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**THE RISE AND PERPETUATION OF A MODERATE
INFLATION, COLOMBIA 1970-1991**

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THE RISE AND PERPETUATION OF A MODERATE INFLATION, COLOMBIA 1970-1991

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ABBREVIATIONS

- ADF: Augmented Dickey Fuller Test
- AID: Anticipated Import Deposits
- CB: Central Bank
- CPPU: Constant Purchasing Power Unit
- EC: Exchange Certificates
- EEB: Economic emergency Bonds
- FER: Foreign Exchange Reserves
- GDEF: Government Deficit
- IR: Interest Rates
- M(O)RR: Marginal (Ordinary) Reserve Requirement
- OMO: Open Market Operations
- PB: Participation Bonds
- SEA: Especial Exchange Account
- RER: Real Exchange Rate
- RPV: Relative Price Variability

1. MOTIVATION

"We can go beyond the numbers alone and, at least on some occasions, discern the antecedent circumstances whence arose the particular movements that become so anonymous when we feed the statistics into the computer. "

Milton Friedman & Anna Jacobson Schwartz [1963]

In the post-World War II era many countries have experienced rates of inflation between 15% and 30% over a number of years; among them Portugal and Colombia who witnessed such rates for more than a decade. Only in Colombia they become an endemic phenomenon; the inflation rate jumped in 1973 from single digit levels to fluctuate in the vicinity of 20% thereafter. This paper studies the Colombian inflationary experience over the period 1970-1991; the working hypothesis is that the stylized facts of the country's moderate inflation rate are explained mainly by the effect of shocks, in particular to foreign exchange reserves and food supply, and the accommodating behavior of monetary authorities.

This line of argument has been formalized by Ball (1990b), and differs from other, more commonly proposed causes of inflation inertia such as widespread indexing, seignorage and the pegging of exchange rate. The textbook analysis of

Abstract

Colombian inflationary experience is explained using a theoretical model that stresses two elements: the effect of shocks and the type of policy designed to respond to them. The empirical investigation uses the event-study methodology and finds that the model successfully accounts for the main characteristics of the country's inflationary process; foreign exchange reserves, agricultural and policy shocks, as well as lack of commitment to low inflation by the authorities are the main causes behind the sustained high/moderate level of inflation. An assessment of the costs of inflation is made; a striking result is that the positive relationship between inflation and price variability, widely documented for other countries, is not found during the periods of high but stable inflation in Colombia.

inflation presents the "time inconsistency" framework as a more suitable explanation for low-inflation, industrialized economies, whereas the seignorage argument would apply to countries with high and unstable inflation. Colombia is an interesting intermediate case because of its moderately high yet stable inflation. The first goal of this paper is to provide historical evidence supporting the validity of a variant of the game theoretic explanation for Colombian inflation. This contrasts with existing arguments favoring the seignorage view for the Colombian case (see Salazar, 1992; Suescún, 1992; and Carrasquilla 1994, 1995,1996). Hence, for us seignorage would be a consequence rather than a cause of Colombian inflationary process.

A second objective is an assessment of the costs of this type of inflation. The results indicate that during the final subperiod (1986-1991) under study, characterized by high and stable price increases, the economy may have reached a state of nearly *frictionless* inflation. In contrast, the costs of inflation associated with relative price variability, appear to have been higher during periods of strong shocks.

The contribution of this paper is the assessment of a reputation model of inflation by means of a review of the historical experience of a particular country. The difficulties in testing these types of models have been recognized (see Alesina,

1988; Romer, 1995, p. 409)¹; the methodology traditionally used has focused on cross-section correlations between the rate of inflation and the degree of independence of the Central Bank (see Alesina, 1988; Cukierman, 1992 and Cukierman et al. 1992). Our paper aims instead to test the validity of the reputation approach through the evaluation of the historical evidence in a particular country.

Our results cast doubt on one particular feature of the theoretical model used; namely, that the replacement of a *weak* policy maker with a *strong* one is not a matter of chance, but is in large measure related to the economy having reached a level of inflation considered "inadmissible"; i.e. it is related to the inflationary record of the economy.

The paper is divided into six sections. The next section presents the structure of the theoretical model for the emergence of moderate inflation². The third section explains the *event-study* methodology used to test the model; it also presents the definition and the dates of shocks to the Colombian economy. Section four tests the predictions of the model by monitoring the policy reaction to inflationary shocks as well as the actual behavior of inflation in the aftermath of those

¹Alesina (1988, p. 17) points out three major difficulties in testing this type of models, "in which institutions and policymakers' behavior are modelled endogenously": i. the lack of degrees of freedom, since institutional changes are sporadic phenomena. ii. arbitrariness in choosing policymakers' objective function. And iii. difficulty of quantifying crucial variables, such as Central bank independence. In this respect see also Cukierman (1992) ch. 19.

²a full presentation of the model is in Appendix 1.

episodes. Two types of evidence are used to characterize the *type* of policy-maker at each point in time: **i.** statistical evidence, following the Romer-Romer (1989) methodology; and **ii.** historical one, based on a review of the Minutes of the Monetary Board, the body charged with monetary, exchange rate, and credit policy during the period of study. The fifth section addresses the costs of inflation, and the sixth section concludes.

2. THEORY: SHOCKS AND ACCOMMODATION

The working hypothesis of this paper is that the major forces behind Colombian inflation are captured in the model developed by Ball (1990b). The model, which is described at length in the Appendix, addresses the question of how exogenous macro-shocks lead to persistent inflation³. The framework is common to the asymmetric information policy-games literature (Kydland and Prescott, 1977; Barro and Gordon, 1983a; Backus and Driffill, 1985), and considers the alternation in office of two types of policy-maker, who differ in their taste for inflation, and hence in their reaction to shocks.

In response to shocks, the so-called *strong* policy-maker (S) will react with an anti-inflationary policy, so as to return inflation immediately to zero. In contrast, a *weak* policy-maker (W), fearing the costs associated with fighting inflation, pursues a accommodation policy. As the author explains, the shifts in office between S and W are not necessarily reappointments of the person in charge of monetary policy; a change in the policy regime is enough to generate S or W behavior.

³For other formal treatment of persistency see Cukierman (1992), Ch. 15.

In the absence of a shock W has an incentive not to create inflation to establish instead a reputation as a *strong* policy-maker. Once a shock occurs, however, W does have the incentive to fight inflation, and will accommodate to its new higher level, an attitude that reveals its type. Additionally, at the beginning of every period the policy-maker is replaced, with some probability, with one of a different type. This set-up implies that at each moment in time, in the absence of a shock, the public is *uncertain regarding the type of policy-maker* who is actually in office. Given the inflationary record the public assigns a probability to W being the type in office; the policy-maker's reputation is given by one minus such probability.

With no shocks inflation is zero (or at its optimal level), and the public is ignorant of the policy-maker's true type. Once the shock occurs the public observes either no inflation, proving that S is indeed in office, or a positive inflation, revealing that W is in charge. In this last case such inflation will *persist* until the random arrival of a S policy-maker, who will bring inflation back to zero (or to its socially optimal level).

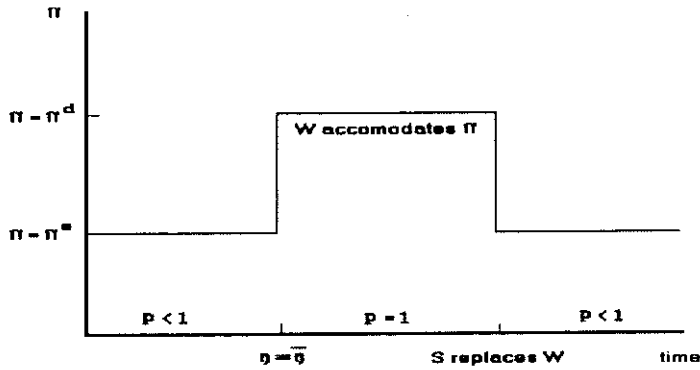
This sequence of events appears in Figure 2.1, and can be described as follows:

(I) $p < 1$, $\eta = 0$, $\pi = \pi^*$ [optimal initial inflation]

(II) $\eta = \bar{\eta}$, either: S sets $\pi = \pi^*$, $p = 0$, back to (I) during next period

or: W sets $\pi = \pi^d$, and $p = 1$, to (III)

Figure 2.1: Weak Policy-maker's Response to a shock ($\eta = \bar{\eta}$)



(III) in all subsequent periods W sets $\pi = \pi^d$, until it is replaced with S , who sets $\pi = \pi^*$; back to (I).

where, p is the probability that W is in office; η is the shock which is either zero or $\eta = \bar{\eta}$; π is observed inflation rate; π^* is the socially optimal inflation rate, and π^d is the optimal inflation rate for W (see Appendix 1). From (I) and (II) it is also clear that a flat inflation rate will be the response of S to an inflationary shock.

The most attractive features of this model of inflation are: **i.** it displays persistent inflation after the shock. **ii.** in equilibrium W "has a positive loss from creating surprise inflation - if the cost of moving to persistently high inflation

exceeds the short-run gain from the boom" (p. 16, Ball, 1990b)⁴. Indeed, as Ball puts it, "W forgoes a boom to avoid inflation but accepts inflation to avoid recession. This behavior is possible because the cost of a recession exceeds the gain from a boom. The source of this asymmetry is the convexity of the loss function - a rise in unemployment has a larger absolute effect than a fall." We will show that this is a very appealing feature for the Colombian experience which has in general adhered to the following description: do not push economic growth so far as to trigger inflation, and do not fight inflation so much as to generate negative growth⁵.

One salient shortcoming of the model is that the replacement of the policy-maker is random and unrelated to the inflationary record. In reality, the likelihood of the appointment of a strong policy-maker may increase with the rate of inflation⁶. The evidence on Colombia shows that this in fact is the case: S behavior is displayed when the shock threatens to push the inflation rate above some threshold.

⁴This happens insofar as the discount factor is large enough.

⁵Unlike any other country in the area, Colombia has not experienced negative growth or inflation rates higher than 40% since 1932 (see Cárdenas, 1992a).

⁶Although the jumps from high to hyperinflation in many countries indicate that this is not always the case.

3. THE INFLATIONARY SHOCKS IN COLOMBIA

In order to test this model on the Colombian experience a number of issues need to be demonstrated. First, that the jumps in Colombian inflation have been typically triggered by easily identifiable shocks. Second, that the behavior of the policy-maker in each episode can be clearly characterized as "weak" or "strong" by some acceptable criterion, and that the presence of a W policy-maker coincides with the jump of annual inflation to a higher and persistent rate. And third, that reductions in π coincide with the presence of a S policy-maker and/or with disinflationary shocks⁷.

Colombia can be characterized as a small open economy which since 1967 managed its nominal exchange rate with a crawling-peg⁸. For most of the period under study, coffee had the biggest share in exports (61% in 1970; 45% in 1985; and, 18% in 1991), making the economy very sensitive to fluctuations in the international price of coffee. This in turn greatly affected the holdings of *foreign*

⁷We assume symmetry in the effects of shocks.

⁸Kamas (1994) shows that Colombia's crawling-peg regime in fact acted more as a fixed exchange rate regime than as a floating one.

exchange reserves (FER⁹), and was therefore one of the major sources of shocks to the economy. Such inflows of foreign liquidity had to be translated into pesos by the Central Bank, thereby causing direct monetary expansions. In fact, monetary policy in Colombia has in large part been directed to counteracting the effects of repeated FER shocks.

For these reasons, our first task will be the identification of the dates of FER shocks; the variable chosen to represent these shocks is the holdings of international assets by the Central Bank¹⁰. In order to account for those facts that escape the FER-shock explanation, other sources of shocks will be explored: the evolution of the price of food stuffs, widely claimed as having large impact on the CPI, as well as policy-induced inflation.

The event-study methodology will identify the periods in which these shocks occurred, and will trace the behavior of the tools and policy indicators used by the monetary authorities in the aftermath of those episodes. The empirical exercises allow us to label the behavior of policy indicators as representing either accommodation (e.g. "weak" policy reaction), or stabilization (e.g. "strong" one).

⁹A list of abbreviations appears at the end of the paper.

¹⁰FER was preferred to the international or domestic price of coffee, as not all variations in these prices lead to movements in FER or to changes in monetary aggregates. The use of FER also helps to include shocks generated by non-coffee exports, which became increasingly important since 1986.

If the model described in the previous section is a correct one for Colombia, the combination of the shock and the policy response should predetermine the pattern of the consequent evolution of the inflation rate.

3.1. FOREIGN EXCHANGE RESERVES SHOCKS

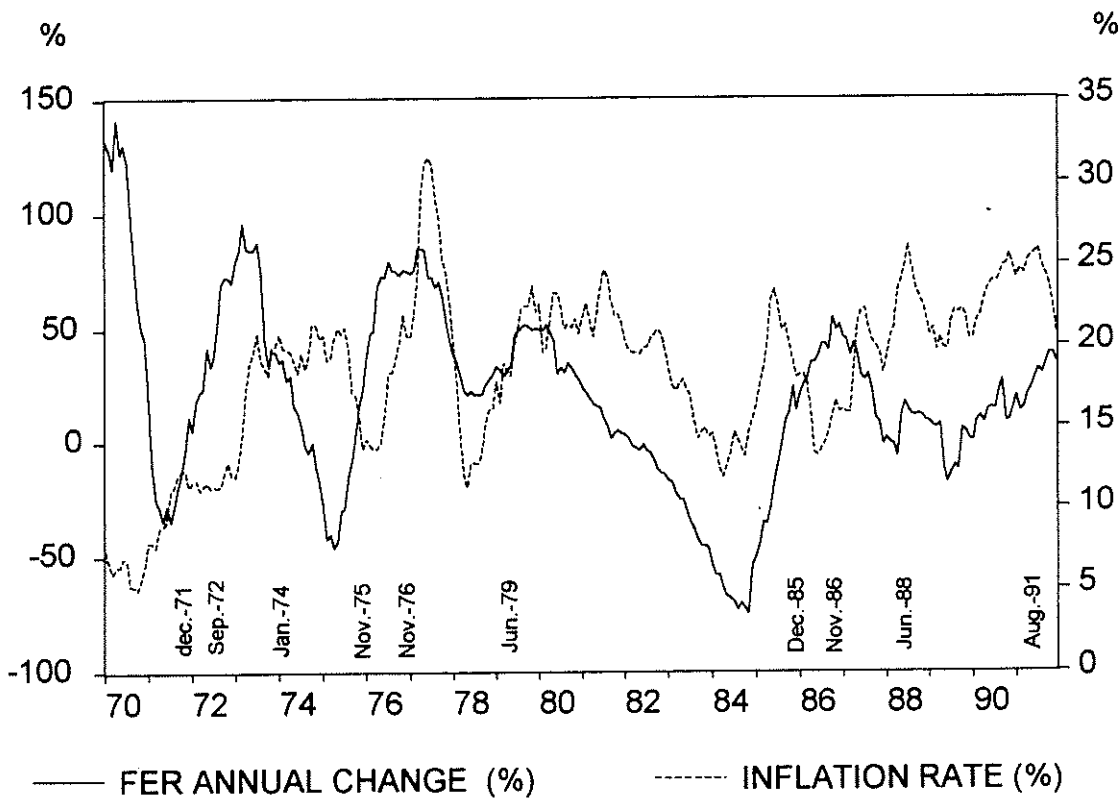
Figure 3.1 shows the evolution of FER annual growth rate and the inflation rate (right-hand scale) over the past 25 years. Clearly, since 1971 the country has experienced dramatic shifts in its holdings of international assets (see left-hand scale), mainly caused by the fluctuations in the price of coffee. The four big upward jumps in the inflation rate between 1973 and 1986 were preceded by dramatic increases in FER. The scene changed during the late 1980s. After 1986 non-coffee exports (oil, coal, flowers, bananas, leather products) increased to historically unprecedented levels, replacing coffee as the main legal source of international liquidity, and initiating a period characterized by less dramatic variation in FER.

In identifying the periods of FER shocks we pick those months in which the *quarterly* growth of the FER surpassed 20% for at least two consecutive months¹¹.

As in the definitions of hyper-, high or moderate inflation (Cagan, 1956; Dornbusch and Fischer, 1992), this is a convention whose adoption is justified for its

¹¹With an statistical approach Julio (1995) finds shocks to inflation in dates similar to the ones reported here.

Figure 3.1: FER SHOCKS AND INFLATION



usefulness in this context; indeed, we claim that these shocks embody the information of the most relevant episodes affecting the external sector in Colombia. This definition leads to the identification of 10 shocks (see dates in the bottom of Figure 3.1)¹².

3.2. POLICY INDICATORS AND STATIONARITY TESTS

For analyzing the responses of the authorities¹³ to shocks we chose four indicator/tools of economic policy: the ordinary required reserves ratio of commercial bank checking deposits (ORR); the change in the real exchange rate (DRER); the fiscal deficit in real terms (GDEF); and the monthly change in the effective interest rate (DIR)¹⁴. The series are covariance stationary and thus suitable for the simple time series techniques that will be used throughout the paper. The results of the Augmented Dickey-Fuller tests for unit roots appear in Table 1.

¹²The two episodes of Dec-1971, and Aug-1991 will not receive the same attention as the other shocks throughout the paper. The reason is that for the former the lack of data prior to 1970 made the statistical tests unfeasible. For the latter, the policy reactions after 1992 belong to a quite different monetary regime, in place since the second half of 1991.

¹³During this period the "Monetary Authority" was not independent of the fiscal authorities, since, as we will see in our review of the Minutes of the Monetary Board, the influence of cabinet ministers was substantial.

¹⁴This is the interest rate paid by the banks for 90 days time deposits. The lack of monthly GDP data prevented use the GDEF to GDP ratio. This set of variables will hereafter be referred as "tools" although strictly speaking RER and IR are intermediate targets.

Table 3.1. A.D.F. test for Stationarity

	A.D.F. t-statistic	Critical Value	Stationarity (confidence)
CPI	1.08	-3.99	no
Annual inflation rate (DCPI)	-2.66	-4	no
Monthly change in inflation (DINFL) *	-2.98	-2.86	5%
Fiscal deficit in real terms (GDEF) **	-3.29	-3.13	10%
Real exchange rate (RER)	-2.12	-3.98	no
Monthly change in RER (DRER)	-3.29	-3.13	10%
Interest rate (IR)	-1.29	-3.99	no
Monthly change in IR (DIR)	-5.85	-3.99	1%

(a) Monthly data, 1969:01 - 1992:12. Unless specified, the variables in differences are in yearly log differences: $\log(X_t) - \log(X_{t-12})$; all tests were performed with 12 lags, constant and trend. GDEF is seasonally adjusted. (*) no trend; (**) Observed monthly fiscal deficit deflated by PPI. Source: Revista del Banco de la Republica.

4. POLICY REACTION TO INFLATIONARY SHOCKS

4.1. STATISTICAL EVIDENCE

We will track the policy responses to 8 of the 10 FER shocks identified in the previous section. To this end we performed the following exercise:

- i. estimate a forecasting equation for each indicator for the entire 1969-91 period;
- ii. compute a dynamic forecast for each variable during the 18 months after each shock; and,
- iii. compute the difference between the actual behavior of the variable and the forecasted one.

In this way, and following Romer and Romer (1989), we recover the evolution of the variable in the aftermath of the shock, *apart from what it otherwise would have been*. The result of this exercise appear in Appendix 2 (Fig. A.1 to A.5). For each variable the difference between its actual and forecasted value is referred as "*forecast errors of univariate autorregresion*". These errors embody the behavior of each indicator of monetary policy apart from what it would have been had the shock not occurred. Hence, the graph of those errors indicates the policy reaction to the shocks.

For clarity of exposition the figures are divided into three subperiods: "Early Seventies", containing the shocks of Sep-1972, Jan-1974 and Nov-1975; this was the period when the economy passed from one digit inflation to 20%. "Late Seventies" for the big two coffee shocks of Nov-1976 and Jun-1979. And "Eighties" for the three relatively small shocks occurred in Dec-1985, Nov-1986, and Jun-1988.

4.1.1. Ordinary Required Reserve Ratio (ORR)

During the period of study, Colombia was characterized by restrictions to capital mobility, and a Central Bank monopoly of international reserves. Booms in export revenues were to be monetized, creating monetary expansions. A "strong" monetary policy aimed at counteracting such expansion should increase the ORR in order to reduce secondary creation of money by commercial banks¹⁵. Figure A.1 shows that during the 1970s the behavior of ORR was basically consistent with contractionary policy. In the early 1970s (Chart A) the ORR was increased 3 to 5 percentage points during the first year after the shock; although in the Sep-72 episode the ORR was allowed to fall during the first 6 months following the shock. In the late seventies (Chart B) it took the authorities between 5 and

¹⁵Other widely used tools targeted the Monetary Base, like Open Market Operations and import deposits; however their use was hindered by lack of data for the whole period of study.

8 months to use this tool, but once in use it was increased by more than 5 percentage points, a policy which was typically reversed 16 months after the shock. In contrast, during the eighties (Chart C) this tool did not display the expected increase, even falling by nearly 5 percentage points after the Jun-88 shock.

4.1.2. Real Exchange Rate (RER)

Under exchange controls the *nominal* exchange rate determined the amount of domestic currency that exporters received from the Central Bank for every dollar they brought into the country. Rigorously, the variable controlled by the authorities is the nominal rather than the real exchange rate. However, the rhythm of nominal devaluation has clearly targeted the real exchange rate. This justifies our use of RER for tracking the actions of the monetary authority (see Wiesner, 1978). Its expected behavior as part of a contractionary package is a revaluation. Such behavior characterized the episodes of Nov-75 (7 months after the shock) and Nov-76 (4 months after). It was clearly absent in the Sep-72 and Jan-74 shocks and in most of the 1980s (see Fig. A.2).

4.1.3. Fiscal Deficit (GDEF)

The standard role of fiscal accounts in a stabilization package should be to yield a surplus or eliminate a deficit, so as to relieve the Central Bank of the duty of buying short term debt from the government. This behavior was obtained in all cases but Sep-72, Dec-85 and Nov-86 (see Fig. A.3).

4.1.4. Interest Rate (IR)

During the 1970s this variable was controlled, and during the 1980s was targeted by monetary authorities, justifying its inclusion in our set of "indicators". It should unambiguously increase in a contractionary package given the monetary arrangements of the period under study. From Fig. A.4 we obtain the same reaction pattern found so far: contractionary in the seventies, and little relation with anti-inflationary policy during the eighties.

4.1.5. Summary

The summary of these responses appear in Fig. 4.1. where we assigned W or S to each variable depending on its behavior during the first months after the shock. One meaningful regularity can be identified: only a 4-S policy mix was able to turn back a jump in π (1976.11 shock); on the other hand, timid packages

(with a maximum of two S) accommodated the shocks and led to persistent higher inflation thereafter.

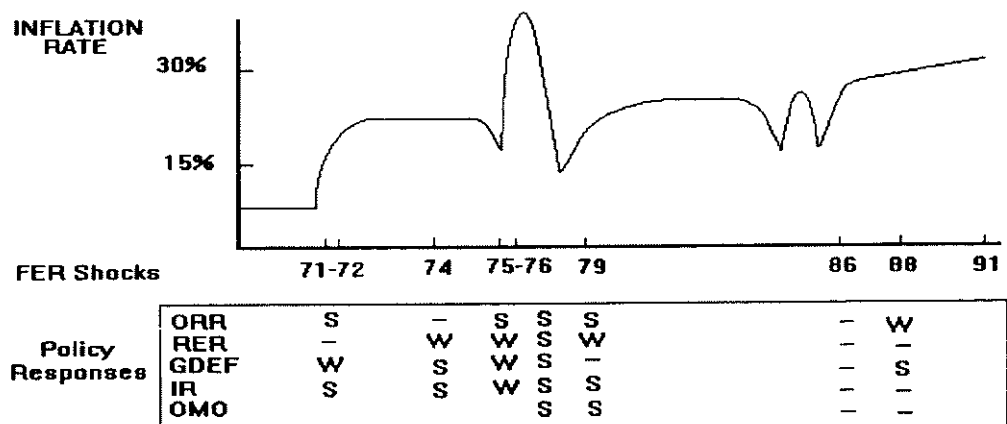
The Sep-72 experience was characterized by an initial fall of ORR (7 months), an almost flat response of the RER, a persistent fiscal deficit, and an IR increase, but only after the full strength of the shock has been felt¹⁶. This certainly characterizes a WEAK policy response to a big shock (7 months duration). The behavior of the inflation rate associated with this episode can be seen in Figs. 3.1 and A.5: it jumped from 12.7% in Sep-1972 to 21.5% 10 months later.

The theoretical model predicts that under a weak policy response an increase in the inflation rate will display persistency; this was indeed the case, with the annual inflation rate remaining above 20% until Sep-1975, 4 years after the shock. Of course, in-between came the Jan-1974 FER (2-months-long) shock. To face it, the ORR increased between the 4th and the 8th month, only to fall steadily after that; the RER devalued (especially after the 7th month); the fiscal deficit was turned into a surplus after the 6th month, and IR jumped more than 10 percentage points¹⁷; i.e. a policy mix - - W - S - S for ORR-RER-GDEF-IR,

¹⁶An incipient revaluation in the eleventh month was reversed one month later. These elements may indicate either that the authorities were not familiar with the type of shock they were facing, or that they regarded it as transitory, not requiring a strong contractionary policy. We will elaborate on this in the next section.

¹⁷This episode coincides with the implementation of an indexation mechanism for the nominal interest rate called UPAC, which is the Spanish abbreviation for "Constant Purchasing Power

Figure 4.1: Sequence of Events in Colombian Inflation and Characterization of Policy Responses



W : "weak" policy response; i.e. non-compatible with anti-inflationary package
 S : "strong" policy response.
 - : no easily identifiable reaction.

Source: Appendix 2.

respectively, resulted in a basically flat inflation rate.

The 1975-76 episodes belong to the same macroeconomic situation, and led to the most interesting case of *strong* anti-inflationary policy-making of the period under study. Together, these two shocks lasted one year and a half. The effect on inflation was dramatic: it jumped from 15% for Jan-1976 to 34% one year and a

Unit" (CPPU henceforth); this indexation mechanism produced for the first time positive real interest rates for savings deposits, and has since been blamed for the inflation that emerged from the early 1970s.

half later (see Fig. 3.1). The policy responses to both shocks were strongly anti-inflationary in all the indicators at hand (see Sarmiento, 1978, and Fig. 4.1)¹⁸; as a result, the annual inflation rate fell to 12.6% after one year of application of the medicine. This behavior is certainly that of a strong policy-maker. Curiously enough, immediately following the successful decline, π bounced rapidly back up to 25%, although no FER shock was present. We will address this issue in the next section.

The 1980s show little action on the ORR, IR and RER fronts, and high fluctuations in GDEF (see Fig. A.3). The authority did not use its tools in any dramatic way to fight inflation, and it appears that the strength of the shocks was not enough to challenge them.

Finally, the same type of econometric exercise was performed on the inflation rate; Fig. A.5 shows that in the aftermath of 4 out of 5 of the 1970's shocks π jumped, and in 3 of them, the increase was between 5 and 10 percentage points above its previous tendency; afterwards inflation either displayed persistency (Sep-72 and Jan-74), or fell as a consequence of the policy response (Nov-76 and Jun-

¹⁸IR declined slightly after Nov-1975 and reacted only 5 months after the Nov-1976 shock. One has to bear in mind that these shocks greatly increased liquidity in the economy, leading to a rightwards shift of the LM curve, thus reducing the interest rate. In fact, econometric results show that Colombia displays a liquidity effect of one to two quarters duration (see Toro, 1987 and Echeverry, 1993).

79). It is important to stress that the first shock (Sep-72) led to a permanent increase in the rate of inflation which somehow was "validated" by the next episode (Jan-74).

In sum, the theory successfully explains the major events registered by π : persistency when W policy-making was present, and disinflation when S-policy-making took over; the event-study methodology proved to be an adequate device for our purposes. The only fact that escapes explanation is why the origin and lack of persistency of disinflations. This will be the topic of a later section.

The evidence presented so far has focused on the post-shock behavior of some representative policy indicators. However, such variables are themselves part of a macroeconomic equilibrium that partly endogenizes their behavior. Therefore, in order to provide outside evidence for characterizing the policy responses, we studied the Minutes of the Colombian Monetary Board, certainly the best evidence on policy-making available. This is the subject of the next pages.

4.2. EVIDENCE FROM THE MINUTES OF THE MONETARY BOARD

"En Colombia se ha desarrollado la costumbre de atribuir todo o parte de un aumento en medios de pago a causas específicas tales como la entrada de reservas internacionales [...]. En un sentido estrictamente próximo puede existir alguna justificación para esta costumbre. Sin embargo, en un sentido más profundo, teniendo la autoridad monetaria el poder suficiente como para incrementar o compensar movimientos en los medios de pago iniciados en otra parte, debe asumir responsabilidad por todos los movimientos de tales medios de pago. En otras palabras, se debe asumir que todos esos movimientos están de acuerdo con o expresan la voluntad y la intención de la autoridad monetaria. " L. Currie (1983), p. 37

This section is a summary of the chronological study of the Minutes of the Monetary Board and the Documents of the Board Advisors (available upon request). It aims at identifying the main elements of the monetary policy package designed to face each FER shock. In providing more information to classify policy responses as either W or S, it will reinforce the classification of Fig. 3.1, and enrich our understanding of each episode with information on discussions pursued at the highest sphere of monetary policy-making in the country.

4.2.1. The Jump in the Inflation Rate: 1971-1974¹⁹

The session of Feb. 23rd 1972 is crucial to understand the mood of the monetary authorities during the first episode (**Dec.-1971 : Jan.-1972**), which led to a jump in the inflation rate from 7% to 13%. The analysis of the Board's *Advisors* at that point found a lower-than-expected growth of liquidity for the year. Accordingly, expansionary monetary policy was undertaken, in the form of lower Ordinary Reserve Requirements (ORR) and higher growth of banking credit, as well as a reduction of "Anticipated Import Deposits" (AID). This clearly established a propitious environment for inflation.

Regarding the first shock on our list (e.g. **Sep.-1972 : Mar.-1973**), the session of Oct. 30th 1972 summarizes the basic weakness of the policy mix designed to face the inflationary pressures. During that meeting, the following issues were raised: i. the fiscal deficit was going to be at least 50% higher than expected at the end of the year; ii. with long term export promotion goals in mind, the board refused to make use of exchange rate policy (i.e. inducing a real appreciation); iii. the exhaustion of the available monetary tools (marginal and ordinary reserve requirements) and foreign trade mechanisms (allowances for faster imports drafts)

¹⁹For a thorough explanation of the Colombian economy during the 1960s and the first years of the 1970s see Diaz-Alejandro (1976) and Wiesner (1978).

as admitted; and finally iv. the Boar rejected the Advisor's petition for a new bond suitable for Open Market Operations (OMO). These elements confirm the weak character of the policy package used to confront the effects of the shock.

The discussions around the next episode (**Jan.-74 : Feb.-74**), are interesting for their summary of the events of the previous year and a half which resulted in an *unintended* jump of the inflation rate. The Board members quarrel as to who bears responsibility and finally adopt measures sought by some since the beginning of the inflationary pressures, and which had been postponed for one reason or another.

According to the advisors, the reasons behind the "evident lack of success" of the anti-inflationary policy are, first, the unsatisfactory fulfillment of the government's planned budget, in other words, the problem of monetary expansion caused by FER accumulation was of a fiscal nature. Second, the inherent limitations of monetary policy itself. In this regard there are several issues: **i.** the monetary policy's lack of instruments, which were restricted to ordinary and marginal reserve requirements (ORR and MRR respectively), limits to the growth of banking credit and import promoting measures; **ii.** the fact that the commitment to monetary stability was not sustained with the vigor and permanence necessary for it

to have an impact on Means of Payment growth²⁰.

Nevertheless, in terms of policy instruments, this situation led to two major developments for which the advisors had fought since the beginning of the inflationary pressures: the creation, on the one hand, of a new instrument for OMO, the Participation Bonds; and on the other, the move towards higher and freer interest rates, both for commercial banks time deposit certificates and for the OMO themselves.

An important result of this lack of success of policy was the *validation of the new level of inflation*²¹; indeed, some paragraphs show that the government was not interested in reducing inflation to one digit levels, but only in avoiding further increases. For instance, during an extraordinary meeting the then President of Colombia asked for the implementation of all necessary measures to guarantee stability, but added that "it is possible only to reduce the acceleration of the current inflationary process, since certain factors of external character are affecting it"²². Two indicators of this attitude are: first, interest rates of all government and

²⁰Commenting on this analysis the Minister of Finance argued that the government was not to blame for the monetary expansion since the net effect of domestic and foreign fiscal operations was contractionary, and the main causes of monetary pressure were external; the advisors disagreed with that view, and the discussion was left at that state.

²¹Currie (1984, p. 153) expressed the concern at that time regarding the monetary situation, and the fact that they blamed the inflation on a lack of monetary control. See also Wiesner (1978), p. 94.

²²At this meeting the President was informed of the policies undertaken, which included:

central bank instruments were revised upwards to match the new level of inflation; and second, the forecast of nominal GDP growth used by the advisors to compute the desired M1 growth for 1974 was set at 18%, revealing an accommodation to the higher inflation rate.

In sum, despite the fact that the response to the 1974 shock was stronger than those of the two previous shocks, a crucial side-effect was the validation of a new level of inflation above 20%.

4.2.2. The Big FER Bonanzas of the Late 1970s

During the **Nov.-1975 : Feb.-76** episode the monetary authorities faced a problems: a sharp reversal in the external situation in July 1975 forced a sharp change in policy. Expansionary measures had been adopted during the first half of the year, originally meant to compensate for an expected fall in FER, but had to be reversed since it was necessary to neutralize the effect of an accumulation of reserves.

During the first semester of 1976 the ORR and the AID were reduced and

higher interest rates for bank credit; higher ORR; harsher conditions on discount loans; a new structure for AID system; an increased imports budget; reform of the Time Deposits Certificate for banks, including a free interest rate to depositors; and the authorization of the Central Bank to issue Participation Bonds.

the Government sold P/. 800 m.²³ of Economic Emergency Bonds (EEB) to the Central Bank (CB). Although it was clear that during the second half of the year the policy package would have to reverse these measures and to offset monetary expansion, surprisingly some policies taken led to a worsening of the problem of monetary control: i. The Government utilized P/. 1 bn. of a CB loan ("el cupo ") and increased the total of EEB sold to the CB as sources of financing to P/. 1.3 bn.. These two actions accounted for 21% of the total increase in the Monetary Base (MB) during the year. Additionally the government appropriated the revenues of the Special Exchange Accounts ("Cuenta Especial de Cambios", EEA henceforth), which also contributed to primary expansion. ii. The AID was again reduced in October, from 40% to 25%, which eventually accounted for 19% of the annual increase in MB²⁴. The jump in international coffee prices due to the freeze affecting the in Brazilian crop, and the higher volume of coffee and non-traditional exports (which explained 41% of the increase in MB) completed the picture.

Although the authorities set the ORR at 36%, and at 80% for deposits by the Central Government's institutions, they could not design a coherent contrac-

²³P./: Colombian pesos; m.: millions, bn.: billions.

²⁴A study of the behavior of imports in this period is done in Ocampo and Reveis (1979), p.236.

tionary package. Expansionary government financing and the AID reduction were symptomatic of the weak attitude which undermined the sterilization policy. The advisors explicitly blamed these measures for the jump in monetary aggregates, the biggest increase of the previous two decades.

Following the frost in Brazil in mid 1975 and its impact on the world coffee supply, the increase in the international price led to an enormous expansion of Colombian FER. This, together with a widespread drought, that affected agricultural production, set the scene for the **Nov.-1976 : May.-1978** episode. In response the Monetary authority based its policies on a series of premises: the strong relation between M1 fluctuations and inflation, the influence of the agricultural supply on the price level and the identification of FER accumulation as the main cause of excess liquidity in the economy.

The situation became critical in 1977 as the accumulation of FER seemed to accelerate, service exports grew by 82% in the first two months, and inflation increased from 25.9% to 43.5% between December 1976 and June 1977. The yearly rate of growth of the CPI (excluding food) remained approximately constant, while the change in the annual growth rate of food prices escalated from 27.8% to 58.1%. In addition cotton growers suffered crop losses due to the drought, forcing the monetary authority to refinance loans and to grant aid to help the recovery

of the sector.

On another front, the electric sector faced a crisis. The Fondo de Desarrollo Eléctrico, which was created to finance the sector, had a shortfall of P/. 2.2 bn. by the end of 1976 and of P/. 3,9 bn. a year later. This created a monetary expansion of P/. 1.5 bn. in 1976 and, according to the advisors, it would create an expansion of P/. 5 bn. (5% of the monetary base) in 1978.

Ocampo et al. (1978) assert that a crucial component of the strategy was the rejection by the government to use taxation on the booming sector, with the consequence of allowing the tremendous external shock to fully transmit its effects domestically. In response, the Central Bank undertook a policy aimed at reducing the liquidity of the economy and containing the inflationary process. The major imbalance was due to the transitory balance of payment surplus, which could not be neutralized by policies affecting international trade as they would reverse long run objectives. The decision was made to allow the accumulation of FER and to reduce public expenditure (see Sarmiento, 1978).

For the advisors the increase in savings had to come from sectors that were enjoying an income surplus. That is where the Exchange Certificates (EC) and the AID came into play; freezing an important portion of the increase in the Monetary Base. The EC were bonds exchanged for FER from coffee and service exports;

they could be used immediately for payments abroad, or be redeemed from the Central Bank some period after their release. This tool was later extended to exports of cotton, flowers, meat and precious stones and the maturity period was extended from one month to three (see Wiesner, 1978, p. 101). The second tool (AID) obliged importers to pay in advance the majority of international drafts. In addition, the Central Bank bought only foreign currency that met a series of requirements and importers had to make their drafts within a stipulated period.

Other tools used were the ORR, which was raised by three percentage points and a Marginal Reserve Requirement (MRR) of 100% on current account deposits, on top of their level on October 22nd 1976. The government cut its expenditure and obtained more revenues through taxes. PBs were not used in this episode; as stated by the Minister of Finance the CB should not have to deal with the costs of monetary control; It was felt that there were other possible tools, equally as effective, which entailed no cost to the Bank.

The advisors deemed this stabilization policy successful. By the end of 1977 EC led to a contraction of P./13.8 bn; the AID government surplus resulted in contraction and the savings deposits of P/.12.7 bn. The combined effect was a Monetary Base 50%. According to the advisors' data, the price index for food slipped from 58.9% in June to 35% in December 1977, and inflation was scaled

down from 43.5% to 29.3% over the same period.

It is of paramount importance to understand the 1975-78 period as a whole; indeed, the particular policy mix of the second half of 1975 and 1976 explains why the inflation rate rose from less than 15% at the end of 1975 to more than 30% at the beginning of 1977. Several elements are crucial: **i.** the only partial reversal of the expansionary measures of the first half of 1975; **ii.** the expansionary government financing and the further fall in AID during the second half of the year; and **iii.** the fact that, at the beginning of 1976, the Board eliminated 25% of AID requirement²⁵; and, **iv.** as Table 4.1 shows, the positive but still timid OMO pursued with regard to the coffee growers surplus during the first quarter of 1976²⁶. These were the components of a weak policy attitude, which, when added to the FER shock, were responsible for the jump in inflation. An effective contractionary effort and a coherent package was designed and carried out from Dec. 1976 onwards (see Sarmiento, 1978), when the level reached by the inflation rate was deemed inadmissible.

²⁵The AID was eliminated in February. The advisors blame this measure for the monetary expansion of the first semester (see AD-74/1976, Aug. 11, p. 4).

²⁶In fact in AD-100/1976, Oct. 20th, the advisors point out that the most worrisome element is the behavior of the OMO. The commitment of the coffee growers was to acquire EB for \$ 100 million during the second semester of 1976; however they actually bought \$ 17 m. between June and October. Hence, the advisors consider that : "... under the recent behavior of the figures it does not seem feasible to reach the foreseen sterilization and, therefore, the goals of M1 growth agreed upon by the Board. "

This evidence favors the view that the advent of a S-policy attitude is **not a random phenomenon**, but is determined by jumps in the inflation rate to levels considered inadmissible; such an inflation threshold of course depends on the institutional framework and is time-and-place-specific²⁷. This is an element not included in Ball's (1990) model.

²⁷It has to be mentioned that there was no change in advisors in the midst of the crisis.

Table 4.1 Exchangeable Bonds Sold to		
	Coffee Growers	(\$ millions)
Quarter	Exchangeable Bonds	Absolute Change
1975-4	24	23
1976-1	33	9
1976-2	65	32
1976-3	84	19
1976-4	104	20
1977-1	242	138
1977-2	160	-82
1977-3	50	-110
1977-4	1	-49

Source: Jaramillo (1979).

In absolute terms the jump in FER that triggered the Nov.-1979 : Jan.-1980 shock was twice as large as that of 1975-76, but its origins were more diverse: exports of **non-traditional products**²⁸ and services, and the capital account contributed more than coffee to the accumulation of FER. The novelty in terms of monetary policy was that all the instruments used to face the previous episode were in full force; this was in particular the case for the ORR and the MRR, whose long duration had already caused harmful distortions in banking systems accounting practices. On the other hand, administrative controls on the interest rate, established in mid-1978 to protect the CPPU system, were still in place. The authorities were thus obliged, fortunately, to use peso-denominated OMO, in the form of PB (see Table 4.2 and Fig. 4.2). This was the most important tool used to counter the effect of accumulating FER. The advisors also claim that fiscal policy greatly contributed to the package, although in our statistical analysis it appears as being neutral (see Fig. 4.1 and Fig. A.3).

²⁸According to standard domestic classification, all exports other than coffee, oil and coal.

Table 4.2 PB / Monetary Base (%)

	1979	1980
Mar.	0	10.4
Jun.	0	10.5
Sep.	1.1	12.7
Dec.	5.4	11.7

Source: Memorando Semanal J. M.

New developments in monetary policy were also derived from this episode. In particular, the advisors argued forcefully in favor of freer interest rates, achieving Board's authorization for liberalizing interest rates on bank loans. The harmful effects on the financial system's profitability resulting from the policy high reserve requirements of the previous three years was also recognized by the authorities; hence, measures were taken to relieve this burden and to move towards a more ra-

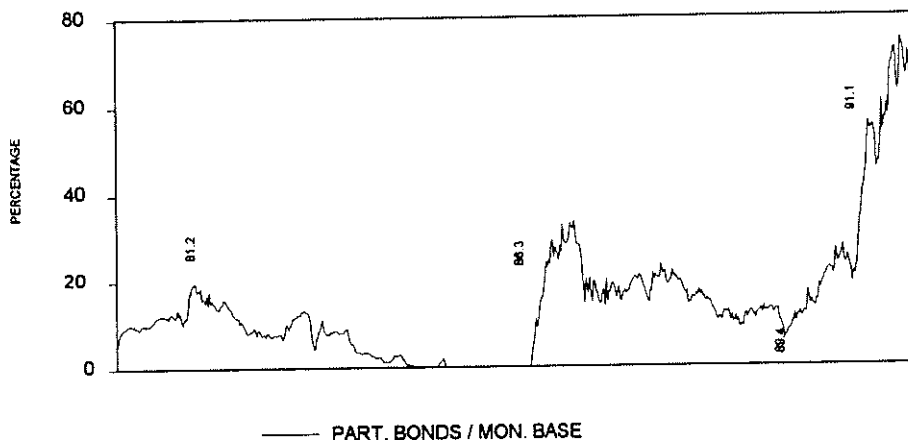
tional reserve requirements policy compatible with the anti-inflationary monetary policy. Finally, the advisors promoted a faster pace of devaluation, as a signal to induce more imports drafts and to mitigate the FER accumulation.

At the beginning of 1980 an atmosphere of satisfaction reigned in the advisors' documents and in Board meetings because of 1979's results. A final increase in M1 of 24% was considered as positive despite the fact that the inflation rate for employees salaries was at 26.5% and for wage earners it had reached 29.8%. This can be interpreted as a clear sign of the validation of such levels as being normal or acceptable inflation rates. In fact the advisors recognized that the chronic inflation of the previous 8 years had been accompanied by equally chronic increases in liquidity, indicating the validation by the authorities. This was also clear to outside observers, as in the quote by Currie at the beginning of this section. The advisors manifested also their preoccupation with the political pressures against a stronger anti-inflationary policy, and proposed a gradual reduction in the money supply growth targets to 15% over the following three years.

4.2.3. A Validated level of High Inflation: 1985-1991

In Dec.-1985 : Jan.-1986 the country received another FER shocks, whose timing could not have been more appropriate. Having just left a difficult adjust-

Figure 4.2: Participation Bonds over the Monetary Base (%) 1979-1991



ment program caused in part by a rapid depletion of its international assets, the economy was thirsty for foreign exchange inflows. At the time of the shock the inflation rate was displaying a downward tendency. The EC played an important role in turning down the inflation rate during 1985, since its return was linked to the nominal rate of devaluation. When the shock hit the economy the authorities were conscious that the EC become a less attractive policy option (did not have an attractive expected return anymore), and shifted towards PB. Fig. 4.2 shows the big jump of PB following March 1986.

The package used during this period included an acceleration of imports drafts, the issue of PB and, repeatedly underlined and praised by the advisors, an agree-

ment with coffee growers which allowed the creation of big and timely savings in the very sector which was receiving a major share of revenues in the economy.

The authorities did not display an overwhelming preoccupation with the shock that occurred during the last two months of 1986. The inflation rate was around 20%, and the Bonanza Policy, as can be seen from Fig. 4.2, was heavily dependent on PB, whose level reached 35% of the Monetary base. For the sake of long run exports competitiveness, the decision was taken not to sacrifice the RER to a contractionary policy, and FER were consciously accumulated. Other noticeable measures were the increase in ORR of governmental deposits in the banking system, and the effort to reduce the high seasonal jump of liquidity at the end of the year. The policy was again regarded as widely successful by the members of the Board and M1 growth targets were set for 1987, validating a level of inflation of 20%.

In a remarkable discussion promoted by the advisors, the claim was made that the "cupos" and the use of the EEA represented direct and messy interference by the legislative branch and the government in the realm of monetary policy. This argument was rejected within the Board on the grounds of the high level of unemployment afflicting the country, typifying a W attitude.

During the first quarter of 1988 (our next shock is in June 1988) the inflation

rate jumped 2.5 percentage points. The explicit aim of the Board was to use gradual measures in order not to validate such increases in prices. However, some other issues also occupied its attention: **i.** the allegedly high level of nominal interest rates (37% in April); **ii.** the low profitability of the financial system; and **iii.** the slow pace of growth of some monetary aggregates. These issues were basically explained by the lack of liquidity due mainly to a flight to cash on the part of the public (originated by government measures taken at the end of 1987). Hence, the policy proposed during the second quarter was not to seek too eagerly the monetary goals set at the beginning of the year.

The inflation rate continued to rise until it reached a peak of 30.3% in June (a record level for the decade), leading the advisors to consider food imports in addition to a reduction of monetary growth. However, no strong measures were taken in the OMO or CB-loans fronts. The remainder of the macroeconomic indicators, however, exhibited a satisfactory performance.

During the third quarter an administrative control was imposed on interest rates, and money was pumped into the economy through all available channels to compensate for the contraction of the previous 8 months. No sign of S attitude was displayed during the whole second semester. On the contrary, a clearly expansionary policy was adopted. In sum, 1988 was characterized by a stop-and-go

policy on the monetary front, caused by the incompatible objectives of simultaneously reducing inflation and interest rates, and by the constraints imposed by a weak financial system and the low demand of the public for current accounts.

The common denominator for the 1980s was the validation of a certain level of inflation. The inflation-validating behavior of the authorities was evident in the following:

1. Many objectives were clearly set above inflation in the authorities' line of priorities during this decade. Among them one could identify:
 - i. economic activity and unemployment, where there was a constant fear that a drastic anti-inflationary policy would imply a cost in terms of economic activity.
 - ii. the health of the financial system where it was considered imperative to provide the financial system with an acceptable level of profitability, especially after the financial crisis of the first part of the decade. And
 - iii. the external sector, where the fear of a foreign exchange crisis, such as that experienced between 1982-84, permeated the whole decade.
2. The systematic disregard, in particular by the Ministers of Finance, of the advisors' claims that political pressures promoted expansionary CB-loans to the government, or complicated the pursuit of monetary policies associated

with higher interest rates.

3. The persistent practice of setting targets of money supply growth on the basis of a stable level of inflation, with no explicit intention of long run inflation reduction.
4. The apparent disregard of the two episodes in which the inflation rate fell below 15%, which could otherwise have been seen as opportunities for setting a new long run ceiling for the inflation rate.
5. The over-emphasis by many economists on the inertial character of Colombian inflation, though discredited on several occasions by the advisors, which may have led to the conviction that the price necessary to reduce inflation would be too high.

In sum, the evidence of the Minutes of the Monetary Board provides narrative support for the working hypothesis, and to the characterization of policy responses proposed in the previous section. One element remains to be explained: what stopped the three disinflations that occurred between 1978 and 1991? this is the topic of the next section.

4.3. END OF DISINFLATIONS (Agriculture and Policy shocks)

Among the stylized facts of Colombian inflation depicted in Fig. 4.1 three episodes of disinflation require clarification. The theory presented predicts that at some (random)

point in time a strong policy-maker will disinflate; this, as we have already seen, adequately describes the 1977-78 disinflation. This was not the reason for the 1982-84 disinflation, when a negative demand shock rather than the presence of a strong policy-maker was the cause behind the events. The third disinflation, as we will see, was again due to "strong" policy measures.

For our purposes, however, the most interesting question regarding these episodes is why the fall in π was not persistent (as Ball's model predicts), but was followed by a jump of 10 percentage points in each case. The natural tendency would be to think that the policy-maker turned weak when faced with increasing costs in terms of output and employment. But table 4.3 indicates that the explanation has to be found somewhere else: indeed, after these dates there seems to be no trace of a systematic shift towards weak policy-making.

Table 4.3 Policy Reaction to End of Disinflations			
	Jul-1978	May-1984	Jun-1986
ORR	-	-	-
RER	S	W	S
GDEF	S	-	S
IR	S	-	-

Source: Figure A.6, Appendix 2.

In fact the source of inflation is to be found in agricultural supply shocks, and in the special package assembled to face the mid-1984 external crisis. We will first concentrate on the two dates when agricultural shocks were determinant.

4.3.1. Agricultural output shocks

Fig 4.3 shows that in July 1978 and June 1986 the food component of the CPI displayed a dramatic change in its tendency²⁹. The question is whether the jump

²⁹The strong effect of food prices on the CPI are not exclusive to small economies; Fischer (1981b) reports that during the 1970s most of the observed increases in price variability in the USA was due to large increases in the prices of food and energy.

in the CPI caused the increases in the food price index (FPI), or the other way around. The behavior of agricultural production can shed light on the direction of causality. The figure also shows the growth rates of agricultural output and food price changes during the months adjacent to the dates in question. Three facts can be noted:

i. As expected, there is a strong inverse relationship between the two variables, visible in both panels and in the slope of the regression lines.

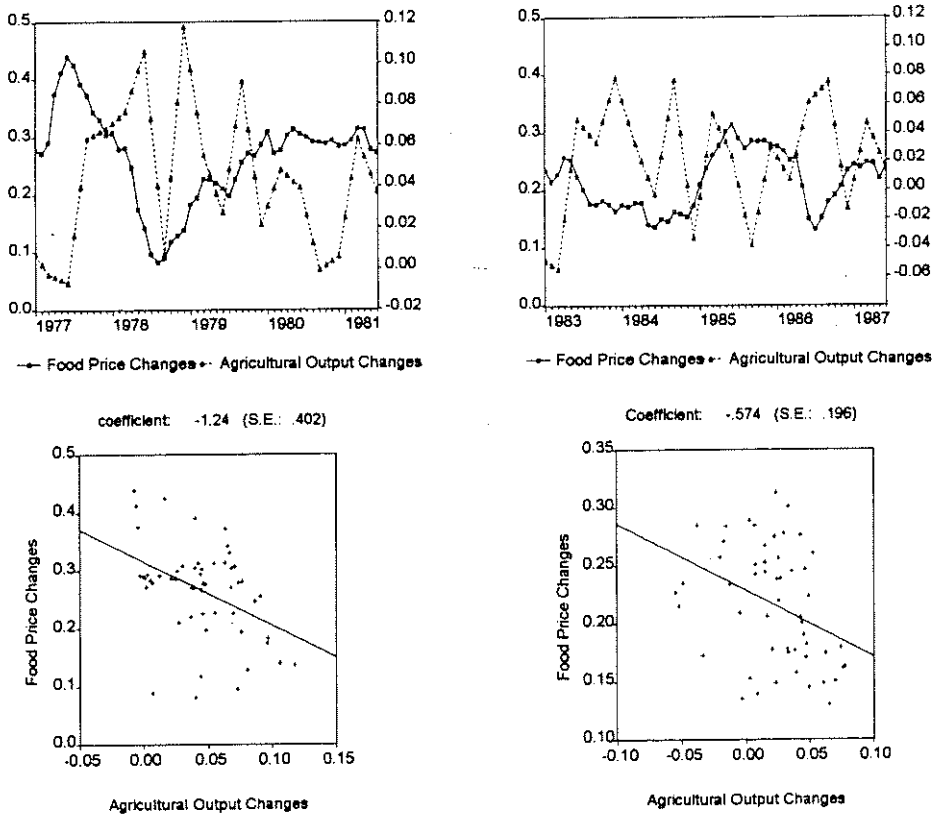
ii. The third quarter of 1978 witnessed a drastic fall in agricultural production, which coincided with a change in the tendency of food prices. This fall was part of the adjusting process of some agricultural products to the drastic drought of 1976-77; in deed, there is evidence that a longlasting cobweb model characterizes some agricultural products with high weight on Colombia's CPI³⁰.

iii. The second half of 1986 also displayed a collapse in agricultural output, from rates of growth of more than 5% in the 2nd and 3rd quarters to negative growth in the 4th quarter.

The conclusion we draw is that in the months adjacent to July 1978 and June 1986 a shift in agricultural production led to increments in food prices, and became

³⁰In particular potatoes and vegetables (9% of CPI) and meat (10% of CPI). Research in process by Felipe Jaramillo indicates that an exogenous shock causes the supply of these products to display dampening fluctuations during the following three and four years. Hence, the disinflation reported and the subsequent rebound may easily be part of the same shock.

Figure 4.3: Agricultural Shocks and Food Price Increases



a major independent cause behind the end of the disinflations. This is reinforced by the fact that the only component of the CPI that saw a dramatic change from a declining tendency in the proximity of these dates was food³¹. Therefore we claim that the shocks that explain these episodes were strong recessions in agricultural production³².

In these two cases inflation displayed persistency after the shock. From table 4.3 we know that, if anything, the authorities used their tools to counteract inflation; however, the strong policy following July 1978, accommodated a level of inflation of 25% for the 3 years after 1979. Similarly, the policy mix after June 1986 was softened following the shock of Nov. 1986, and was not aimed at creating a disinflation, but rather at containing the increase in inflation.

³¹The timing of CPI-inflation and food-prices-increases shows that the exact date of the increase of the CPI occurs one or two months *before* that of the food prices; in fact, during the Jul-78 and the Jun-86 increases miscellaneous and clothing groups respectively, preceded by one month the low point of "food-inflation"; however, those other components of the CPI remained stable afterwards, giving food prices all the responsibility for the further increase in the CPI-inflation.

³²Another force behind these events may have been the rate of devaluation. A plot of RER and the inflation rate displays similar patterns to those of Fig. 4.3. The story here would be that exporters received some exchange rate gains simultaneous with this episodes, ultimately also contributing to the end of disinflations.

4.3.2. The Adjustment package of 1984-85

The last increase in π that remains to be accounted for is that of June 1984. The response to this conjuncture was a drastic adjustment package in the fiscal and external sector, consisting mainly of a government deficit reduction, tax reform, and a rapid acceleration of the rate of devaluation (see Banco de la República, and Garay and Carrasquilla, 1987). The authorities, to some extent, sacrificed a decrease in the inflation rate to the goal of balancing the economy ³³.

During the first months of 1986 the monetary authority used a rather new tool, not included in the battery of Appendix 2: the Open Market Operations (see Notas Editoriales, Feb, 1986); the OMO and a fall in food prices produced the turn down in the tendency of π during 1985. According to one official of the CB, the mood of the second half of the 1980s was of avoiding the reemergence of a balance of payments crisis; to this end ambitious targets of inflation reduction were sacrificed. We do not recall one published statement of policy-makers during the years 1978-1991 that set goals for the inflation rate of less than, say, 15%.

³³The official explanation of the inflation increase is as follows: "... the results with respect to the evolution of prices have been satisfactory. Indeed, in spite of the increase in the rhythm of growth of the CPI from 18.3% in 1984 to 22.5% in 1985, the country ended the year with a tendency towards price stabilization. These favorable results were reached in spite of various adverse forces that threatened inflation: (i) the exchange rate adjustment; (ii) the generalization of the Value Added Tax in 1984; (iii) the necessary restrictions to imports imposed in 1984 and the first half of 1985." (Notas Editoriales, Revista del Banco de la República, Dec. 1985, p. 18; our translation).

Inflation became an issue only when it reached rates in the upper twenties ³⁴. Apart from that, the overall attitude was closer to what Ball characterizes as W.

5. IS THERE A FRICTIONLESS INFLATION IN THIS WORLD?

5.1. REVIEW OF THE LITERATURE AND HYPOTHESIS

Since the Bailey (1957) article, there has been an extensive literature on the costs of inflation; in this section we will concentrate on one stream of thinking which stresses that the main welfare costs of inflation emerge from the positive correlation between its level and relative price variability (RPV). According to the traditional view, in an uncertain environment (where the difficulty of separating aggregate from idiosyncratic shocks leads to misperceptions of price changes; see Lucas, 1973) higher price dispersion reduces the information content of prices and leads to inefficient decisions by producers. Recent literature (Benabou, 1992; and

³⁴The official yearly inflation rate is computed with the formula

$$\Delta CPI = ((CPI_t / CPI_{t-12}) - 1) * 100$$

rather than the log-difference of the CPI; for this reason the upper bound of our figures appears to be 27%, whereas the upper-bound in people's minds (policy-makers, the press and the public) was around 30%. Every time the inflation rate came close to 30% the monetary authorities reacted with effective contractionary measures.

Benabou and Gertner, 1993) casts doubt on the necessary connection between RPV and welfare loss. When these authors endogenize the acquisition of information by producers and consumers, the increase in relative price dispersion can lead to an equilibrium in which the incentives for more search are welfare enhancing. The issue deciding the welfare costs of inflation is the cost of acquiring information. Environments of low search-costs may reverse the traditional evil of inflation³⁵.

Ball (1990a) aims at generating the traditional positive inflation-RPV relationship but through another channel. In his model, which is similar to that presented in the appendix, higher inflation increases uncertainty regarding future monetary policy. The source of uncertainty is the public's awareness W and S alternation, and whose consequences are more dramatic if inflation is high.

The empirical literature has addressed different issues regarding the inflation-RPV relationship:

i. *the sign*: Marquez and Vining (1984) survey a number of empirical studies,

³⁵One interesting issue is whether inflation and increased RPV raises or reduces search. Benabou (1992) maintains that RPV always raises the return to search, in particular for low search-cost types; if consumers face monopolistic or oligopolistic producers increased search reduces monopoly power, and therefore increases welfare. For Tomassi (1994) inflation depreciates the information that current prices convey about future relative prices, makes people less choosy, diminishes their holdings of "information stocks" and causes a welfare loss. A similar point is defended by Ball et al. (1993).

and report that most of the statistical tests yield positive and significant association, apart from a study on Great Britain which obtained a negative though statistically insignificant relationship. More recent tests have confirmed this result for different countries (Domberger, 1987; Van Hooymissen, 1988, and Lach et al., 1992).

ii. *stability*: Fischer(1981b) finds that for the USA before 1972 the coefficient of π as a regressor of RPV is negative, though not significantly different from zero; after 1972 it is positive and significant indicating that the relation between relative price variability and inflation became important with the oil price shocks.

iii. *inflation volatility and RPV*: since, as we have seen, high inflation is not necessarily more volatile than low inflation, a further issue is whether volatility, rather than the level of inflation, is related to RPV³⁶.

iv. *causality*: although it may seem that inflation comes first and enhanced RPV emerges as a consequence, the direction of causality is not obvious. Different models have justified paths ways of causation; in particular, Ball et al. (1994) present a model in which shocks to RPV induce inflation.

Here we will deal with the first two issues on this list. The point we want

³⁶The topic of inflation uncertainty received attention in the issue of the *Journal of Money Credit and Banking* of August 1993, part 2.

to make is that a moderately high and stable level of inflation *is not necessarily correlated with higher RPV*. However this relationship is not stable across time.

5.2. THE TEST

To this end we computed the standard deviation of annual changes in the four major groups of the CPI: food, clothing, housing, and miscellaneous. This is the variable we call RPV^{37} . Higher variability in relative price changes is recovered by higher dispersion in price adjustments across different groups.

To address points **i.** and **ii.** of the previous list we performed the following exercise: we run the regressions 5.1 and 5.2.

$$RPV_t = \beta_0 + \beta_2\pi + \varepsilon_1 \quad (5.1)$$

³⁷Marquez and Vining (1994) say that the most frequently measure of relative price variability used is:

$$VP_t = \sum_{i=0}^n w_{it} (DP_{it} - \pi_t)^2$$

where, DP_{it} is the rate of change of the price of the i th commodity; w_{it} is the weight measure, and n is the number of commodity groups included. Our measure is:

$$RPV_t = \sqrt{VP_t}$$

in other words, the standard deviation of the increments in the 4 big groups of the CPI, taking $w_{it} = 1/4$. We chose to take the annual increments instead of the monthly ones to filter the strong seasonality of these indices (especially food prices).

$$RPV_t = \beta_0 + \beta_1 RPV_{t-1} + \beta_2 \pi + \varepsilon_2 \quad (5.2)$$

with a window of 36 months of data, for the period Jan.-1970 : Dec.-1991. The window was moved forward one month at a time. The results for the β_2 coefficients of Eq. (5.1) are plotted against time in Figure 5.1³⁸.

The volatility of the β_2 estimate is striking. The level of inflation does not *necessarily* leads to enhanced RPV. A positive and significant association is found for the periods when inflation was affected by shocks, 1971-78 and 1983-87. The behavior in 1980 is strange, trough short-lived. Finally, 1988-91 a period of persistent and slowly increasing inflation was characterized by a negative and significant association³⁹.

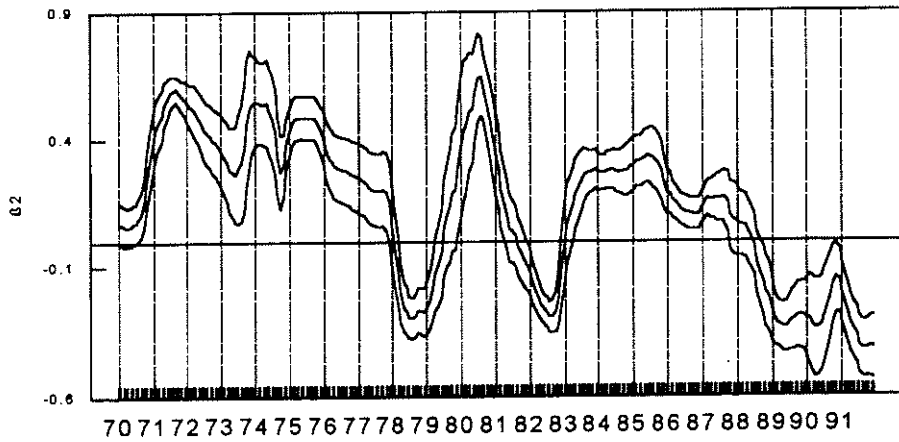
The basic results are robust to the estimation of Eq. 5.2 where the estimates (not shown) display shorter time spans for the significance of β_2 , but still within the periods already described. Hence, the answer to issues i. and ii. is: the rela-

³⁸The data for these regressions are centered at every month; e.g. β_2 of Jan.-1970 results from a regression estimated with the 36 months between Jul.-1968 : Jun.-1971. The size of the window was chosen by trading-off the asymptotic properties of the estimators, which demanded more observations, against the pattern of change of the Colombian inflation, which required a relatively short estimation period.

³⁹Evans and Wachtel (1993) have stressed the importance of *inflation regimes*. Their results point out that the uncertainty surrounding the future inflation regime at horizons of two or three years affected unemployment more than short-term uncertainty. Hence, time spans of relatively stable (yet slowly growing) inflation can lead it to be less costly.

Figure 5.1: Inflation and RPV 1970-91 - Equation 5.1

INFLATION RATE COEFFICIENT *
Window of 36 months - Centered



* $RPV = G_0 + G_2 \text{ INFLATION}$
Centered (18 observations on each side).

— Coefficient
- - + 2 S.E.
- - - 2 S.E.

tionship between the level of inflation and RPV is unstable, but displays positive sign during periods of shocks⁴⁰.

5.3. DISCUSSION

5.3.1. Indexation

One key element behind these results is the presence of widespread indexation (see Carrasquilla, 1992; Cárdenas, 1992b; Uribe, 1994b); this, in fact, was the case for the nominal interest rate, the exchange rate, labor and other nominal contracts, as an optimal response to a quite predictable (within a range) rate of inflation. Fischer and Summers (1989) argue that indexation mechanisms oriented to alleviate the costs of inflation are likely to be self-defeating, insofar as they promote more inflation. They claim that further jumps in π are associated with widespread indexation, since it hinders policy discipline. In the case of Colombia the forms of inflation mitigation introduced had mainly two effects:

- i. they reduced the effective costs of inflation during "normal" (e.g. no-shocks)

⁴⁰For a shorter span, and with a richer sample of CPI components, Jaramillo and Córdoba (1995) study the third and fourth moments of inflation; they also perform a test of the relationship between π and its second moment congruent with our results. Oliveros (1989) pursues a test similar to ours and finds a positive association between π and RPV; however that result emerges from his period of study. Other empirical estimations of the costs of inflation have been performed for Colombia, especially by the group of researchers of the Central Bank. Almost without exception they yield positive costs for the 1972-1991 period. See Carrasquilla et al. (1994), Uribe (1994a), Partow (1995) and Posada (1995).

periods; and,

ii. they diminished the incentives for inflation reduction for the government, as the evidence from the Minutes shows.

But, as we argue next, the indexation did not lead to lack of policy discipline.

5.3.2. An "Inflation Ceiling " as a discipline-enhancing phenomenon

Contrary to Ball's (1990a) prediction, higher inflation did not increase uncertainty about monetary policy. The fact is that within the institutional framework of Colombian monetary policy a high level of inflation reduced the margin of action of the monetary authority (the scope for discretion) and therefore diminished uncertainty about the course of future policy actions. In the case of Colombia this can be supported by the fact that the head of the Central Bank has had stability of tenure, with periods of up to 10 years⁴¹. The evaluation of his performance has been traditionally related to the inflation record.

It also became apparent that the costs of any jump in inflation above a threshold of 30% would be very high. Some observers of Colombian inflationary process have called attention to such attitude; in particular, Hirschman (1978) asserts the

⁴¹This is one of the commonly used indicators of CB independence (see Cukierman, 1992). Meisel rightly classifies this period as one of no CB independence, compared to previous time spans during this century; however, for Latin-American standards Colombia's CB was relatively more independent of the government.

following: "moderate inflation may be helpful to a government and particularly to a finance minister who is trying to resist political pressures toward more spending. Inflation is a telling proof that spending is already taking place at an excessive rate. [...] Inflation supplies not only evidence that spending must be controlled [but also] in a number of developing countries inflation has acted as an equivalent of war in setting the stage for more forceful taxation." In this sense we believe that a consensus inflation ceiling became a discipline-enhancing phenomenon, ultimately increasing the accountability of the monetary authorities.

The authorities revealed that while no emphasis would be put on reducing inflation down by a significant amount, strong policy-making would avoid that inflation surpassed 30%. Hence, a moderate inflation within the 20%-30% bounds was accepted and perpetuated by an implicit consensus between the authorities and the public. As the evidence indicates (see Carrasquilla 1993, 1994, 1995), this state of affairs led to lower RPV.

It might well be the case that prolonged periods of high and stable inflation make the situation close to the Jaffee-Kleiman definition of "steady state inflation rate": **i.** inflation is perfectly foreseen by all individuals; **ii.** institutions allow for full adjustment to inflation; and **iii.** relative prices do not change (cited in Marquez and Vining, 1984). The only identifiable cost of this type of inflation

is the loss in purchasing power of money holdings (Bailey, 1956), and the price-adjustment costs.

Concluding, the country certainly reached a higher equilibrium inflation, but this level might have acted as a disciplinary device for monetary policy. During the second half of the 1980s the government acquired a reputation of not allowing π to go above 30%. This credible upper bound, and widespread indexation, created the remarkable negative relationship between the inflation rate and its variability that we have reported in this section. It is this result which leads us to conjecture the presence of a nearly "frictionless" inflation for some periods of Colombian recent history (Patinkin, 1993).

6. CONCLUDING REMARKS

Ball's (1990 b) theoretical model seems to explain most of the stylized facts regarding the rise and perpetuation of Colombian moderate inflation. However, the emergence of a "strong" policy response against inflation was not a random phenomenon, but determined by the magnitude of the inflationary shock; this should be accounted for by the model. For the country, the emergence of a "consensus upper bound" of 30% determined the timing of strong policy-making.

A positive association between inflation and relative price variability was found only for the periods when inflation jumped to a new equilibrium level, and when shocks were counteracted by "strong" measures. That is, spans when the information structure of agents was forced to adapt to news emerging from shocks and policy responses. In contrast, periods of persistency were characterized by a negative relationship between inflation and RPV.

It is conjectured that a high and stable rate of inflation resulted in consensus for an inflation ceiling that acted as a discipline enhancer and reduced the margin for discretionary action by monetary authorities. In turn it reduced uncertainty regarding future policy. This fact and widespread indexation explain

the seemingly "frictionless" inflation of the second half of the 1980s.

This state of affairs poses a dilemma for disinflationary policy: a reduction to a lower rates of inflation may abolish the "upper bound" that constrained discretion, and hence lead to higher RPV.

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A. Appendix 1: Ball's (1990b) model

The model uses a set-up common to the asymmetric information policy-games literature in an infinite horizon; and uses Markov perfect equilibria for obtaining uniqueness. As it is customary in this family of models, the weak policy-maker minimizes the loss function (2.1)

$$L = (U - U^*)^2 + a\pi^2 \quad (\text{A.1})$$

Where U is actual employment, U^* stands for optimal employment and π is the inflation rate; it shows that W dislikes increases in unemployment as well as in inflation ($a > \pi^*$). On the other hand S does not care about unemployment, and sets $\pi = \pi^*$ whenever he faces a positive level of it.

There is a short-run Phillips curve in which the inflation rate is affected by random macro-shocks:

$$\pi = \pi^e + (U^N - U) + \eta, \quad U^N = U^* + 1 \quad (\text{A.2})$$

Where π^e is expected inflation, U^N is the natural rate of unemployment ($U^N =$

$U^* + 1$ is a normalization in the units of U), and η is the shock. The characteristics of the shock are as follows: $\eta = \bar{\eta}$ ($\bar{\eta} > 0$) with probability q ; and $\eta = 0$ with probability $(1 - q)$. It is observable to everybody and serially uncorrelated; as Ball stresses, the crucial point is that the shock raises the cost of maintaining low inflation.

With this set-up the public and the policy-maker enter in a game of asymmetric information; the former, ignorant about who is in office sets π^e , then the value of the shock η is realized, finally, the policy-maker (whose type can change at any period) decides either to accommodate or to fight the new level of inflation.

In order to obtain uniqueness, Ball concentrates on Markov perfect equilibria; in them agents' actions depend only on variables that affect current payoffs; accordingly, agents do not care about previous realizations of η (since shocks are serially uncorrelated), and only the most recent identity of the policy-maker counts at the moment of setting π^e . If no new information arrived during the last period (e.g. $\eta_{t-1} = 0$), the public remains unsure about the type of the policy-maker and assigns a probability p to the fact that W was in fact in office. Hence, $\pi^e = \pi^e(p)$.

Once π^e has been set, and η observed, the policy-maker, if strong, sets $\pi = \pi^*$; if weak, he solves the following loss minimization problem:

$$\min_{\pi} \left[(U^N - U^*) - (\pi - \pi^E) + \eta \right]^2 + a\pi^2 \quad (\text{A.3})$$

From the first order condition, and upon the mentioned normalization, the expression found for the inflation rate is:

$$\pi^d = \frac{\pi^e + \eta + 1}{a + 1} \quad (\text{A.4})$$

π^d is the level of inflation that W chooses when facing an inflationary shock; it represents an optimal level of inflation since it minimizes W 's loss in the current period. The public observes the realization of the shock, and either zero inflation, which would reveal that S was in office, or π^d , which would show that W faced the situation. If actual $\pi = \pi^d$, then $\pi^e = \pi^e(p = 1)$; e.g. the public will know that W was in office and will set positive inflation expectations for next period; hence, W will have again the incentive to inflate, since its identity has been revealed. This situation will continue until a strong policy-maker is appointed, sets $\pi = 0$, and the game starts over again.

The probability of W being in office is given by p ; if we call w the probability of S being replaced by W , and s the probability of W being replaced by S , then

under no new information ($\eta = \bar{\eta}$), next period's p will be given by:

$$\hat{p} = p(1 - s) + (1 - p)w$$

in this way the public updates p in so far as no shock occurs; that probability evolves to reach $\bar{p} = \frac{w}{(s+w)}$.

The equilibrium of this economy is as follows:

if

X_o : set of p 's for which W chooses $\pi = 0$, when $\eta = 0$

$X_{\bar{\eta}}$: set of p 's for which W chooses $\pi = 0$, when $\eta = \bar{\eta}$

EQUILIBRIUM:

$$X_o = [0, 1), \quad X_{\bar{\eta}} = \{\phi\} \tag{A.5}$$

meaning that if $0 \leq p < 1, \eta = 0$, then W sets $\pi = 0$

and W never sets $\pi = 0$ when $\eta = \bar{\eta}$.

The sequence of events in this economy will then be as follows:

(I) $p < 1, \eta = 0, \pi = \pi^*, p$ evolves to $\bar{p} = \frac{w}{(s+w)}$

(II) $\eta = \bar{\eta}$, either: S sets $\pi = \pi^*, p = 0$, back to (I)

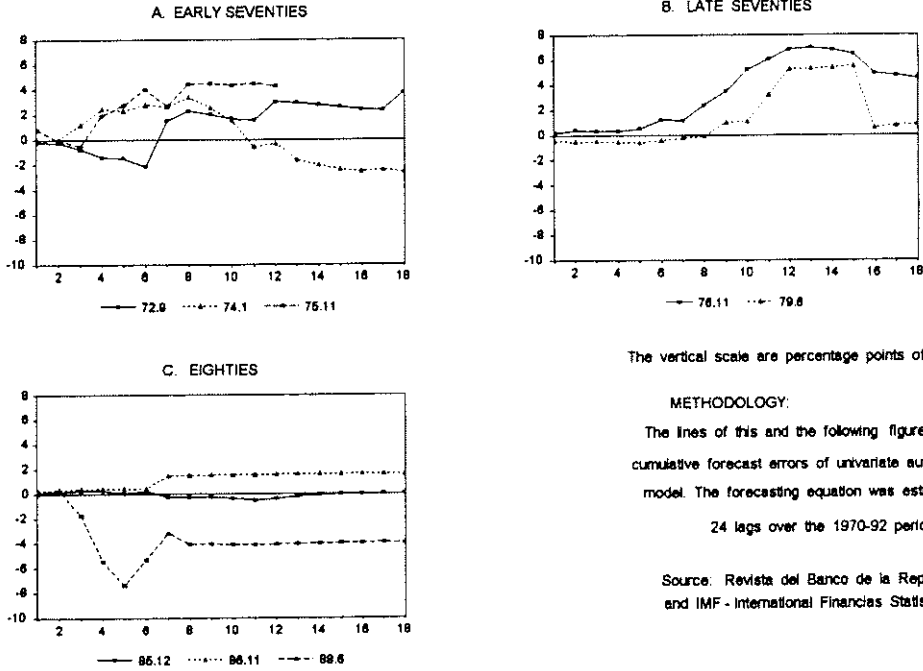
or: W sets $\pi = \pi^d$, and $p = 1$, to (III)

(III) in all subsequent periods W sets $\pi = \pi^d$, until it is replaced with

S, who sets $\pi = \pi^*$, $p = 0$; back to (I).

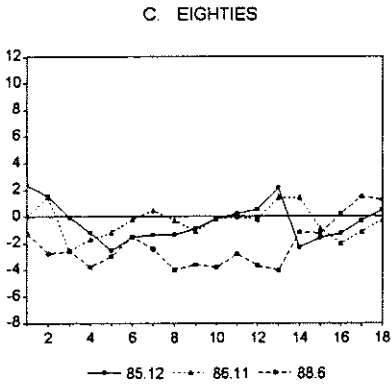
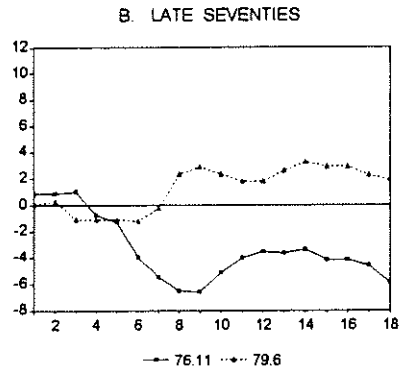
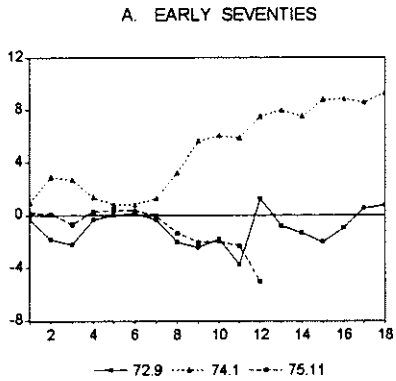
(A.5) is a perfect Nash equilibrium if W cannot gain by deviating from it in any period. the demonstration proceeds as follows: first the present valued of W's loss function when he follows (A.5) is determined; the loss depends on all the states of the economy, depending on p , η , and π . The present value of W's loss, as dependent on who was the most recent policy-maker, are derived through dynamic programming; given the one-period losses in various states and the probabilities of moving to new states through shocks and policy switches. Second possible deviations are accounted for. And third all deviations are found to be losers. A full demonstration can be found in Ball's paper itself. Here we describe how the demonstration proceeds.

Figure A.1: The ORR after FER Shocks



A. Appendix 2: Policy Reaction Functions

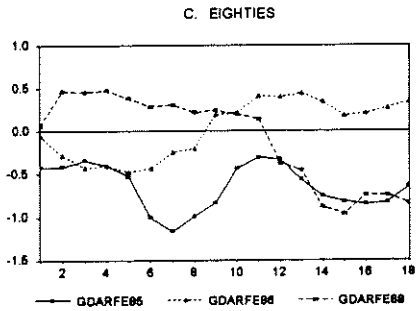
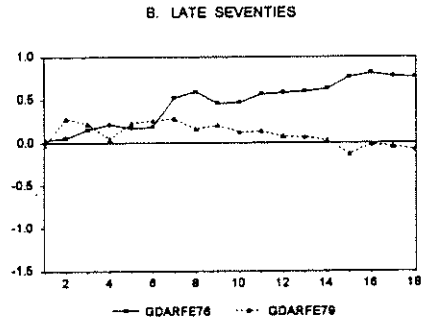
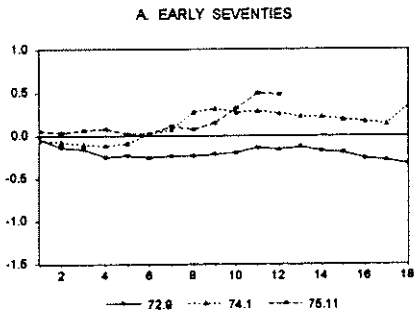
Figure A.2: The RER after FER Shocks



The scale represents cumulative percentage points of the index of the RER (1986=100).

Positive numbers indicate real devaluations.

Figure A.3: The GDEF after FER Shocks



The scale are constant millions of pesos of 1990.

Figure A.4: The IR after FER Shocks

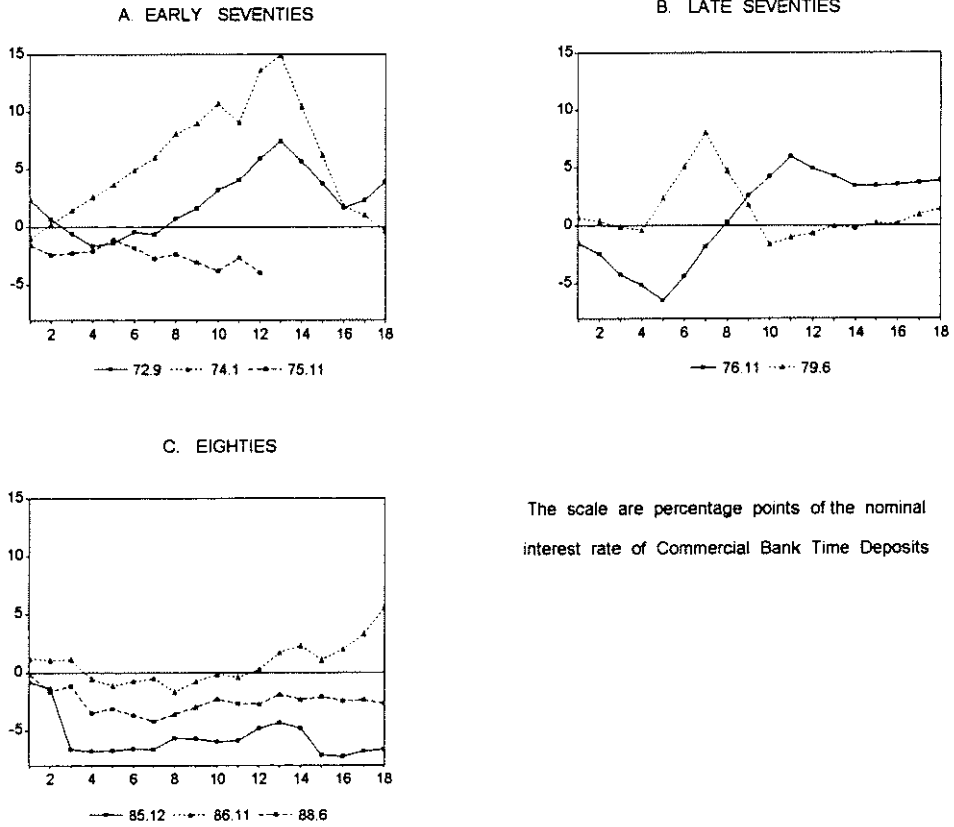
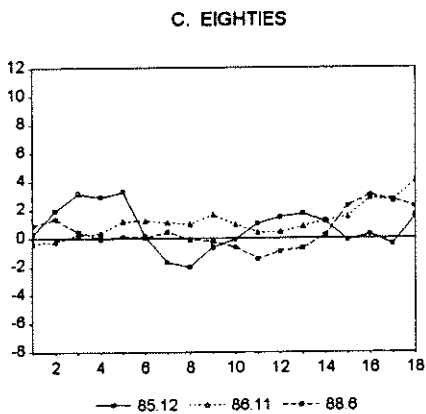
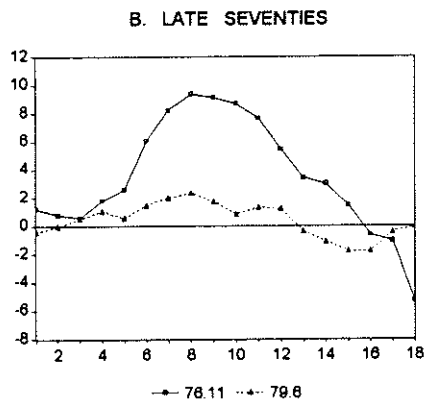
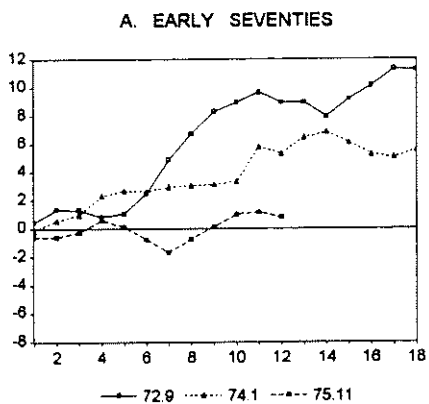


Figure A.5: The INFLATION RATE after FER Shocks



The scale are cumulative percentage points of monthly change of inflation. Positive numbers indicate that inflation increased more than what the autorregresive model forecasted.

Figure A.6: Policy Indicators after End of Disinflations

