international capital movements. Hence, reserve and net debt movements depend on a variety of policies, the exchange rate policy being only one of them. However, the question on the sustainability of the policy package can be reduced to the following: does the implied evolution of net debt ensure solvency? If, for example, equation (1) is interpreted as the consolidated budget with b^G representing net government debt, then the solvency requirement reduces to the question of whether $e^{-rt}b^G$ is not strictly positive as time goes to infinity. If it is not, the policy package is sustainable. In this case simple integration of (1) implies solvency, in that the present value of taxes, including the inflation tax, is equal to the present value of expenditures plus initial net debt.

It is clear from this discussion that if there exists a sustainable policy, then typically there also exist many others. For if a given trajectory of taxes, monetary injections, and spending is consistent with a trajectory of a managed exchange rate, then an increase in current spending on, say, tradeables, together with a sufficiently large reduction in spending on tradeables in the future, is also a sustainable policy (think especially about a small country). Or a current tax reduction with a sufficiently large increase of taxes in the future should also do the job. What matters is the matching of government outlays and receipts in present value terms. This makes clear the point that sustainability depends crucially on fiscal management, that there exist degrees of freedom in the choice of instruments that will be adjusted to the exchange rate policy, and that there exist degrees of freedom as to the timing of use of these instruments.

This brings us to the second question; namely, what are the real effects of exchange rate management? It has been demonstrated by Helpman (1981) and Lucas (1982) that in the absence of distortions and in the presence of Ricardian equivalence, intertemporal balancing of the government budget ensures that exchange rate management will have no real effects. Namely, changes in the time pattern of the exchange rate will induce changes in the time pattern of reserve holdings and net debt which will not feed back into private decision making. Here the absence of distortions is crucial, as has been demonstrated, for example, by Aschauer and Greenwood (1983). In fact, the presence of distortions often destroys Ricardian equivalence, which is also essential for neutrality of exchange rate policies. However, Ricardian neutrality may not exist even in the absence of distortions, as happens for example when there are finite lifetimes of economic agents who live in different periods. In the latter case, which is of practical relevance, future tax liabilities are not fully incorporated into the budget constraints of the currently alive population, making the government's outstanding debt part of private wealth (see Leiderman and Blejer (1987) for a survey).

The latter case has been studied by Helpman and Razin (1987) in the context of an exchange rate freeze, using a Yaari-Blanchard type consumption function (see Blanchard (1985)). As an unexpected exchange rate freeze generates a capital gain for the currently alive population (because the unexpectedly low exchange rate level increases the real value of nominal asset holdings such as money balances) and this capital gain is not fully offset by future tax liabilities due to the absence of Ricardian equivalence, it brings about an increase in private consumption and a worsening of the trade account. Future tax liabilities increase because the exchange rate freeze brings about reserve loses which increase net government debt, and the servicing of the larger debt together with the solvency requirement imply the need for future reductions in the budget deficit. These are achieved in this exercise by means of higher taxes (expenditure cuts will be discussed at a later stage). As time goes by and the share of the population that enjoyed the capital gain declines while the share of the population that faces only tax liabilities increases, consumption tends to decline until it becomes lower than what it would have been in the absence of an exchange rate freeze. This demonstrates a channel through which exchange rate management leads to temporarily high private consumption, a worsening of the trade account, reserve losses, and larger government net debt[12]. These features were observed during the exchange-rate-managed disinflation attempts in Argentina and Chile in the late seventies, and Israel in 1982-83, which did not include budgetary restrain with the slowdown of devaluations (see Edwards (1985), Corbo, de Melo, and Tybout (1986), and Helpman and Leiderman (1987a)). In fact, these outcomes do not depend on the details of the particular model that has been described above; the logic of the argument applies to many circumstances in which future tax liabilities are not fully incorporated into the budget constraints of those who experience capital gains with the inception of exchange rate management. Moreover, the tendency towards an increase in aggregate spending is strengthened if one takes account of the existence of durables. The temporarily low real exchange rate, if indeed is perceived to be temporary, induces earlier purchases of durable consumer goods, stockpiling of industrial inventories, and earlier investment in machines and equipment, thereby increasing spending and causing reserve losses (see Dornbusch (1985)).

It is shown in Helpman and Razin (1987) that under these circumstances exchange rate management has real effects unless very specific tax policies

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[12]For an empirical test of this channel using time series data for Israel, see Leiderman and Razin (1987).

are implemented with the choice of an exchange rate path. These tax policies are intended to undo the redistributional effects of the exchange rate policy, and they are typically difficult to calculate. One major feature of these policies is that they require immediate adjustments--any postponment generates real effects.

In order to concentrate on other issues, assume for the rest of this section that there is no break-down of Ricardian equivalence as a result of finite lives. This leaves room for real effects that result from distortions or from different forms of budgetary adjustments. An example of the former is the recent analysis by Calvo (1986), who uses two models in which the nominal interest rate affects private real consumption. In the first case, which relies on an effective consumption cash-in-advance constraint, consumption is a decreasing function of the nominal interest rate. A temporary reduction in the rate of devaluation with an eventual recourse to money financing generates via the interest parity condition temporarily low interest rates. This is so because the eventual recourse to money financing leads to rates of devaluation that are equal to the rate of money growth, which is higher than the initially low rate of currency devaluation (see also van Wijnbergen (1986)). This is just another example of monetarist arithmetics (see Sargent and Wallace (1981)). Hence, consumption is high during the time span of low rates of currency devaluation, and low afterwards when money financing is pursued. In this case the initial rise in consumption in response to low interest rates worsens the trade account of the balance of payments and brings about added reserve losses, thereby generating effects which are similar to those described above. Observe, however, that while in the previous case the consumption and balance of payments effects stemed from a tilt in the consumption profile as a result of finite lifetimes, with no need to abandon exchange rate management, here it stems from the eventual abandonment of exchange rate management which leads to a distortion via a changing nominal interest rate. Which effect is more important is an empirical matter, although both produce similar results which seem to be consistent with the above-mentioned episodes.

In fact, after several months following the Argentine and Israeli plans of 1985, the consumption and trade data showed a noticeable similar pattern to what has happened during the above mentioned exchange-rate-based stabilization efforts, despite the presence of price and wage controls. One may therefore argue that the considerations that we have described have also a bearing on these episodes, because indeed following the initial major adjustments that were described in Section II what remained was essentially a fixed exchange rate policy. We will discuss the Israeli case in more detail at a later stage. Here, we would like to express our view that a reliance on a consumption function which depends on the nominal interest does not seem to be very satisfactory in the explanation of these events, and that we find the alternatives more appealing.

Expectations of an eventual abandonment of exchange rate management have played a major role in these and other episodes. The importance of this possibility for current macroeconomic performance has been formally studied in recent years, beginning with the work of Krugman (1979) (see, for example, Lizondo (1983), Obstfeld (1984), Flood and Garber (1984), Blanco and Garber (1986), van Wijnbergen (1986), and Drazen and Helpman (1987a,b)). The typical view was that a failure to support the exchange rate with current policies leads to the abandonment of exchange rate management and to money financing of the budget deficit (see, however, Drazen and Helpman (1987a,b) for the role of fiscal policy). Three major conclusions have emerged from this analysis. First, if the timing of the policy collapse is known with certainty, there will be no premium on foreign exchange, there will be typically a run on reserves just before the policy's collapse, and there will be no exchange rate jump at the collapse point. Second, if there is uncertainty, then there will be a risk premium on foreign exchange which will drive the nominal interest rate, and there will be typically an upward exchange rate jump at the collapse point. And third, balance of payments developments prior to the collapse depend on whether the collapse is followed by a fiscal adjustment and the nature of this adjustment, with the limiting case being a fiscal adjustment that prevents a collapse of the exchange rate policy.

These findings shed substantial light on the recent as well as earlier stabilization efforts, because in all of them exchange rate management was pursued without immediately balancing the budget. For this reason one can view these stabilization efforts as two stage programs: the first stage begins with exchange rate management and other adjustments, while in the second stage either a further fiscal adjustment takes place or the first-stage exchange rate policy is abandoned. More complicated variants are, of course, also possible, but the simple two-stage variant suffices in order to clarify the issues at hand.

Take as an example a modified version of the model that was discussed in the previous section. Now suppose that it deals with an open economy in which there are two goods; a traded and a nontraded good. The nontraded good replaces leisure. The utility function is:

$$u(c, c_N) + v(M/Q) \ ,$$

where c is consumption of traded goods, c_N is consumption of nontraded goods, and Q is a price index (a linearly homogeneous function of the price of traded and nontraded goods). Assume that there is free capital mobility and that the foreign currency price of traded goods is constant. The following discussion is based on Drazen and Helpman (1987a) (with a slight change of notation). If there is no uncertainty, the consumer's optimal program implies:

$$(2') \qquad v'(mq)q/\theta = r + \dot{\epsilon}/\epsilon,$$

where $m=M/\epsilon$ are real balances in terms of traded goods; $q=\epsilon P^{*}/Q$ is the real exchange rate, measured as the ratio of the price of traded goods to the price index Q; θ is the marginal utility of tradeables; and r is the foreign interest rate on foreign currency denominated assets.

Assuming for simplicity that the subjective discount rate β is equal to the interest rate r implies that the marginal utility of consumption of tradeables, θ, does not vary with time. Hence, if government spending on tradeables and nontradeables and its lump-sum taxes are constant during the first stage of the program; i.e., the stage at which it maintains an exchange rate freeze, then the constancy of the marginal utility of consumption of tradeables and market clearing imply constant private consumption of traded and nontraded goods (there is no growth). Therefore the real exchange rate is also constant during this phase. These considerations together with (2') imply that during the period in which the exchange rate is constant there is price stability (recall the discussion at the beginning of this section) and real money balances m are constant. However, real balance holdings depend on the marginal utility of consumption and on the real exchange rate.

Now suppose that the public expects the current exchange rate policy to be maintained forever, but as current macroeconomic policies imply a growing public debt that is inconsistent with solvency, the public expects a policy adjustment at a known date T. For simplicity, let the adjustment bring the economy to a steady state. Naturally, under these circumstances it cannot expect recourse to money financing, because money financing requires a positive rate of inflation, which is inconsistent with a fixed exchange rate in a steady state. It can be shown that if lump-sum taxes are expected to be used there is balance in the current account of the balance of payments prior to T, if a budget cut on traded goods is expected there is a deficit on current account, and if a budget cut on nontraded goods is expected there is a surplus on current account (provided the marginal utility of tradeables is increasing with the consumption of nontradeables). In the first two cases there is no run on reserves, while in the last case there is a run on reserves at T if the elasticity of the demand for money with respect to the interest rate is smaller than one--the usual case. If, on the other hand, the public expects the exchange rate policy to be abandoned at T and to be replaced by money financing of the budget deficit (the case originally analyzed by Krugman), there will be current account balance and a run on reserves at the policy switch point, but no exchange rate jump. In fact, every second-stage policy package that includes a budget cut on nontraded goods or recourse to money financing induces a run on reserves. The run on reserves is induced by a downward shift in the demand for money at the policy switch point. In the case of a budget cut on nontradeables the decline in the demand for money is caused by a depreciation of the real exchange rate while in the case of money financing it is caused by a rise of the nominal interest rate.

These considerations show clearly that a change in the public's expectations about the second-stage policy adjustment can induce shifts in consumption and the current account. Thus, for example, if the implementation of a program generates expectations of a second stage budgetary adjustment in the form of a budget cut on nontraded goods, and in the course of time these expectations change towards higher taxes or money financing, then the change of expectations will bring about an immediate worsening of the trade and current accounts. This seems to be relevant, for example, to the case of Israel in 1985, where the original plan included projections of budget cuts on nontradeable services, such as education and social services, but which were not forthcoming. If the public considered it to be a signal that they will not be forthcoming in the future as well, it might have induced a rise in consumption and a worsening of the trade account, which have indeed taken place.

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The cases considered so far imply that abandoning of exchange rate management produces no discontinuity in the exchange rate path. In practice, however, it seems that a typical collapse of an exchange rate policy involves a large discrete devaluation. The latter possibility (together with other relevant features) can be explained by the presence of uncertainty, especially about the policy switch time. This type of uncertainty introduces a risk premium in the mominal interest rate, which is equal to the product of the conditional density of a policy switch (that is, conditional on no switch taking place so far) and the capital loss on money holdings in the event a switch will take place now. If the above conditional density is rising with net government debt, then the nominal interest rate is rising over time and the demand for real balances is falling. The latter generates reserve losses (see Drazen and Helpman (1987b)). Hence, instead of a one-time run on reserves in the certainty case, in the case of uncertainty the adjustment starts early, and it is characterized by continuous reserve depletion. Moreover, in the uncertainty case the abandoning of exchange rate management induces a discrete devaluation, such as those observed in Argentina in 1981, in Chile in 1982, and in Israel in 1983. In fact, the existence of mass points in the probability distribution function or discontinuities in the density function of the timing of a policy switch generate runs on reserves that are not necessarily associated with an actual abandonment of exchange rate management. The economic interpretation of these characteristics is that the public believes that the particular point in time is a point at which a policy switch is most likely to take place, and they can be related to political or economic events.

Finally, the presence of uncertainty can contribute to the explanation of the very high real interest rates that have been observed immediately after the implementation of the programs that relied on an exchange rate freeze. Recall that the real interest rate is calculated as the difference between the nominal interest rate and the actual rate of inflation. If there is initially low confidence in the program, and in particular in the success of the exchange rate policy, the risk premium resulting from a possible policy switch may be substantial. This leads to high nominal interest rates. In this case a successful program that reduces at once the rate of inflation generates data which imply high real interest rates on the basis of this calculation. The less confidence there is in the policy, the higher will be the real interest rate. And by the same token, the more confidence the public develops towards the success of the program, the lower becomes the real interest rate.

V. Price-Wage Dynamics

The notion that the inflation rate includes an important inertial component was shared by those who shaped the stabilization plans of Argentina, Brazil, and Israel. The basic idea was that due to formal and informal indexation arrangements, to staggered price setting, to slowly adjusting expectations, and to the existence of monetary accommodation, the inflation rate is largely predetermined. In Dornbusch and Simonsen's (1987, p. 4) words,

> "Inertial inflation means that inflation today is approximately equal to what it was yesterday."..."The reason for this persistence or inertia is primarily formal or informal indexation interacting with staggered wage setting. This may take the form of a legally imposed wage rule according to which wage adjustments today are based on the inflation over the past year or the past six months. It may also be that much more informal wage bargaining may lead to the same result. Other than through wage indexation the same mechanism also works via expectations. In setting their prices firms will have to estimate their own cost increases and the price increases of competing firms. The best guess is that, cyclical and supply shock factors aside, inflation today will be approximately what it was yesterday."

Consequently, it was argued that anti-inflation policies are not likely to succeed unless they directly break the existing inflationary inertia.

The fact that movements in inflation have own-persistence is apparent from Table 5. The table gives sample autocorrelations of monthly inflation for Argentina, Brazil, and Israel. It can be seen that these autocorrelations start at relatively high levels, and decay slowly with increased lags. Whether this own-persistence proves the existence and importance of inflationary inertia is a controversial issue that we take up later on in this section.

[Table 5]

There are several ways in which inflationary inertia arising from wage-price dynamics can be modeled. One central view, which is evident from the above quotation, stresses the role of multiperiod nominal contracts and wage indexation (see, for example, Taylor (1980)).[13] As far as the latter is concerned, there can be formal agreements that stipulate wage increases in response to past price increases or current wage adjustments in anticipation of future price increases ('ex-post' and 'ex-ante' indexation, respectively, in the terminology of Fischer (1984)).

Given a path of nominal wages and a path of expected price movements, there is an implied expected path of real wages and employment, provided employment depends on real wages. If under these circumstances the rate of

[13] Apart from wage indexation, indexation of financial assets proves to be also important; it prevents the erosion of private wealth as a result of inflation. Consequently, the inflation tax can be collected only from money or near monies. Thus, the base of the inflation tax is relatively small, and it shrinks as inflation increases over time. These features justify the modelling of such economies as economies in which private holdings of nonmonetary assets, such as bonds, are denominated in real terms, as we have done in the previous sections, and as we will do in what follows.

inflation is unexpectedly reduced, say by a stabilization program, and the path of nominal wages remains unchanged, then real wages rise above and employment declines below the expected levels. Hence, there is an output cost associated with the disinflation, and this cost is due to nominal wage stickiness. Moreover, a given unexpected contraction of aggregate spending for disinflation purposes has a smaller disinflationary effect in the presence of backward looking wage indexation than in its absence. In order to attenuate the loss of output that is generated by disinflation under these circumstances, it is suggested to use wage controls at the start of a disinflation program. Such controls help also achieve a given disinflation with a smaller demand contraction.

This mechanism, that implies an inverse relationship between unexpected inflation and real wages, and a positive relationship between inflation and employment, may contribute to the explanation of certain short-run fluctuations in Argentina, Brazil and Israel. However, it cannot explain some major price, wage, and employment developments. If indeed this mechanism was the sole source of wage changes, then during inflationary periods, and especially during periods of rapid inflation, one would observe declining real wages and rising employment. In contrast to this prediction, there are major episodes in which high and accelerating inflation was associated with rising real wages. Thus, for example, the acceleration of inflation in Argentina from levels of around 100-150 percent per-year in 1981-82 to 300 and 600 percent levels in 1983-84 was accompanied by a large increase in real wages (more than 30 percent). Similarly, in Israel the rise of inflation from about 10-20 percent per year in the early 1970s to around 100 percent in the early 1980s was accompanied by a real wage increase of more than 20 percent, and the further acceleration of inflation to around 350 percent in 1984 was accompanied by a further rise of real wages of about 16 percent. In Israel in particular there was a secular upward trend in inflation, real wages, and employment during the seventies and early eighties, contrary to the predictions of the backward looking wage indexation model. These increases in real wages cannot be attributed to rising labor productivity and have to be attributed to other factors (see Helpman and Leiderman (1987b) for a further discussion of this point).

In order to deal with episodes in which inflation was associated with rising real wages, it is necessary to specify a wage process that does not rely entirely on backward looking indexation. We will describe such a process and use it to explain rising inflation with rising real wages. Apart from dealing with these secular trends, we will use the model to discuss empirical measurement of inflationary inertia, to derive policies that are helpful for disinflation, and to shed light on the observed policy packages. For this purpose we assume that wages are governed by forward looking considerations and, for simplicity, abstract from backward looking elements altogether. The following discussion is based on Helpman and Leiderman (1987b).

Our setup consists of a modified version of Blanchard's (1986) wage-price spiral model. In this framework firms set in advance nominal prices for a limited period of time, forming expectations about wage and demand developments in the future, and workers set in advance nominal wages for a limited period of time on the basis of expected future price developments. Prices and wages are set at different points in time, thereby representing nonsynchronization between these variables, a feature that is considered to be central to the understanding of these episodes (see Bruno (1986,1987) and Dornbusch and Simonsen (1987)). Monetary policy is assumed to be accommodative in a way that will be explained later. Monetary accommodation is believed to be relevant for Argentina, Brazil and Israel (see, for example, Bruno and Fischer (1986) for a discussion of Israel).

Assume that firms choose prices for a two period time interval in every even period t, and that workers choose the nominal wage rate for a two period time interval in every odd period t. Taking a Spence-Dixit-Stiglitz type specification of preferences for differentiated products with a constant elasticity of substitution (see Spence (1976) and Dixit and Stiglitz (1977)) and with a fixed number of firms, the decision problem of a typical firm in period t even is:

$$(3) \quad \max_{p_t} \; p_t d(p_t) - w_{t-1}\phi[d(p_t)] + \beta_t\Big[p_t d(p_t) - w_{t+1}\phi[d(p_t)]\Big], \qquad t \text{ even},$$

where p_t is the price set for two periods at time t (t even), w_t is the nominal wage set by workers at time t (where t is odd) for a two-period time interval, β_t is the one-period nominal discount factor (equal to one over one plus the nominal interest rate), $d(p_t)$ is the demand function and $\phi(d)$ is labor requirement per unit output (labor is the only variable input).

The demand function is given by

$$d(p_t) = (p_t/P_t)^{-\sigma} a_t \qquad \text{for all} \quad t,$$

where P_t is the price level, a_t is the level of real spending per firm, and σ is the elasticity of substitution and the elasticity of demand.

Workers choose the nominal wage rate for a two period time interval so as to ensure that the present value of two-period wages equals a predetermined present value of real purchasing power ω_t. Namely:

$$(4) \quad w_{t-1} + \beta_{t-1} w_{t-1} = \omega_{t-1}(p_{t-2} + \beta_{t-1} p_t) \qquad \text{for} \quad t \quad \text{even}.$$

Here ω represents the average real wage rate requested by workers, with the averaging taking into account the timing of payments.[14]

Equations (3) and (4) constitute the basic system describing wage-price dynamics. Assuming a constant real interest rate, with ρ denoting the real discount factor, and perfect foresight (we will discuss expectational errors at a later stage), these equations can be combined to yield (recalling that in this case $\beta_{t-1}=\rho p_{t-1}/p_t=\rho p_{t-2}/p_t$ and $\beta_t=\rho$ for t even):

$$(5) \quad 1 = R\,\frac{1+\rho}{1+\rho a_{t+1}/a_t}\left[\frac{\omega_{t-1}\phi(a_t)}{x_t+\rho} + \frac{\omega_{t+1}\phi(a_{t+1})x_{t+2}}{x_{t+2}+\rho}\,\rho a_{t+1}/a_t\right] \quad \text{for} \quad t \quad \text{even},$$

[14] The wage determination rule that is described in (4) corresponds to 'ex-ante' indexation in the terminology of Fischer (1984). In his model this type of indexation leads to a shorter recession with a smaller sacrifice ratio in terms of lost output than backward looking indexation.

where $R=(1-1/\sigma)^{-1}$ is the markup coefficient, $P_t=p_t$, $x_t=p_t/p_{t-2}$ (i.e., one plus the two period inflation rate) and $\phi(\cdot)$ is the marginal labor requirement (the derivative of $\Phi(\cdot)$).

Equation (5) describes the evolution of inflation as an implicit function of the markup, the real interest rate, the evolution of real wages and the evolution of demand. This is a forward looking equation in which current inflation x_t depends on expected future inflation x_{t+2}.

First consider the case in which real spending, the required real wage rate, and the inflation rate are constant. In this case, (5) reduces to:

$$(6) \quad R\omega\phi(a) = \frac{x + \rho}{\rho x + 1} .$$

It is easy to see that for posisitive real interest rates ($\rho<1$) the rate of inflation is higher the higher the markup, the required real wage rate, the marginal labor requirement, and the lower the real interest rate. If marginal labor requirement is rising with output (i.e., marginal costs are increasing), then inflation will be higher the larger real spending.

In order to discuss inflationary dynamics, we assume a positive real interest rate, and for simplicity we also assume that real spending and the required real wage rate are constant. Then the inflationary dynamics can be described by means of Figure 3. The curve that relates x_{t+2} to x_t is rising, going to infinity as x approaches $\bar{x}$ from below, and going to minus infinity as x approaches $\bar{x}$ from above. It intersects the 45^o line at the steady state point A, with a slope larger than one. It is clear from the figure that perfect foresight and expected positive prices require expected and actual rates of inflation to be in the interval $(\underline{x}, \bar{x})$ in all time periods. This, however, is satisfied if and only if the expected rate of inflation is equal to the steady state level. Hence, in this case perfect foresight leads to a constant rate of inflation, equal to the steady state level.

[Figure 3]

Consider an economy in a steady state equilibrium at point A in Figure 3, with $R\omega\phi > 1$, which implies a positive rate of inflation. In order to reduce the long run inflation rate it is required to reduce the real wage rate ω, or the markup R, or the marginal labor requirement ϕ, or to increase the real interest rate. If this is done, the curve in Figure 3 shifts to the north-west, so that the new steady state point is to the left of A on the 45° line. With perfect foresight, expectations adjust immediately to the new long-run level, and so does the actual rate of inflation. No other expectations are consistent with perfect foresight and positive prices in all time periods. Hence, in this case there can be no gradual transition to the new long-run equilibrium--there is no inflationary inertia. In fact, long-run feasibility, perfect foresight, and a positive real interest rate, imply that every permanent shock leads to an immediate adjustment of the rate of inflation to its new steady state level. Naturally, transitory disturbances do generate gradual adjustment (see below).

This model predicts that a once and for all increase in the real wage rate, in the profit rate (the markup), or in real spending (when the marginal labor requirement is rising with output), lead to a once and for all increase in the inflation rate. Thus, it can account for a time series of inflation rates in the form of "steps" -- as has been argued by some observers to have existed in Israel (see e.g.Bruno (1986)). On the other hand, it is inconsistent with the view that a one time expansionary nominal shock leads to inflationary inertia and to an eventually ever higher inflation rate (see Liviatan and Piterman (1986)), despite the fact that we assume a fully accommodating monetary policy; here real permanent shocks are required for the inflation rate to change in steps.

This model suggests that the rate of inflation can be reduced by means of an incomes policy (provided the nature of the price and wage determination processes does not change, such as the length of time during which nominal prices are fixed). The policy should consist of a reduction in the real wage rate or the profit rate. Naturally, monetary and fiscal adjustments are required to support the reduction in the rate of inflation; we will discuss these necessary adjustments in subsection B. While it has been argued that price and wage controls are needed in order to break inflationary inertia (see, for example, Dornbusch (1982)), this forward looking model of a wage-price spiral does not support this claim (backward looking wage indexation can justify such claims, as we have described above). On the other hand, an incomes policy by means of price and wage controls can be helpful under some circumstances in bringing about a decline in the real wage or markup that are needed for disinflation purposes. The argument that controls were needed in order to bring about a reduction in real wages was central in the design of the Israeli program. This, however, is not the only incomes policy that can achieve this result, and the model is silent on the issue of which incomes policies are relatively more efficient.

The model highlights the importance of inflationary expectations. In particular, it supports the view that in a stabilization program that is based on a permanent change in the relevant parameters, it is necessary to also change inflationary expectations. For suppose the public does not believe that the change is permanent. Then it does not reduce its inflationary expectations to the new long-run steady state level. Suppose that the permanent policy change shifts the long-run equilibrium from point B in Figure 3 to A. If inflationary expectations remain temporarily at the old level, then inflation will start rising. And if they do not adjust in the course of time, then they will lead to nonfeasibility. Naturally, rational economic agents are expected to adjust their expectations, and the exact path of transition depends on the nature of this adjustment. Hence, in order to avoid temporarily high inflation rates, it is important to influence expectations by convincing the public that the change is permanent. Some argue that this can be achieved by price controls (see Dornbusch and Simonsen (1987)). However, the considerations that lead to this claim, as well as the broader issues of a policy's credibility and the public's adjustment of expectations, are outside the scope of the present model.

We have already discussed permanent changes in the markup, the real wage rate, the real interest rate, and real spending. However, since in the observed stabilization programs there were also temporary changes in these variables, we now discuss the effects of such changes. Consider an economy in a high inflation equilibrium, say at point C in Figure 3. Now suppose that the authorities bring about a permanent reduction in the markup or the real wage rate, so that the new long-run equilibrium is at point B, at which the inflation rate is lower. However, suppose that the program brings about a temporarily larger drop in the real wage rate and markup, to a temporarily higher real interest rate, and to a temporary real spending decline. These are features of the Argentine and Israeli data. Under these circumstances the real wage rate, the markup, and real spending and output are expected to increase over time, while the real interest rate is expected to decline. In this case the curve that is relevant for a description of the dynamic trajectory is located to the left of point B, such as the curve that goes through point A. This curve will typically shift over time. However, for expositional purposes, suppose it does not. Then the arrowed path describes the resulting dynamics, where the length of time during which the temporary parameters are in effect determines the initial point; the system has to hit B at the point in time at which all the underlying parameters reach their new steady state values. It is clear from the figure that under these circumstances the inflation rate drops on impact and rises thereafter, until it settles at the new steady state level. This pattern does not change when there are upward shifts in the curve as a result of a gradual adjustment of the real wage, the markup, the real interest rate and real spending. The initial undershooting of the inflation rate in response to a temporary overshooting of the real interest rate, real wage decline, and real spending decline, followed by a gradual upward adjustment of the inflation rate, seems to fit the facts reported in Section II.

In this model employment is demand determined. Hence, in the last example employment decreases on impact, along with the decrease in demand, and rises later on as demand picks up over time, as has happened in Argentina and Israel. Different inflation rates can be associated with a given level of employment, provided real spending is constant. Conseqently, disinflation does not require lower employment, not even temporarily.

This discussion was based on the assumption that monetary policy is fully accommodative. If during an inflationary period money growth is not accommodated to the inflation rate, then the real value of nominal assets is reduced. If this brings about a decline in real spending, the result is lower output and employment. Moreover, if real spending is expected to decline, these expectations lead to upward pressure on the inflation rate. Naturally, this presumes that the mechanism of price and wage determination does not change in face of rising unemployment, which is not plausible. One may expect ω to change in face of prolonged unemployment, and one may also expect under these circumstances changes in the process of wage-price determination.

A. Implications for Measured Real Wages

We now consider implications for measured real wages $w_t/P_t=w_t/p_t$. This discussion is confined to steady states. It can be shown that in the present model, starting with a positive rate of inflation, an increase in the rate of inflation increases the periodic fluctuations in the measured real wage rate, irrespective of the factor that causes the rate of inflation to rise (be it the markup, the real wage ω, real spending, or the real interest rate).

Clearly, the measured real wage rate is larger in odd periods (in which the nominal wage is adjusted) and smaller in even periods (in which prices are adjusted). Figure 4 describes the time pattern of measured real wages. The difference between the solid graph and the broken-line graph is that in the latter ω is larger than in the former (and so is the resulting inflation rate). An increase in the rate of inflation via an increase in ω increases the measured real wage rate in odd periods and reduces it in even periods. And if ω increases and R declines so that $R\omega$ does not change, and therefore the rate of inflation does not change too, this induces an increase in fluctuations of the measured real wage rate. The peak real wage goes up and the trough real wage declines. Fluctuations in the real wage rate also reflect fluctuations in the share of labor in output. Although the fluctuations in real wages depicted in Figure 4 are similar to fluctuations that result from backward looking wage indexation (see, for example, Dornbusch and Simonsen (1987)), they are caused by entirely different factors.

[Figure 4]

B. Closing the model

We have discussed price-wage dynamics under the assumption that the monetary authority pursues an accommodating monetary policy, assuming a given time pattern of real spending a_t. It is shown in Helpman and Leiderman (1987b) that there exists a wide range of spending patterns that are consistent with general equilibrium considerations, given that individuals maximize the discrete-time analogue of the objective function employed in previous sections; i.e.,

$$\sum_{t=0}^{\infty} \rho^t [u(c_t) + v(M_t/p_t)],$$

subject to the usual intertemporal budget constraint. However, this requires the government to pursue an appropriate budgetary policy in order to accommodate the demand for money and ensure solvency. Thus for example, if disinflation leads to a loss of inflation tax revenue, it is necessary to increase other taxes or to reduce spending. The timing of these adjustments is not unique, although credibility considerations suggest to make them as soon as possible, and in particular with the inception of a stabilization program.

It can be shown that in this setup employment is determined by real spending and that there exists a continuum of equilibria which differ in employment levels. This point is important, because it shows that in an environment in which workers make wage demands irrespective of employment, and oligopolistic firms price goods according to MR=MC, real demand management plays a role in the determination of employment.

C. Price-wage controls

We have seen that price-wage controls have been part of several of the stabilization plans described above and we have already discussed some of the rationales for their use. Here we expand the discussion of the role of controls. Three of the arguments for controls are based on the need to break inflationary inertia; inertia that is claimed to arise from backward looking wage indexation, from the staggering of price setting, and from a slow adjustment of inflationary expectations. We have already dealt with the first type of inertia. Indeed, in that case wage controls can break the inertia and enable disinflation with lower transitional output and employment costs. Observe, however, that in this case there is no need for price controls; the control of nominal wages cuts off current inflation from past wage contracts. Nevertheless, it is sometimes argued that labor unions refuse to agree to a wage freeze without price controls and the fixing of the exchange rate. This was indeed the Israeli case.

The second argument is based on the notion that prices are not adjusted continuously and that different firms adjust prices at different points in time (see, for example, Sheshinski and Weiss (1977) and Blanchard (1983)). In this case a reduction in money growth and in aggregate demand brings about disinflation at a slower pace than in an economy with synchronized price setting. Therefore, by bringing about faster synchronization of price adjustments price controls are thought to be a mechanism that speeds up the disinflation process. To the extent that price staggering coexists with backward looking wage indexation, these arguments call for wage and price controls, with part of the price controls being achieved by means of fixing the exchange rate.

The third argument concerns expectations. It is argued that in an economy with a history of inflation and failed disinflation efforts, inflationary expectations do not decline on impact with the inception of a stabilization program. Rather, expectations adjust slowly as there is a gradual process of learning of the new policy and its degree of success. Under these circumstances effective price controls may speed up the downward adjustment of inflationary expectations.

Having explained some of the main arguments advanced by proponents of wage and price controls in recent stabilization programs, we now discuss some of the difficulties that arise from their use. The foremost difficulty is to choose the controled levels of wages, prices, and the exchange rate so as to make them compatible with each other and with the underlying monetary and fiscal policies. This is especially the case if controls are to affect expectations so as to make the disinflation policy credible. Incompatibility of these choices may lead to shortages, to unemployment, and to speculative attacks on the exchange rate, thereby endangering the entire stabilization program. This is more so once it is recognized that an economy is subjected to regular random shocks, and in particular in view of the uncertainties that are generated by a major stabilization program per-se. In the Israeli case, for example, the external shocks, e.g. the decline of the dollar to which the domestic currency was pegged and the decline in raw material prices, were rather favorable, in the sense that they helped sustain the fixed exchange rate policy. It is not clear, however, how succesful the policy would have been in the presence of adverse external shocks.

Since there are economic costs associated with controls, with part of the costs stemming from the risks associated with the ability to sustain them for a prolonged period of time, it is necessary to carefully weigh these costs against potential benefits that they may contribute to the disinflation process. This cost-benefit calculation has also to take into account the eventual need to remove the controls, and the effects of uncertainty about how and when they will be removed and the consequences of their removal. Brazil is a case in point which shows apparent high costs associated with the controls-policy. These costs showed up in the form of shortages, black markets, and the disruption of economic efficiency. Israel is a case in point which shows that controls may be not very costly. In this case there were no apparent shortages, black markets, or disruption of economic efficiency. The major difference between these countries appears to be that the initial alignment of controled prices, wages, the exchange rate, and monetary and fiscal policies was approximately compatible in Israel (with external shocks enhancing this compatibility), but it was not in Brazil.

We now turn to an examination of the implications of price-wage controls in the context of our specific model. While the model is not capable to shed light on the role of controls in breaking inflationary inertia that stems from backward looking wage indexation, it does provide some insights on the other two arguments. Moreover, it helps to explain why controls need not lead to shortages, and their role in the incomes policy that is required in order to disinflate in the presence of price-wage staggering.

The first thing to be noticed is that in the presence of such controls the previous wage- and price-setting equations are no longer relevant, because price controls prevent firms from choosing prices and wage controls prevent workers from choosing wage rates. In particular, if the government imposes a price-wage combination in all time periods, firms can only choose how much to produce up to the demanded quantity of goods while workers can only choose how much to work up to the demanded quantity for labor. Hence, employment is determined by the demand for labor.

In order to analyze the effects of controls on output and in order to see whether they will result in shortages, it is useful to contrast competitive with oligopolistic market structures (the following discussion is based on Helpman (1987)). Panel (a) in Figure 5 describes a competitive market in which D is the demand curve and MC is the marginal cost curve, assuming that a unit of labor produces a unit of output (this assumption sharpens the analysis). In a competitive equilibrium price equals marginal costs and the supplied quantity is determined at the intersection point A. Now, if the government imposes price-wage controls in the form of upper ceilings, then the wage controls shift down MC and the price controls are effective only if the controled price is below the new wage rate (otherwise the equilibrium price is lower than the price ceiling). Hence, with effective price controls at the level p^c shortages (excess demand) arise.

[Figure 5]

Now consider an oligopolistic market structure. The marginal cost, demand, and marginal revenue curves of a typical firm are described in Panel (b). Without price controls the intersection of the marginal cost with the marginal revenue curve at point A determines the profit maximizing quantity and price p. In the presence of price-wage controls there are two relevant possibilities. The first arises when the price ceiling p^c is above the wage rate but below the profit maximizing price, as drawn in the figure (taking now MC to represent marginal costs at the controled wage rate). In this case the controls make marginal revenue to be horizontal at the level p^c up to point B, then dropping to C, and coinciding with the MR curve for larger quantities. The firm's optimal policy is to supply the demanded quantity at the controled price; there are no shortages. The firm is making positive profits, with p^c-w being the profit margin.

The second case arises when the controled price drops below the wage rate. In this case supply drops to zero, just like in the competitive case, and shortages emerge.

In the wage-price spiral model, the market structure is oligopolistic. Hence, price-wage controls with the property $w^c \leq p^c$ need not bring about the ceasation of production. Assume that this is indeed the case. Then inflation stops immediately, firms supply the resulting demand, and employment is determined by the demanded output level. The government is requested to accommodate the demand for money and to be intertemporally balanced.

Two additional points should be noted. First, it is still the case that output and employment can be at a continuum of levels; expectations of many employment levels are self-sustaining. Second, the model implies that in order to stop inflation it is sufficient to control either prices or wages. Naturally, the choice of instrument affects the distribution of income between labor and profits, but both lead to price-wage stability. Price-wage controls enable a choice of a specific income distribution. In Israel, for example, the plan has caused a major income redistribution from profits to wages (the share of wages in domestic income has risen by about seven percentage points between 1984 and 1986).

In relating this model-specific analysis to the observed disinflation programs, we draw the following main conclusions. First, the existence of an oligopolistic market structure may account for the casual observation that price controls did not lead to shortages in Argentina and Israel (although this has to be qualified by noting that some of the controls were not effective). Second, as explained in detail in Helpman (1987), this type of market structure can also account for the observed comovement of real wages, employment, and the trade account in Israel during the period of price controls-- namely, the rise in real wages and employment and a deterioration of the trade account, starting with the last quarter of 1985; comovements that are not readily explainable by a model with a competitive market structure. And third, although wage and price controls may contribute to disinflation in an economy characterized by a price wage spiral of the above-described type, they are not the only instruments that can achieve it. Hence, even in those cases in which an incomes policy is required, our analysis does not identify apparent advantages to these types of controls.

D. Testing for inertia

The existence and relevance of inertia in the above discussed inflationary episodes is an open empirical question. It has been quite common (at least in the Israeli debate on this issue) to use autoregressive representations for inflation in order to empirically assess inertia.

Consider for example the analysis by Bruno and Fischer (1986). They show that in quarterly inflation autoregressions for Israel, the size and sum of coefficients on the first and second lags have increased over time along with the inflation rate. For 1965:I-1971:I this sum is 0.56, for 1975:III-1978:IV it is 0.87, and for 1979:I-1982:IV it is 1.04. Their conclusion is that the evidence supports the notion that there is considerable inertia in the inflationary process in Israel and that this inertia has been growing over time.

In what follows we use the foregoing analytical framework of wage-price dynamics in order to point out some limitations of this approach and to suggest an alternative route for empirical research. An important limitation of using inflation autoregressions to assess inertia is that in the countries under study the inflation rate is nonstationary. Consequently, some of the inflation autocorrelations are likely to be spurious and may not neccessarily capture the inertia phenomenon. In order to illustrate this point, we have estimated inflation autoregressions without and with the inclusion of a deterministic time trend variable[15]. Instead of using them directly, we have calculated the implied moving average representations (or impulse response functions) given in Charts 8, 9 and 10. We have used monthly data for

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[15]Obviously, other detrending methods could be used; see Nelson and Plosser (1981) and Watson (1986). As it will become clear later on, our view is that this issue should be resolved on the basis of what is implied by the theoretical model being investigated. The AR equations that we estimated regress the inflation rate on a constant and six lagged values of inflation. As explained in the text, we also ran these equations with the addition of a time trend term.

Argentina (80:5-84:12), Brazil (73:1-85:12), and Israel (70:12-83:9), where in each case the time period is chosen so that there is no apparent break in the inflation process.

[Charts 8,9,10]

The evidence in the charts is quite clear. When time trends are not included, there seems to be some own persistence of shocks to the rate of inflation. However, the results are sensitive to inclusion of a time trend in the autoregressions. When this is done, the impulse response functions show that a one-time inflation shock has only short-lived effects on subsequent inflation rates, thereby raising doubts about the existance of inertia. These findings hold for all three countries.

Having established that findings from inflation autoregressions are not robust with respect to the inclusion of a time trend variable, the next question is why, if at all, such a variable should be included in the equations? And more generally, what seems to be a proper test of inertia? To answer these questions, let us go back to the price-wage spiral model developed in this section. Equation (5) gives the model's implicit solution for the inflation rate as a nonlinear function of the markup, the evolution of required real wages, the real interest rate, the evolution of demand, and expected future inflation. Clearly, for some configurations of changes in these factors over time (e.g., rising real wage rates and constant real spending) the model is capable of generating a highly persistent series of inflation rates, of the type that have been used to claim the existence of inertia, despite the fact that the model does not produce inertia per-se.

Hence, univariate inflation autoregressions do not provide direct evidence on inflationary inertia. In order to test the hypothesis of inflationary inertia, it is necessary to formulate a model that embodies it, and face it with data.

VI. Concluding Remarks

Recent stabilization programs have been generating evidence which enables close examinations of competing views about the desirability of various policies. Although it is premature to reach final judgement on existing controversies, we draw some tentative conclusions at the present time.

First, an immediate reduction of the budget deficit is important for successful disinflation. Postponment of this adjustment need not fail a program, but only if the government succeeds to build up confidence in its fiscal discipline by other means. An immediate reduction of the deficit seems like an effective means of generating credibility, even if further adjustments may be required in the future. Argentina, Bolivia and Israel are cases in point. All these countries used immediate fiscal adjustments, despite the fact that it was clear at the time that further adjustments will be needed (including Israel which did not have a budget deficit in 1986, but in which some revenue was only temporary, such as certain taxes and emergency foreign aid). Brazil, on the other hand, did not rely on a contractionary fiscal policy in the Cruzado Plan, and was indeed the least successful in combating inflation.

Second, a credible exchange rate freeze does not necessarily eliminate inflation, and it does not seem to be a prerequisite for a quick reduction of the inflation rate. The latter point is illustrated by Bolivia's program, which did not include such a freeze. The former is illustrated by the other programs. In fact, the entire issue of the role of an exchange rate freeze is difficult to resolve on the basis of recent experience. The difficulty is most apparent in the case of Israel, which has maintained a fixed exchange rate longer than the other countries. On the one hand, the accompanying policies, and in particular fiscal policy, were most supportive, and the decline in the dollar, oil prices, and other commodity prices (which were to a large extent unexpected), helped greatly to sustain the fixed exchange rate. Hence, unexpectedly favorable external circumstances were instrumental in supporting the exchange rate policy. On the other hand, there was indeed hardly any pressure on the exchange rate, and its time path helped to reduce inflation through a decline in the rate of increase of the price of traded goods. But inflation was not eliminated. Rising spending that began in the fourth quarter of 1985, which was fed by private consumption, drove up prices of nontraded goods.

In assessing the usefulness of exchange rate targets in a stabilization package, it is necessary to take into account the degree to which the central bank can control intermediate monetary targets, such as credit. In some cases, such as Argentina and Israel, the institutional structure makes monetary control difficult to attain. When this is coupled with the fact that a major stabilization program brings about large shifts in the demand for financial assets, it may be concluded that it is sometimes preferable to supplement intermediate targets with exchange rate targets, despite the well known dangers of exchange rate management. In retrospect it seems that, under the prevailing circumstances, the exchange rate freeze contributed successfully to the disinflation in Israel.

Third, the experience of Argentina and Israel shows that price and wage controls did not generate shortages and severe disruptions, although this statement has to be qualified in view of the fact that it is not clear how effective these controls have been in practice (especially in Argentina). But the experience of Brazil shows that controls may lead to substantial shortages and disruptions. Differences in the programs of these countries show that in order to avoid these phenomena, a careful alignment of relative prices and aggregate spending are required before the imposition of controls. This may be possible for economies in which oligopolistic market structures are prevalent. Under these circumstances controls need not cause severe losses of employment and output. On the other hand, prolonged controls may be quite damaging, even if the resulting harmful effects are not as visible as shortages, because relative prices can hardly be expected to be at their efficient levels. It is clear from our analysis and from Bolivia's experience that successful disinflation can take place without controls. And even in the case of Israel, which implemented a succesful 'heterodox' program so far, price controls seem to have played a minor role in the disinflation process relative to budgetary, monetary, wage and exchange rate policies.

REFERENCES

Aschauer, D., and Greenwood, J. (1983) "A Further Exploration in the Theory of Exchange Rate Regimes," Journal of Political Economy 91: 868-75.

Bental, B., and Eckstein, Z. (1987) "Inflation, Deficit and Seignorage with Epected Stabilization," to appear in Economic Effects of the Government Budget, (eds.) Elhanan Helpman, Assaf Razin and Efraim Sadka, The MIT Press.

Blanchard, O. J. (1983) "Price Asynchronization and Price Level Inertia," Inflation, Debt, and Indexation, (eds.) Rudiger Dornbusch and Mario Henrique Simonsen, The MIT Press.

——— (1985) "Debt, Deficits and Finite Horizons," Journal of Political Economy 93: 223-47.

——— (1986) "The Wage Price Spiral," Quarterly Journal of Economics CI: 543-66.

Blanco, H., and Garber, P. (1986) "Recurrent Devaluation and Speculative Attacks on the Mexican Peso," Journal of Political Economy 94: 148-66.

Blejer, M.I. and Liviatan, N. (1987) "Fighting Hyperinflation: Stabilization Strategies in Argentina and Israel, 1985-86," manuscript, International Monetary Fund.

Bruno, M. (1986) "Sharp Disinflation Strategy: Israel 1985," Economic Policy 2: 379-402.

——— (1987) "Israel's Stabilization: The End of the Lost Decade?" Economic Quarterly 37: 914-925 (Hebrew).

——— and Fischer, S. (1986) "The Inflationary Process: Shocks and Accommodation," The Israeli Economy: Maturing Through Crises, (ed.) Yoram Ben-Porath, Harvard University Press.

Calvo, G.A. (1986) "Temporary Stabilization: Predetermined Exchange Rates," Journal of Political Economy 94: 1319-29.

Cavallo, D.F., and Pena, A. (1983) "Deficit Fiscal, Endeudamiento del Gobierno y Tasa de Inflacion: Argentina, 1940-1982," Estudios Economicos, April-June.

Corbo, V., de Melo, J., and Tybout, J. (1985) "What Went Wrong with the Recent Reforms in the Southern Cone," Economic Development and Cultural Change : .

Dixit, A., and Stiglitz, J.E. (1977) "Monopolistic Competition and Optimum Product Diversity," American Economic Review 67: 297-308.

Dornbusch, R. (1982) "Stabilization Policies in Developing Countries: What Have We Learned?," World Development, 10: 701-8.

——— (1985) "External Debt, Budget Deficits, and Disequilibrium Exchange Rates," International Debt and the Developing Countries, (eds.) Gordon W. Smith and John T. Cuddington, The World Bank.

——— and Simonsen, M.H. (1987) "Inflation Stabilization With Incomes Policy Support: A Review of Recent Experience in Argentina, Brazil and Israel," Group of Thirty, New York.

——— and Fischer, S. (1986) "Stopping Hyperinflation: Past and Present," Weltwirtschaftliches Archiv CXXII: 1-46.

Drazen, A., and Helpman, E. (1986) "Inflationary Consequences of Anticipated Macroeconomic Policies," working paper no. 2006, N.B.E.R.

———— and ———— (1987a) "Stabilization With Exchange Rate Management," forthcoming in the Quarterly Journal of Economics.

———— and ———— (1987b) "Stabilization With Exchange Rate Management Under Uncertainty," to appear in Economic Effects of the Government Budget (eds.) E. Helpman, E. Sadka and A. Razin, The MIT Press.

Edwards, S. (1985) "Stabilization with Liberalization: An Evaluation of Ten Years of Chile's Experiment with Free Market Policies, 1973-1983," Economic Development and Cultural Change : 223-54.

Fischer, S. (1984) "Real Balances, the Exchange Rate and Indexation: Real Variables in Disinflation," NBER Working Paper No. 1497, forthcoming in Quarterly Journal of Economics.

———— (1986) "Exchange Rate Versus Money Targets in Disinflation," in his Indexing, Inflation, and Economic Policy, The MIT Press.

Flood, R.P., and Garber, P. (1984) "Collapsing Exchange-Rate Regimes: Some Linear Examples," Journal of International Economics 17: 1-14.

Helpman, E. (1981) "An Exploration in the Theory of Exchange-Rate Regimes," Journal of Political Economy 89: 865-90.

———— (1987) "Macroeconomic Effects of Price Controls: The Role of Market Structure," working paper 3-87, The Foerder Institute, Tel-Aviv University.

———— and Drazen, A. (1986) "Future Stabilization Policies and Inflation," to appear in Finance Constraints, Expectations and Macroeconomics, (eds.) M. Kohn and S.C. Tsiang, Oxford University Press.

——————— and Leiderman, L. (1987a) "Slowing Down of Devaluation, Monetary Accommodation, and Inflation: A Comparison of Argentina, Chile and Israel," Economic Quarterly , forthcoming (Hebrew).

——————— and ——————— (1987b) "The Wage-Price Spiral and Inflationary Inertia," manuscript, Tel-Aviv University.

——————— and Razin, A. (1987) "Exchange Rate Management: Intertemporal Tradeoffs," American Economic Review 77: 107-123.

Knight, P.T., McCarthy, F.D., and van Wijnbergen, S. (1986) "Escaping Hyperinflation," Finance and Development 23: 14-7.

Krugman, P.R. (1979) "A Model of Balance-of-Payments Crises," Jornal of Money, Credit, and Banking 11: 311-25.

Leiderman, L., and Blejer, M.I. (1987) "Modelling and Testing Ricardian Equivalence: A Survey," International Monetary Fund, Working Paper 87/35.

——————— and Razin, A. (1987) "Testing Ricardian Neutrality with an Intertemporal Stochastic Model," working paper, The Foerder Institute, Tel-Aviv University.

Liviatan, N., and Piterman, S. (1986) "Accelerating Inflation and Balance of Payments Crises, 1973-1984," The Israeli Economy: Maturing Through Crises, (ed.) Yoram Ben-Porath, Harvard University Press.

Lizondo, J.S. (1983) "Foreign Exchange Futures Prices under Fixed Exchange Rates," Journal of International Economics 14: 69-84.

Lucas, R.E. (1982) "Interest Rates and Currency Prices in a Two-Country World," Journal of Monetary Economics 10: 335-60.

Nelson, C.R., and Plosser, C.I. (1981) "Trends and Random Walks in Macroeconomic Time Series: Some Evidence and Implications," Journal of Monetary Economics 10: 139-62.

Obstfeld, M. (1984) "Balance-of-Payments Crises and Devaluation," Journal of Money, Credit, and Banking 16: 208-17.

Sachs, J. (1986) "The Bolivian Hyperinflation and Stabilization," working paper no. 2073, N.B.E.R.

Sargent, T.J. (1982) "The Ends of Four Big Inflations," Inflation: Causes and Effects, (ed.) Robert E. Hall, University of Chicago Press for N.B.E.R.

———— and Wallace, N. (1981) "Some Unpleasant Monetarist Arithmetic," Federal Reserve Bank of Minneapolis Quarterly Review :1-17.

———— and ———— (1987) "Inflationa and the Government Budget Constraint," in Economic Policy in Theory and Practice, (eds.) Assaf Razin and Efraim Sadka, Macmillan.

Sheshinski, E. , and Weiss, Y. (1977) "Inflation and Costs of Price Adjustment," Review of Economic Studies 50: 287-303.

Spence, M. (1976) "Product Selection, Fixed Costs, and Monopolistic Competition," Review of Economic Studies 43: 217-36.

Taylor, J. (1980) "Aggregate Dynamics and Staggered Contracts," Journal of Political Economy 88 : 1-23.

van Wijnbergen, S. (1986) "Fiscal Deficits, Exchange Rate Crises and Inflation," to appear in Economic Effects of the Government Budget (eds.) E. Helpman, A. Razin, and E. Sadka, The M.I.T. Press.

Watson, M.W. (1986) "Univariate Detrending Methods with Stochastic Trends," Journal of Monetary Economics 18: 49-75.

TABLE 1: MACROECONOMIC INDICATORS FOR ARGENTINA (1983:I - 1986:IV)

Period		Inflation (% monthly)	GDP (Index)	Industrial Employment (Index)	Industrial Real Wage (Index)	Budget Deficit (%of GDP)	M1 Growth (% monthly)	M5 Growth (% monthly)	Real Interest rate (% monthly)	Real Exchange rate(Basket index)	Real Exchange rate($ index)	Trade account ($ mil.
1983	I	13.40	100.00	101.80	86.80	7.00	3.70	7.40	0.80	120.00	124.40	957.0
	II	11.70	104.20	100.40	96.10	8.25	14.70	12.30	0.07	108.90	118.90	922.0
	III	17.00	109.10	97.70	104.90	9.00	9.40	11.90	3.83	93.70	111.10	793.0
	IV	18.00	112.26	100.20	112.30	15.80	28.90	22.30	1.93	99.20	120.00	660.0
1984	I	16.60	114.73	104.40	120.60	12.50	14.10	17.00	1.38	94.50	110.20	1294.0
	II	17.80	119.21	102.80	127.60	12.30	17.90	15.40	3.67	88.20	106.10	1350.0
	III	22.90	120.28	101.30	128.50	9.75	11.00	14.40	8.90	81.60	102.80	754.0
	IV	18.00	123.89	103.10	131.60	10.75	23.20	18.10	1.20	93.90	93.70	124.0
1985	I	24.10	122.40	108.00	122.00	11.50	12.90	19.80	1.33	91.20	121.00	830.0
	II	28.40	116.77	100.30	116.20	12.30	33.00	35.30	4.17	99.67	128.70	1642.0
	III	3.80	107.31	93.80	105.10	3.30	12.20	11.00	4.63	109.00	135.70	1331.0
	IV	2.50	103.56	94.40	103.20	5.60	11.50	7.10	3.70	107.70	128.00	782.0
1986	I	3.10	103.97	98.90	105.30	4.50	0.80	4.60	3.77	105.30	117.70	550.0
	II	4.40	109.90	94.40	105.60	2.80	7.90	6.40		102.00	109.30	722.0
	III	7.50		92.50		2.60				102.30	102.00	582.5
	IV	5.36								100.00	99.00	582.5

Notes: Inflation is measured by the percentage change in the CPI. Industrial employment is an index of the number of workers, and the industrial real wage is an index of average hourly real wages. The budget deficit(measured by cash flows)includes the nonfinancial public sector and the central bank and is expressed as a percentage of GDP. Real interest rates are regulated 30 days borrowing rates minus monthly inflation. Real exchange rates are adjusted for differentials in consumer prices. The sources are: **International Financial Statistics**, published by the IMF; **Novedades Economicas** and **Newsletter**, published by Fundacion Mediterranea, Cordoba, Argentina; and **Indicadores de Countura**, published by FIEL, Buenos Aires, Argentina.

TABLE 2: MACROECONOMIC INDICATORS FOR ISRAEL
(1983:I - 1986:IV)

Period		Inflation (% monthly)	GDP (Index)	Employment (thousands)	Real Wage Private sector (Index)	Real Wage Public sector (Index)	Budget Deficit (% of GNP)	M1 Growth (% monthly)	M5 Growth (% monthly)	Real Interest rate (% monthly)
1983	I	6.70	28.10	1323.00	108.00	113.00	4.00	13.00	6.80	0.80
	II	7.40	27.00	1343.00	99.80	107.50	1.10	0.70	8.40	0.50
	III	7.50	26.90	1347.00	102.60	108.70	6.80	5.10	8.90	1.40
	IV	15.90	26.70	1344.00	88.30	88.40	3.80	10.80	16.30	4.10
1984	I	12.50	27.10	1325.00	92.20	90.30	8.70	11.70	13.60	2.80
	II	16.00	26.70	1331.00	98.20	107.40	4.90	10.10	14.10	3.00
	III	16.70	27.70	1361.00	98.80	110.30	12.30	12.90	16.40	5.90
	IV	15.50	27.70	1342.00	96.00	106.00	10.10	19.20	17.10	6.80
1985	I	10.30	28.60	1364.00	101.00	99.90	8.50	14.90	12.00	5.80
	II	13.70	29.20	1352.00	94.00	97.80	4.40	6.60	13.40	5.40
	III	11.50	28.30	1333.00	86.50	85.80	0.50	16.90	8.60	5.90
	IV	2.20	27.00	1350.00	88.20	84.10	-0.90	6.70	3.80	6.80
1986	I	0.60	28.20	1354.00	101.50	90.10	-0.70	15.70	4.50	4.30
	II	2.20	28.30	1359.00	102.30	107.00	-4.40	0.90	1.10	1.30
	III	1.00	28.56	1379.00	102.80	105.60	-2.40	7.00	3.20	2.60
	IV	3.00	27.70	1377.00	106.70	105.70	-4.10	4.20	3.20	1.80

TABLE 2 (Continued)

Period		Real Exchange Rate (Basket-Index)	Real Exchange Rate (Dollar-Index)	Controlled Prices (Ratio to CPI)	Trade Account ($ millions monthly)	Private Consumption (Index)	Unemployment (% of labor force)
1983	I	91.00	95.80	99.00	242.30	20.60	4.50
	II	87.50	93.00	98.00	318.10	20.30	4.50
	III	89.00	97.00	96.50	331.70	19.99	4.10
	IV	94.20	104.00	103.00	266.70	19.40	4.90
1984	I	94.60	103.90	110.80	197.10	18.50	5.60
	II	94.40	103.80	105.90	253.70	18.80	5.80
	III	92.50	104.00	99.00	280.60	19.80	5.60
	IV	94.70	107.00	97.80	108.80	18.30	6.40
1985	I	101.00	115.80	102.80	124.70	19.00	5.90
	II	108.00	121.90	111.00	216.20	18.80	6.50
	III	114.00	125.00	128.00	163.60	17.70	7.50
	IV	108.00	115.00	118.00	142.40	19.50	6.70
1986	I	106.00	109.60	117.40	152.40	20.00	7.20
	II	100.00	101.30	120.60	216.20	20.50	7.90
	III	99.00	100.60	120.80	210.70	21.30	6.80
	IV	97.00	98.40	118.40	207.70	21.33	6.60

Notes: Inflation is measured by the percentage change in the CPI. Employment is the number of employed persons (in thousands). The budget deficit (measured by average monthly cash flows) is expressed as a percentage of GNP. The real interest rate is the effective monthly rate on credit lines for businesses minus the inflation rate. Controlled prices is the ratio of the price level of controlled goods and services to the CPI. Private consumption is an index in constant shekels. The trade account is the excess of imports over exports in $ millions, monthly averages.
The sources are: various issues of **Annual Report** and **Recent Economic Developments**, published by the Bank of Israel; and **Israeli Monthly Statistics**, published by Israel's Bureau of Statistics.

TABLE 3: THE FINANCING OF THE PUBLIC SECTOR'S DOMESTIC DEFICIT, ISRAEL 1980-1986
(In percent of GDP)

	1980	1981	1982	1983	1984	1985:1	1985:2	1986
1. Deficit (excl.interest)	6.3	9.8	6.6	3.4	9.1	5.2	-1.5	-3.0
2. Interest	10.7	6.2	6.2	5.9	3.6	7.3	5.7	5.8
3. Domestic Deficit(1+2)	17.0	16.0	12.8	9.3	12.7	12.5	4.2	2.8
Financing:								
4. Base Money Creation	2.1	2.1	1.8	2.4	3.1	2.5	11.1	2.0
5. Domestic Net Debt	10.6	11.9	8.3	0.2	0.4	3.7	-8.0	-1.0
6. Foreign Exchange Sales	4.3	2.0	2.7	6.7	9.0	6.3	1.1	1.8

Source: Bruno (1987) and Bank of Israel **Annual Report** (various issues). The figures for 1986 are preliminary estimates from the Bank of Israel. Line 3 includes in addition to interest payments on government debt, net interest payments on the money base by the Bank of Israel.

TABLE 4: THE FINANCING OF THE PUBLIC SECTOR'S DEFICIT. ARGENTINA. 1980-1986 (IN PERCENT OF GDP)

	(1) Total Deficit	(2) Base Money Creation	(3) Domestic Net Debt	(4) External Financing
1980	11.3	3.2	2.8	5.3
1981	16.4	2.9	6.5	7.0
1982	17.2	4.1	7.2	5.9
1983	12.7	1.0	10.8	0.9
1984	11.3	3.9	8.9	-1.5
1985: I	9.3	3.2	7.7	-1.5
II	23.4	11.4	9.3	2.6
III	5.5	3.5	1.5	0.5
IV	8.3	3.2	0.5	4.6
1986: I	6.8	1.7	2.2	3.0
II	6.0	3.4	-0.2	2.8
III	6.9	4.5	0.9	1.5

Source: Cavallo and Pena (1983). Novedades Economicas (December 1986). and International Financial Statistics.

TABLE 5: SAMPLE AUTOCORRELATIONS OF MONTHLY INFLATION

Lags	Argentina (80:5-84:12) (56 Obs.)	Brazil (71:2-85:12) (179 Obs.)	Israel (71:2-85:6) (173 Obs.)
1	0.82	0.85	0.72
2	0.70	0.80	0.61
3	0.63	0.80	0.58
4	0.53	0.76	0.54
5	0.52	0.74	0.61
6	0.54	0.77	0.65
7	0.46	0.73	0.57
8	0.41	0.73	0.50
9	0.39	0.73	0.51
10	0.34	0.69	0.49
11	0.32	0.68	0.48
12	0.37	0.67	0.55

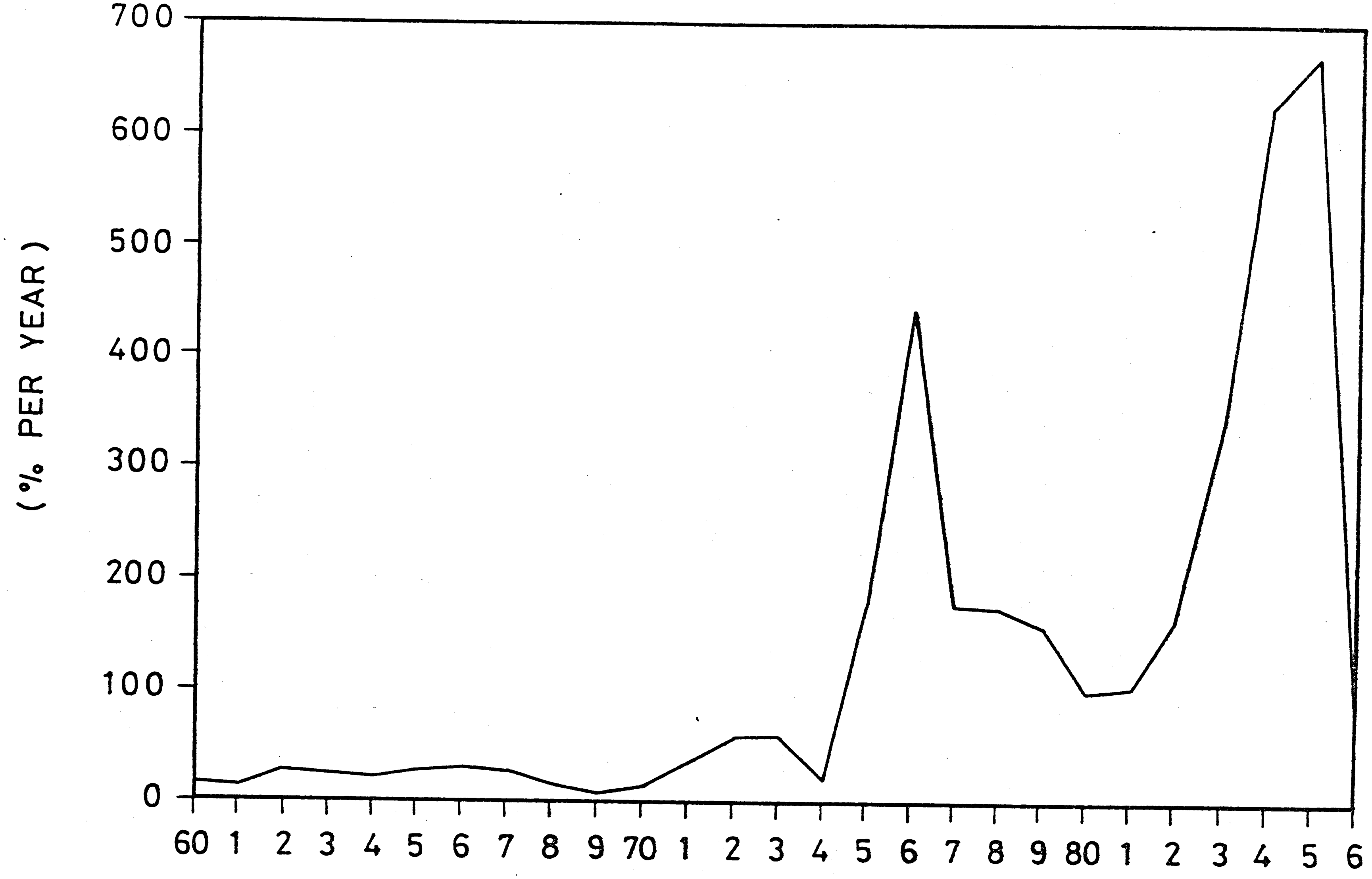


Chart 1: Inflation in Argentina, 1960 – 1986.

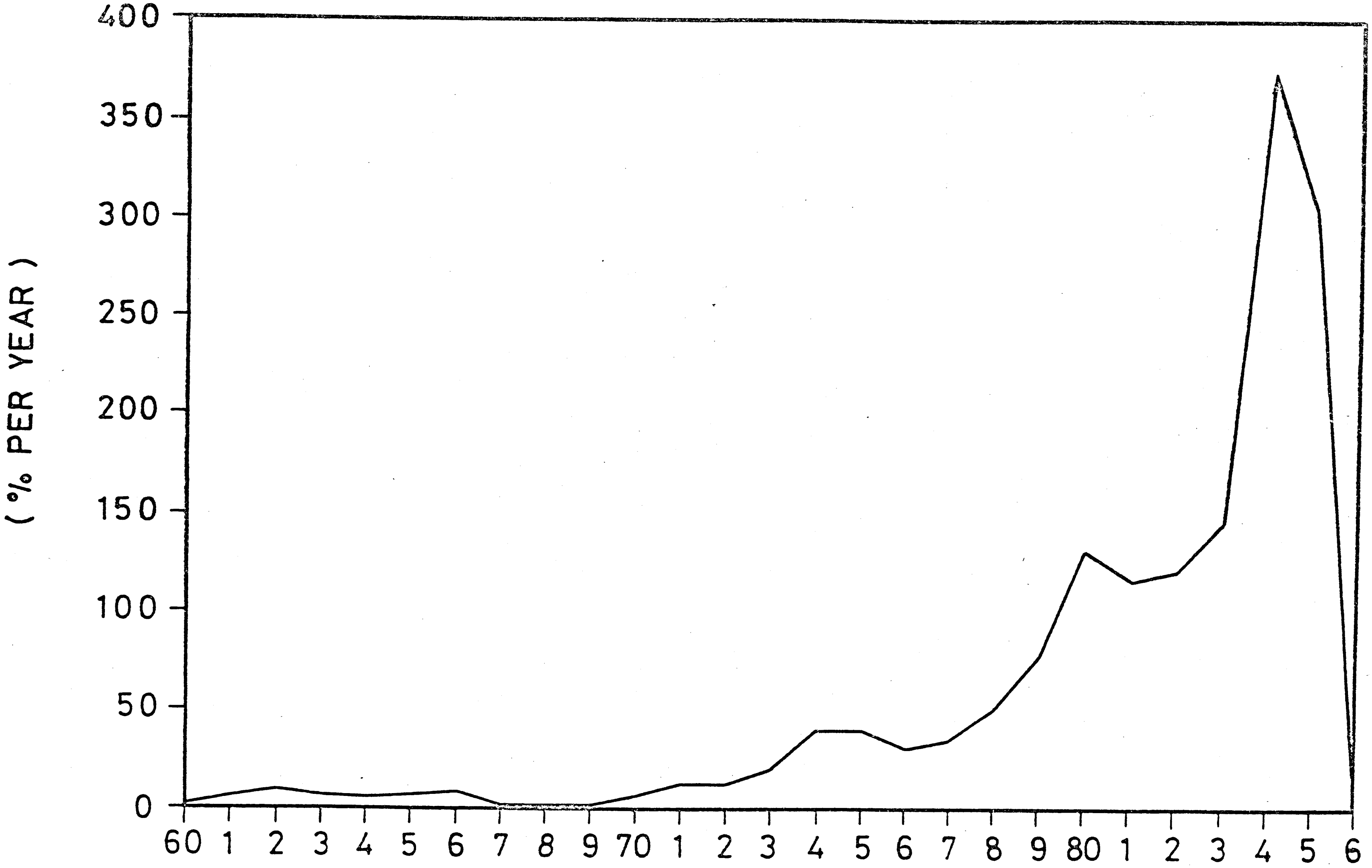


Chart 2: Inflation in Israel, 1960 — 1986.

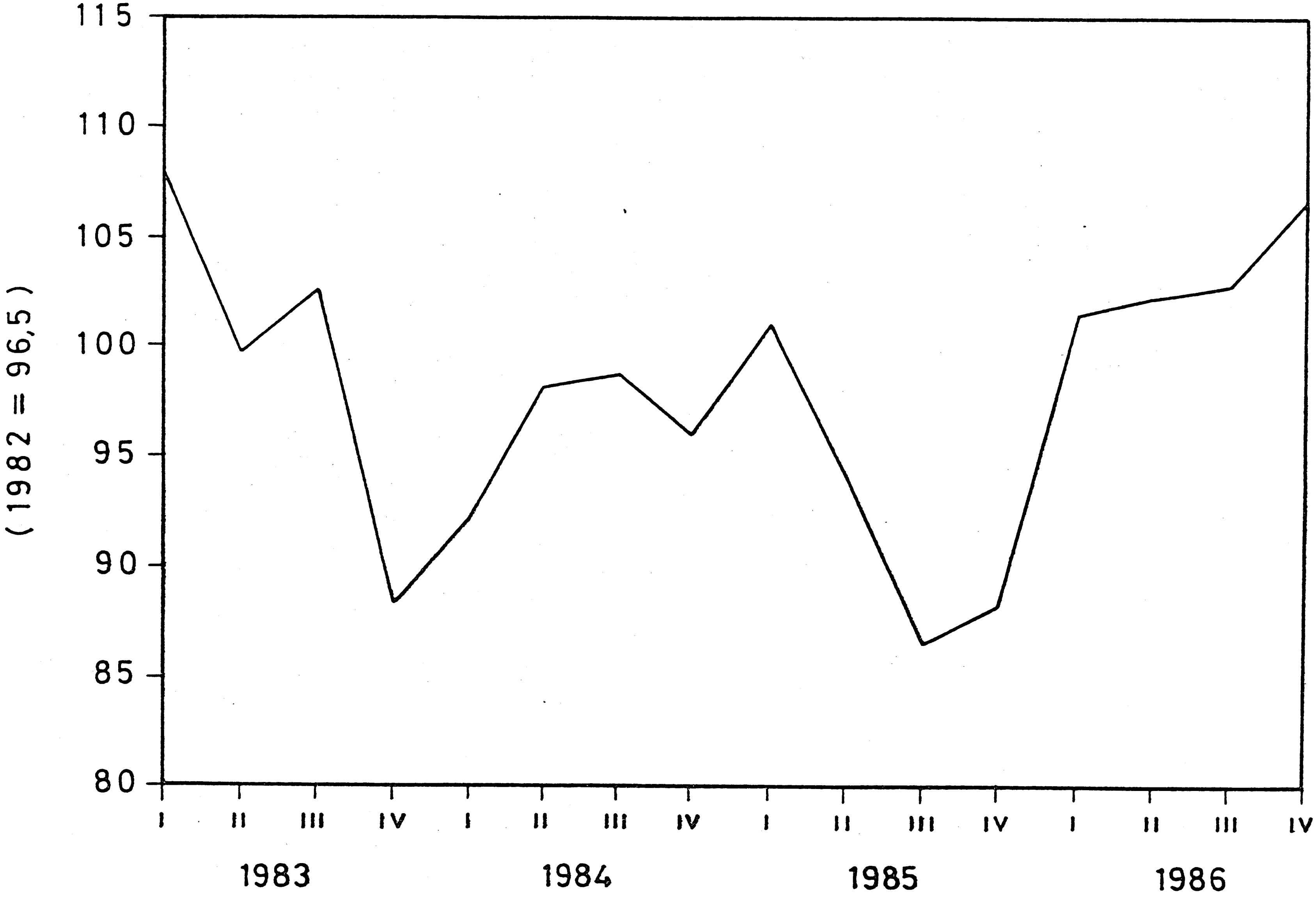


Chart 3: Israel-Private Sector Real Wage Rate.

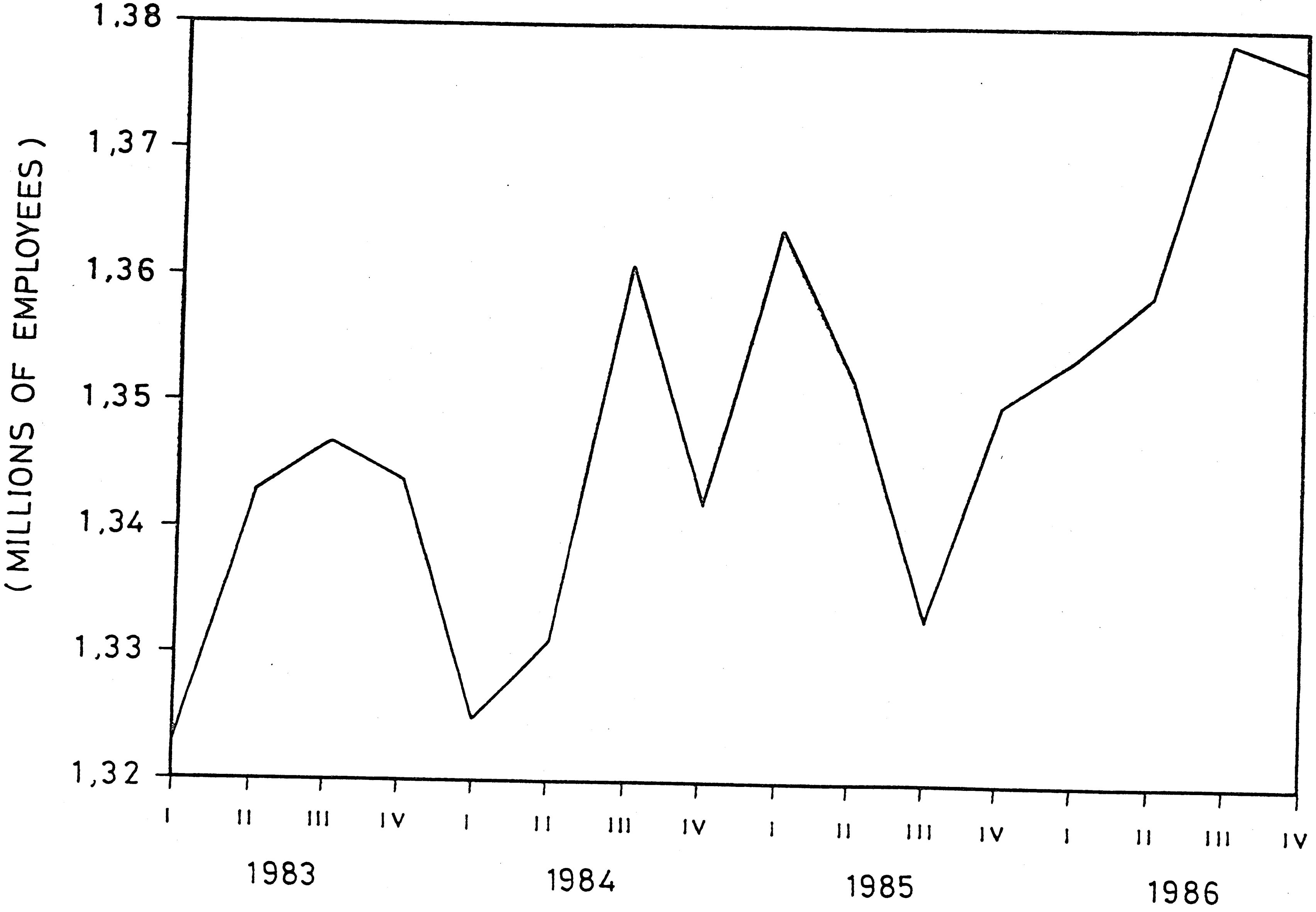


Chart 4: Israel – Employment.

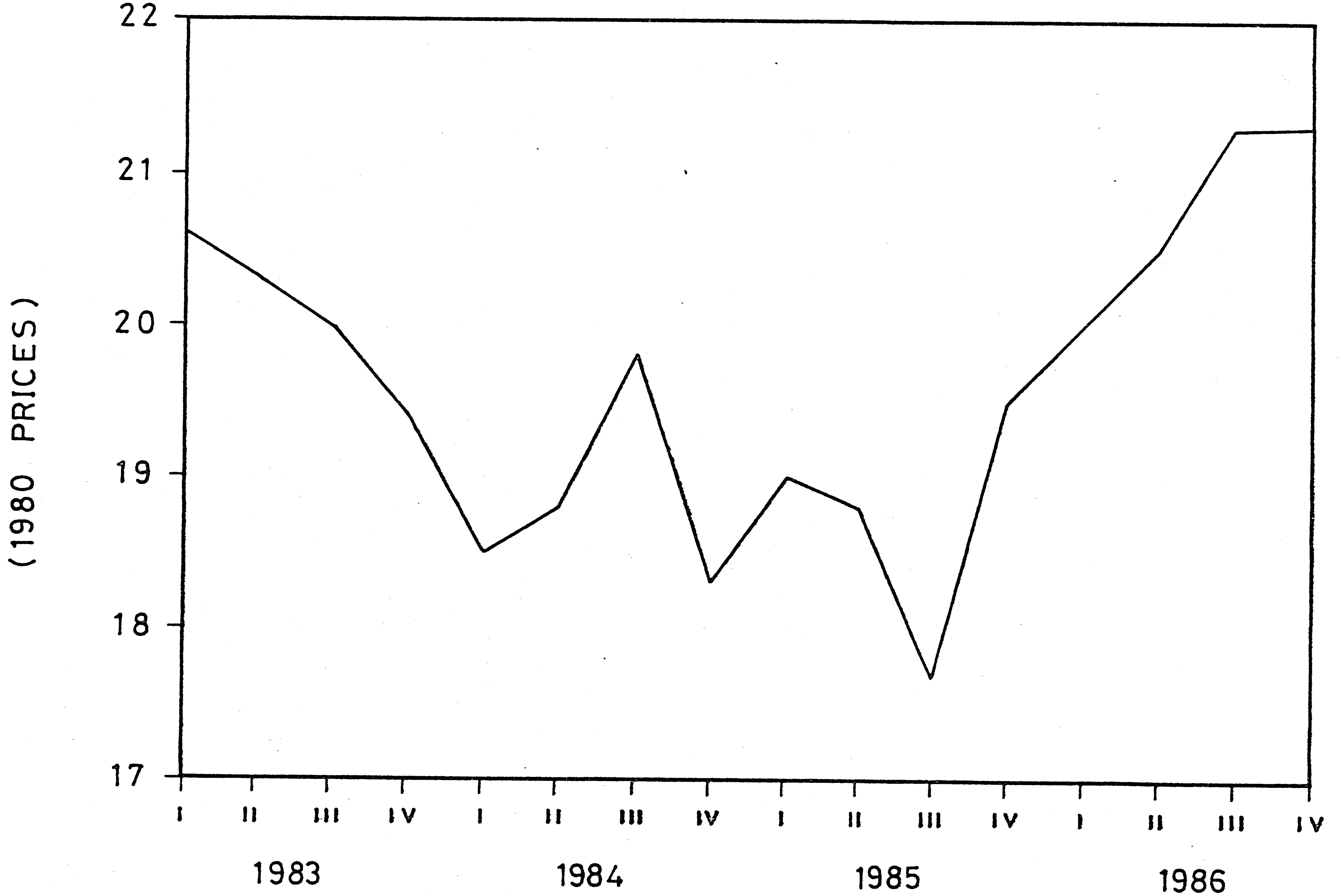


Chart 5: Israel-Private Consumption.

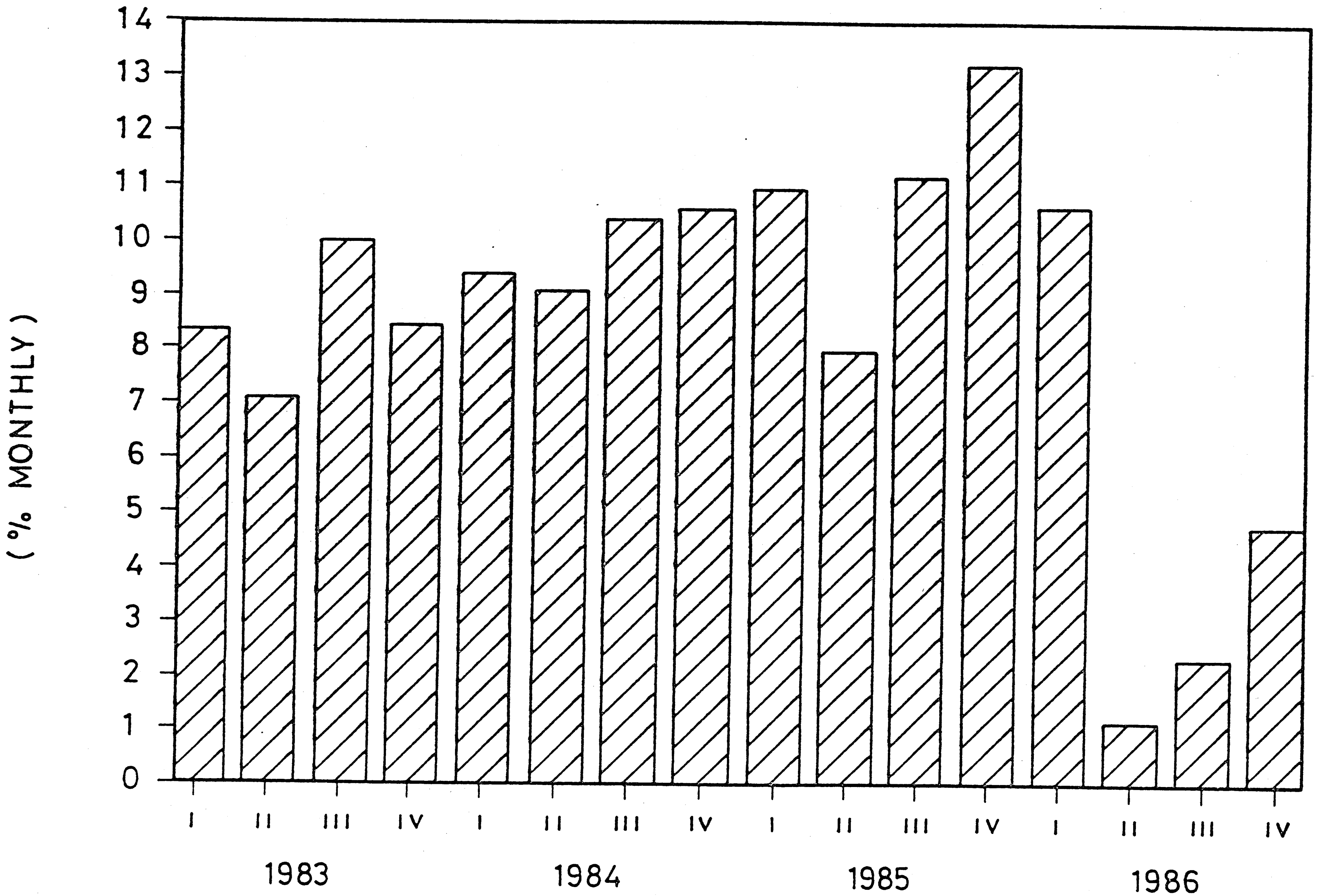


Chart 6: Inflation in Brazil, 1983–1986.

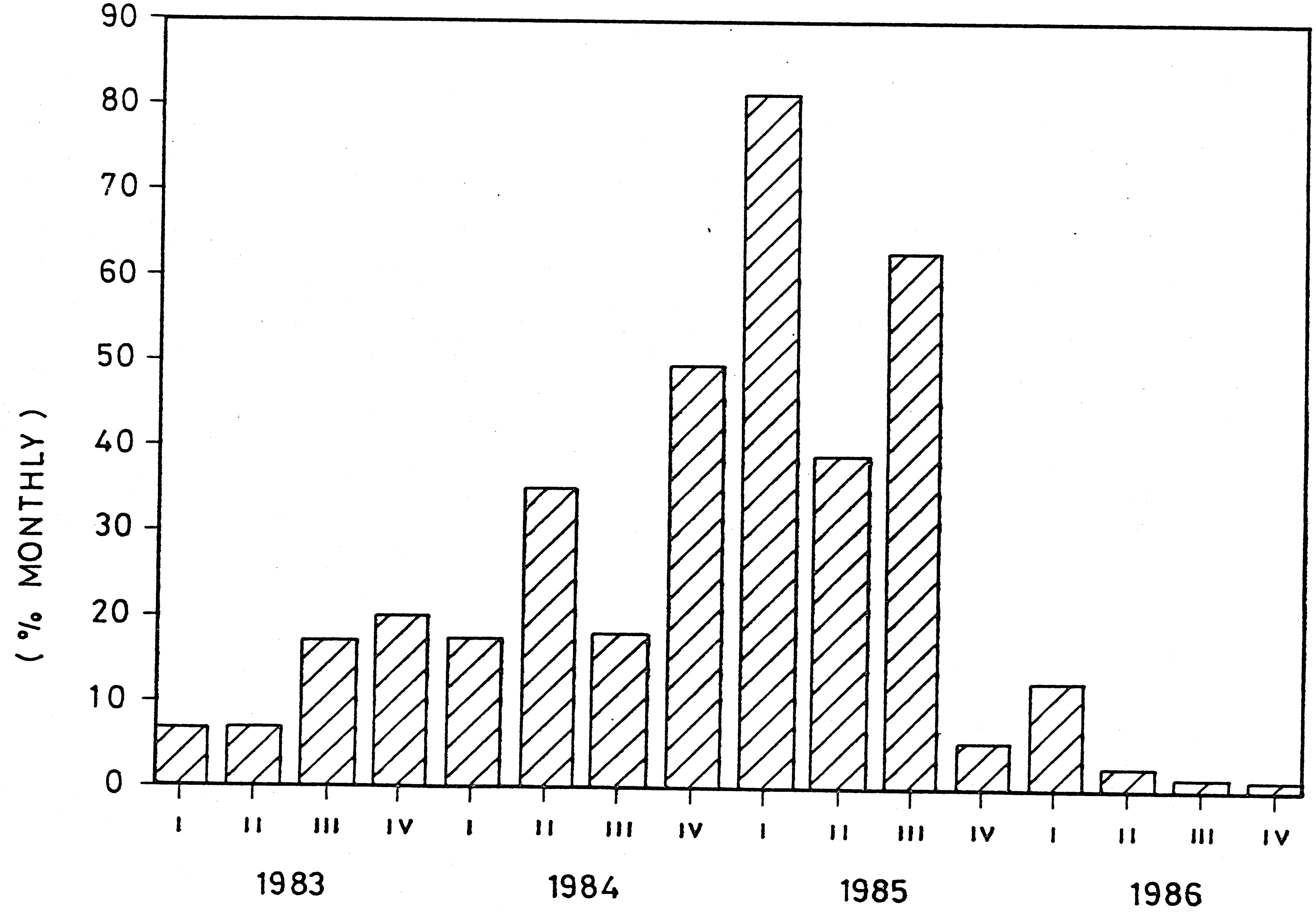


Chart 7: Inflation in Bolivia, 1983 – 1986.

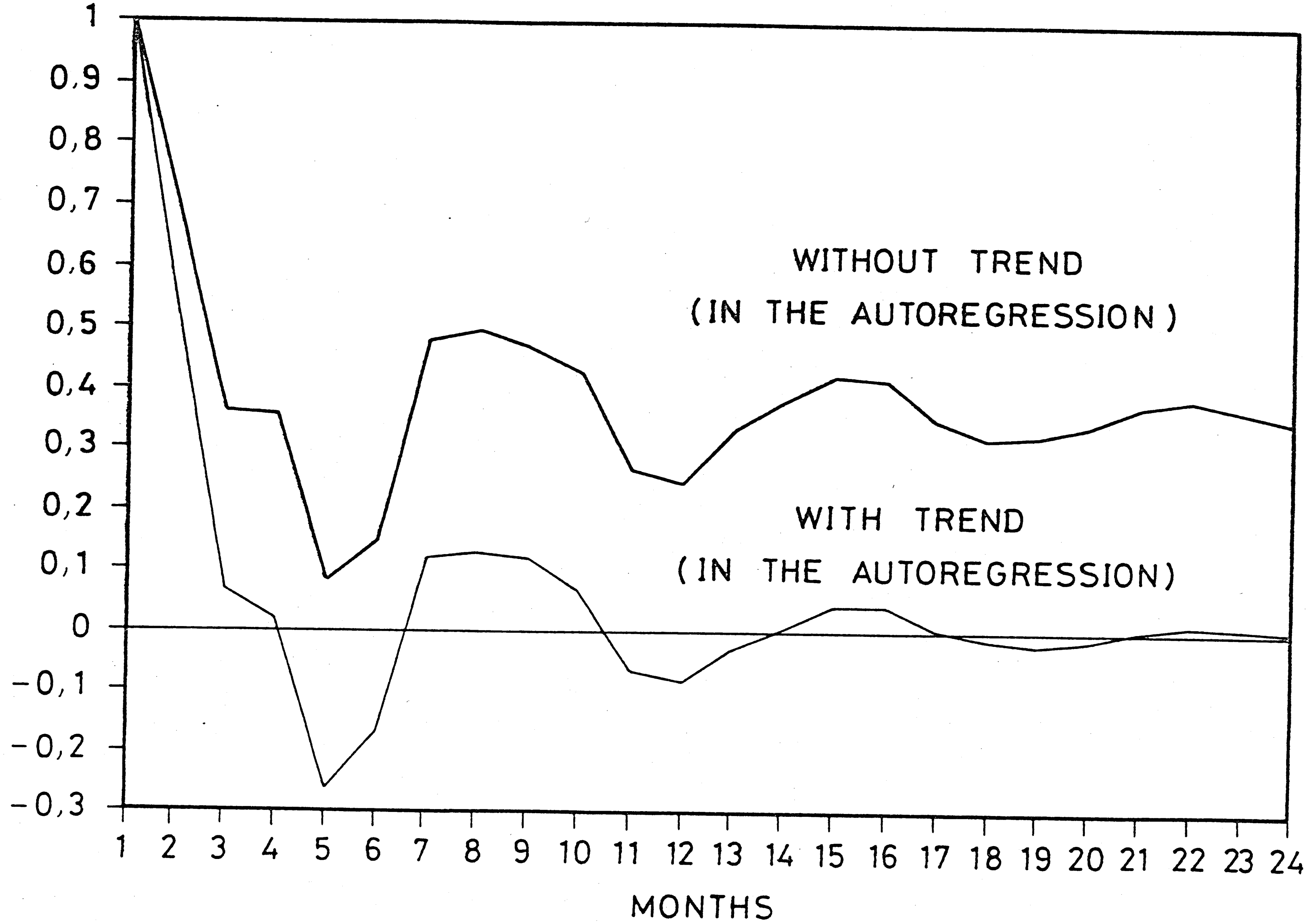


Chart 8: Inflation Responses to a Unit Standard Deviation Inflationary Shock — Argentina.

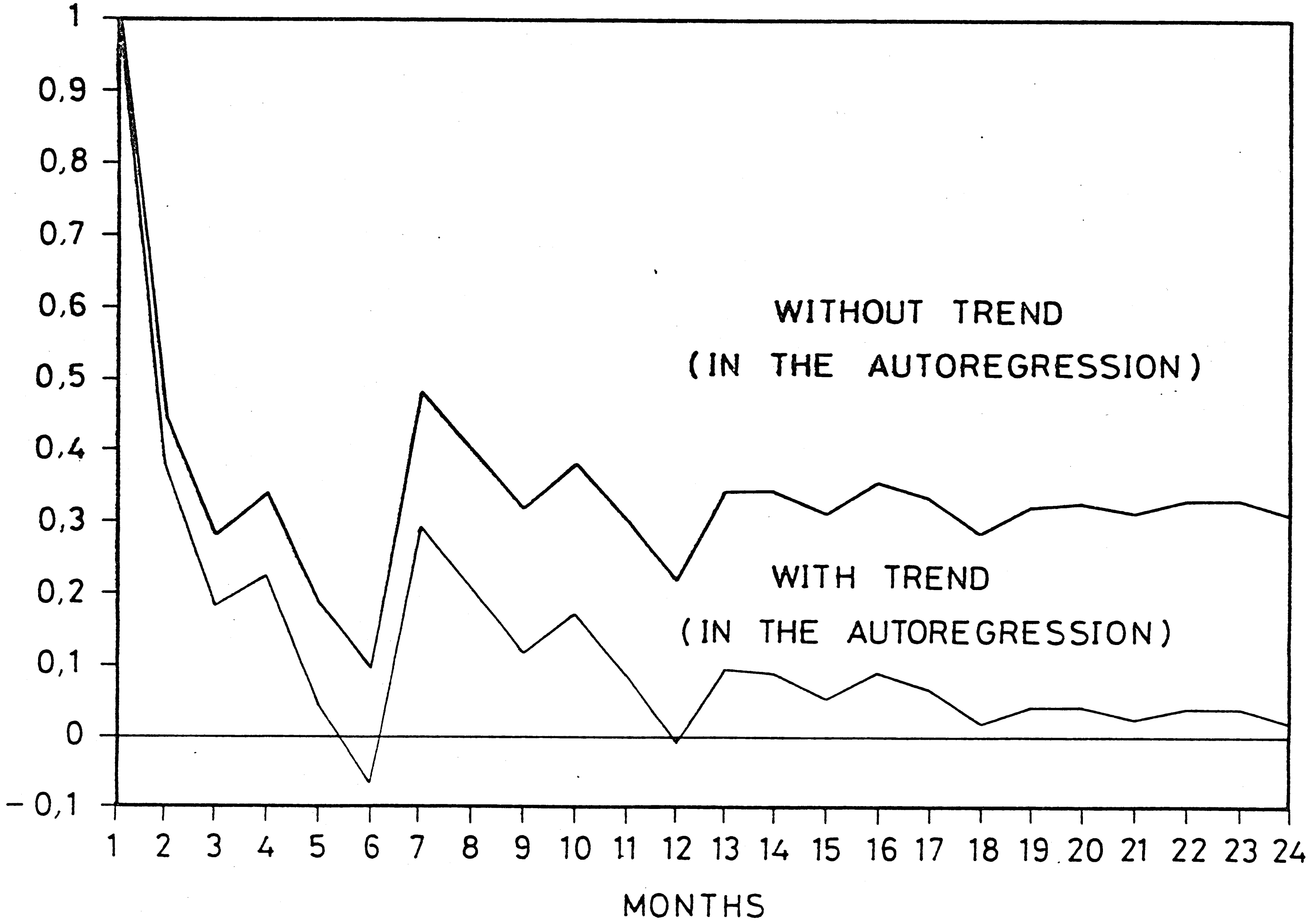


Chart 9: Inflation Responses to a Unit Standard Deviation Inflationary Shock — Brazil.

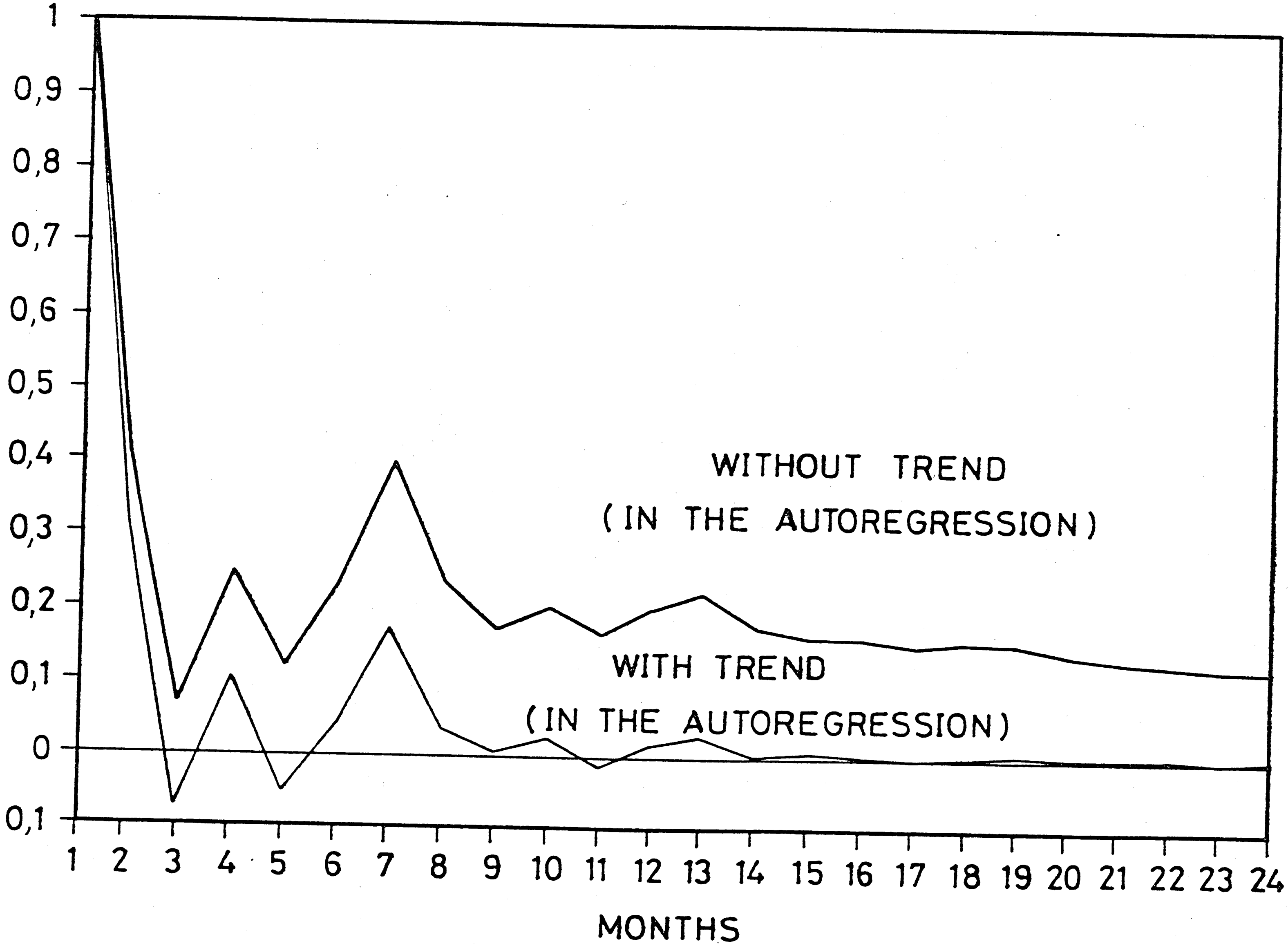


Chart 10: Inflation Responses to a Unit Standard Deviation Inflationary Shock — Israel .

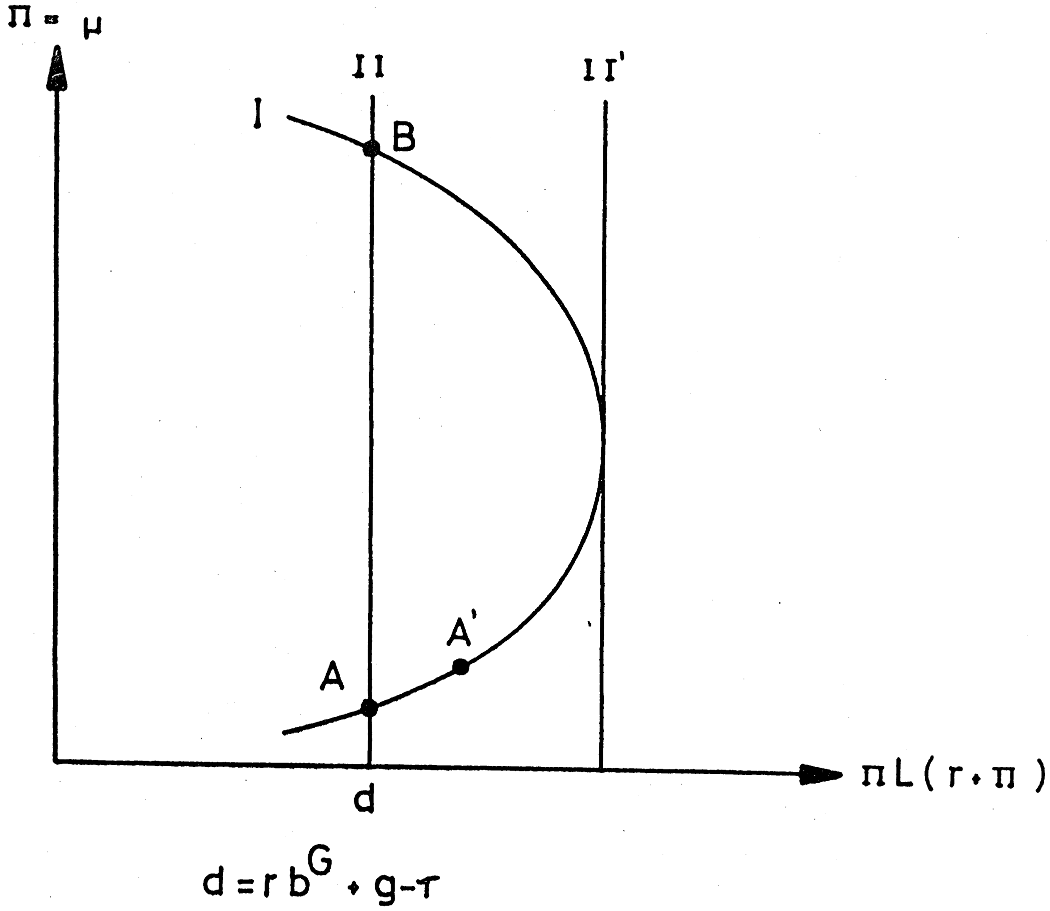
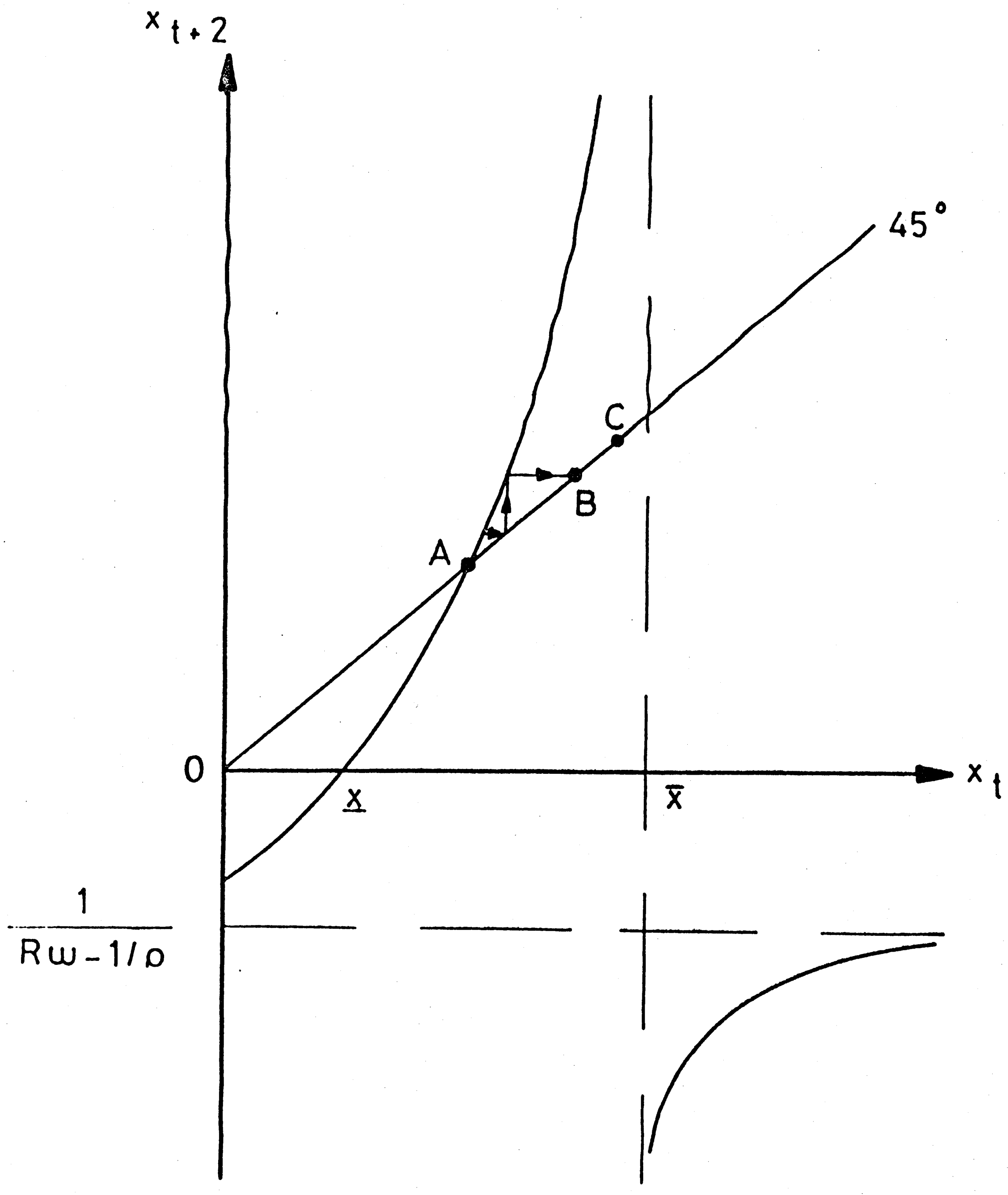


Figure 1: Determination of the Steady State Inflation Rate.



$\rho < R\omega < 1/\rho$

Figure 3: Dynamics of Inflation in the Price Wage Spiral Model.

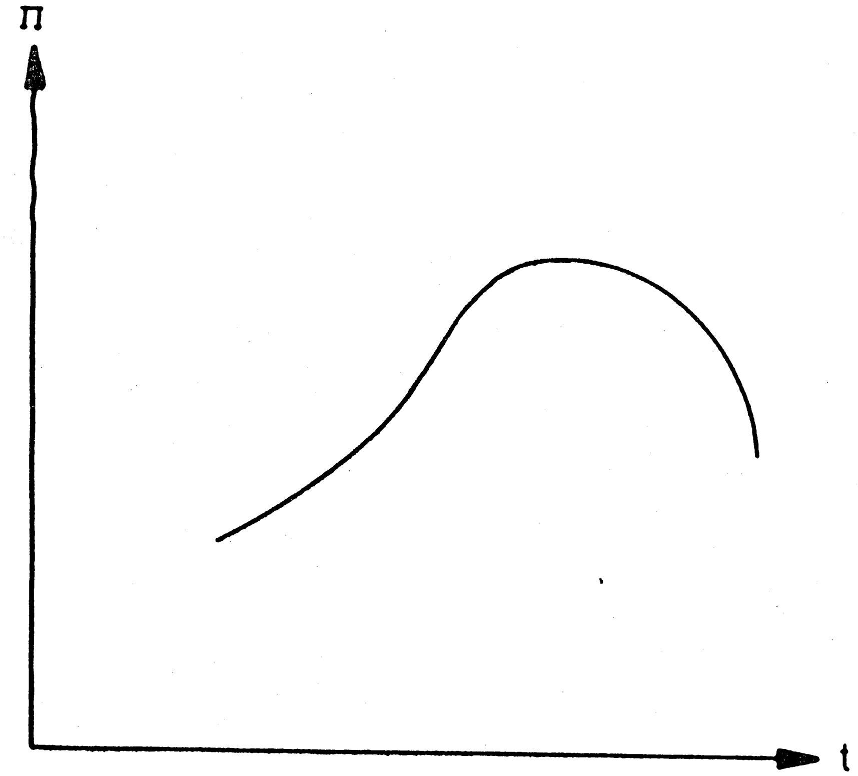


Figure 2: Example of a Possible Inflation Path With a Rising Budget Deficit.

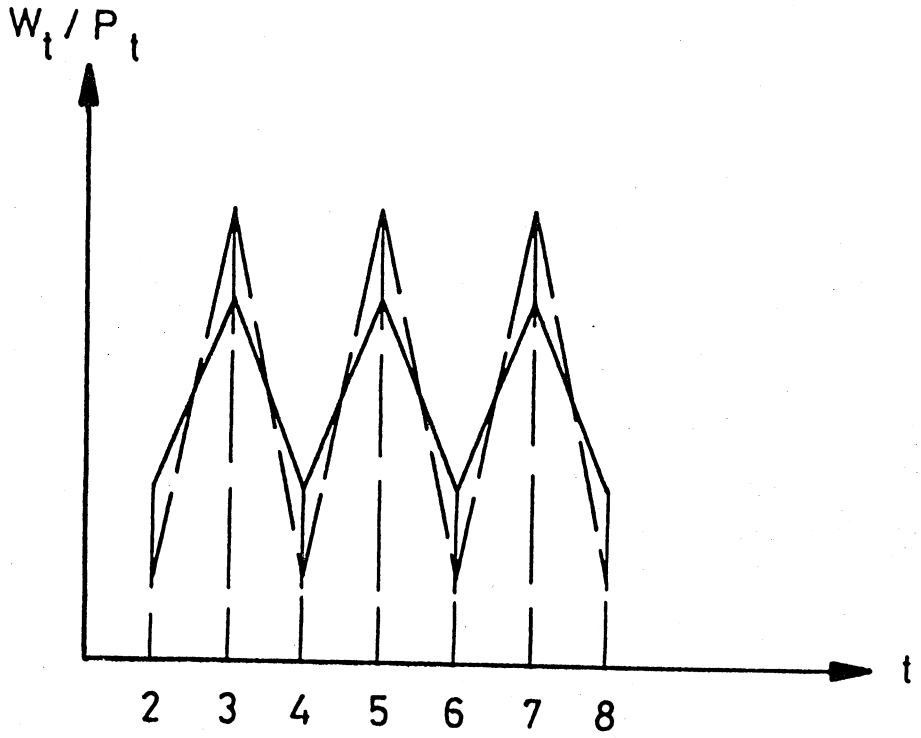


Figure 4: Fluctuations in Measured Real Wages.

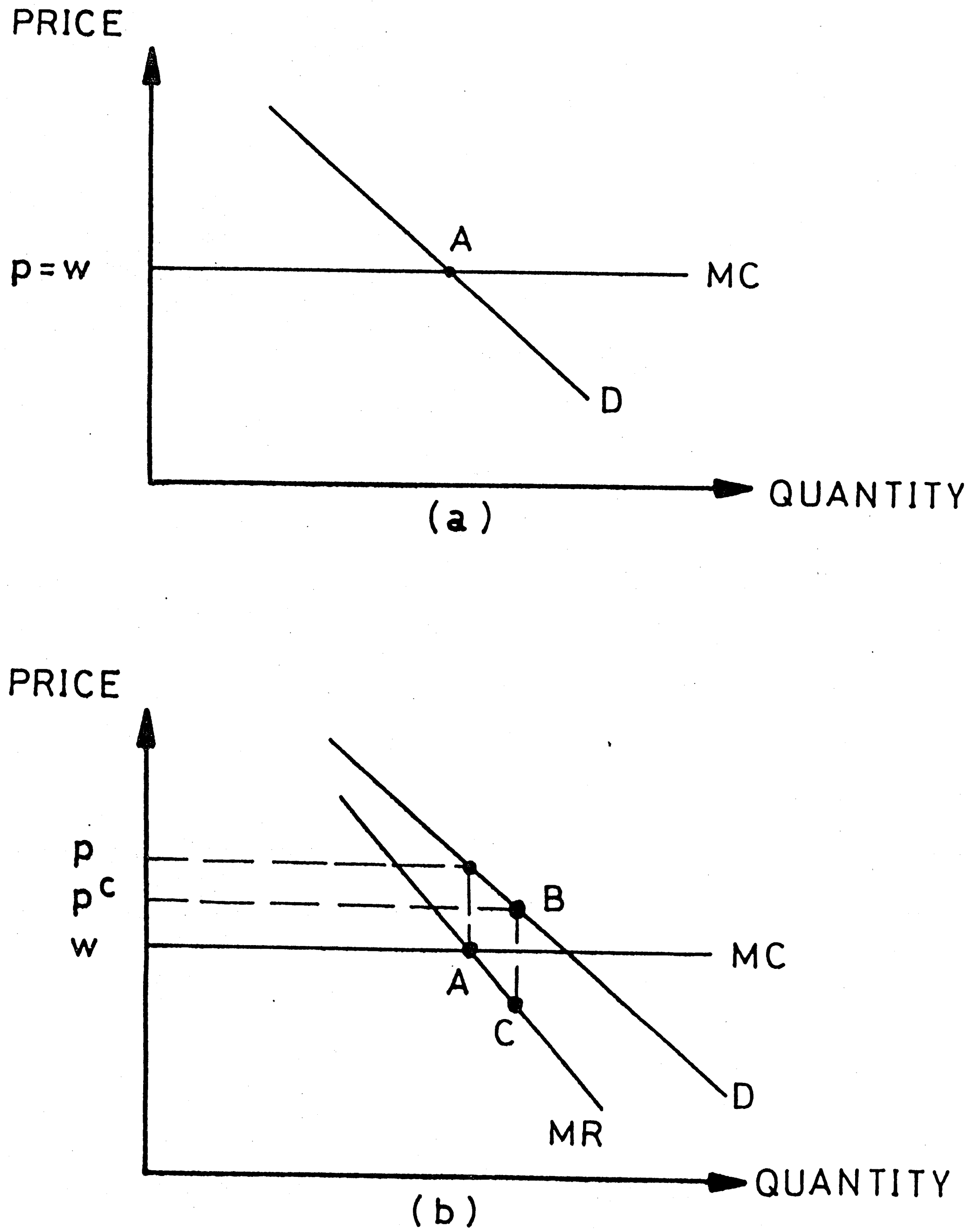


Figure 5: Price Controls Under Competition and Oligopoly.