How Persistent is Inflation in Argentina?: Inflation Regimes and Price Dynamics in the Last 50 Years

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1. INTRODUCTION

A key aspect of inflation dynamics for the monetary policy is persistence, which is merely a measure of the speed at which inflation returns to its trend value after a shock. If inflation is a very persistent process, shocks to this variable take much longer to revert, and causing a disinflation may be a highly costly process in terms of activity level.

The empirical evidence favored for a long time the perception of inflation as a highly persistent process, near to a random walk. The New Keynesian models on which the monetary policy modeling is currently based, settled on assumptions of monopolistic competition and price rigidity, generate an inflation dynamics which is, nevertheless, forward-looking. Since the empirical evidence suggested that inflation is highly persistent, there has been a tendency to include persistence when modeling inflation, in some cases, completely ad hoc.[1]

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[1] See Furher and Moore (1995), Galí and Gertler (1999), Furher (2006) and also Walsh (2003), for a very good review of the literature.

This discrepancy between data and theory has recently encouraged the production of abundant empirical evidence. This evidence, based on data including high and low inflation periods, indicates that persistence is not an inflation-inherent phenomenon but, on the contrary, it seems to vary in relation to trend inflation breaks. These breaks usually coincide with changes in the monetary regime.[2]

However, the concept of regime has remained fairly vague in the literature because it is an *unobservable* associated to institutional factors defining a framework for interactions between economic policy and private agents, influencing the creation of expectations and decision-making by such agents. We will try to identify regimes based on the results deriving from such interactions. In particular, it may be thought that trend inflation may be a proxy of the prevailing monetary regime.[3]

In this paper, we study aggregate inflation dynamics and, in particular, the phenomenon of inflation persistence in Argentina during the 1961-2006 period. We analyze the relation between changes in trend inflation and in its autoregressive component and monetary regime changes.

The assumption of a constant long-term value for trend inflation is undoubtedly implausible for an economy such as Argentina, which experienced moderate inflation in the 1960s and high inflation in the 1970s and 1980s, when monetary policy was strongly limited in its role of controlling inflation due to persistent fiscal imbalances entailing high fiscal dominance. This high inflation regime resulted, by the end of the 1980s, in a hyperinflationary episode after which Argentina adopted a currency board regime, known as Convertibility. During this period monetary policy was essentially passive and inflation dynamics was governed, to a large extent, by external factors. Inflation remained at reduced levels during such period, ending up in the abandonment of such regime in January 2002. After the abrupt peso devaluation, inflation accelerated, and reached a peak in April 2002, returning then to lower values, even though above the average levels observed during the Convertibility regime.

[2] See Marques (2004), Levin and Pigier (2004), Altissimo et al. (2006), and Angeloni et al. (2006), among others, for European economies, and Cogley and Sargent (2006) and Cogley and Sbordone (2007) for the United States.

[3] This is the approach taken by recent literature studying the effects of assuming a positive trend inflation under standard New Keynesian models. See to this respect Kiley (2006), Blake and Fernández-Corugedo (2006), and Ascari and Ropele (2007), among others.

2. INFLATION PERSISTENCE IN THE LITERATURE

Trend inflation can experience discrete breaks due to changes in the long-run determinants of inflation. There is agreement in monetary theory that the long-run value of inflation is closely related to money growth.[4] In this regard, the long-run values of inflation and money growth are not independent of the importance assigned by monetary policy to the goal of stabilizing inflation at a low and stable value. Therefore, the long-run values of inflation and money growth should not be expected to be constant but, rather dependent on the monetary regime.[5] In this respect, the empirical evidence indicates that, under regimes of fiscal dominance, trend inflation as well as money growth are high.[6] On the contrary, once monetary policy is less conditioned by fiscal policy and is able to fulfill its role of providing the economy with a nominal anchor, trend inflation tends to decline. Economies may also experience high inflation rates if there are incentives to monetary policy for exploiting the trade-off between growth and inflation persistently.

In spite of the fact that changes in trend inflation seem to be empirically relevant for inflation dynamics, the New Keynesian models used for monetary policy modeling, focused on short-run fluctuations of inflation and output, generally assume a zero inflation rate for the steady state, setting aside the possibility that long-run inflation may be positive and eventually variable over time.

At the same time, microeconomic models with nominal rigidities providing a theoretical basis for a Phillips curve (Taylor, 1980; Calvo, 1983, and Rotemberg, 1982) generate persistence in the price level, but not in inflation. This feature of these models is not aligned with the empirical evidence, which suggests that inflation is a highly persistent process. Therefore, authors such as Furher and Moore (1995) and Galí and Gertler (1999) propose to include an intrinsic component of persistence in inflation.

Recently, Cogley, Primicieri and Sargent (2007), Cogley and Sobordone (2007) and Sbordone (2006) have shown for the United States that

[4] See Walsh (2003) in this respect.

[5] According to Heymann and Leijonhufvud (1995) a policy regime can be characterized by the behavioral pattern of the interactions between policy makers and private agents, which supports the later expectations formation and decisions.

[6] See Heymann and Leijonhufvud (1995) and Walsh (2003) for a detailed discussion of the relation between monetary and fiscal policy.

inflation persistence may be explained by the presence of a trend inflation that is variable over time. Simultaneously, Benati (2006) and Altissimo et al. (2006) show, for a significant number of countries, that the degree of inflation persistence has varied over time and has been lower in periods when the monetary policy was able to stabilize inflation at reduced levels.

2.1 Inflation Persistence: Conventional Measures

Inflation persistence can be defined as the speed at which inflation returns to its long-run value after a shock.

The most widely used persistence measure in the literature is the one proposed by Andrews and Chen (1994).

Taking into account inflation as a stationary process AR(p)

$$\pi_t = \alpha + \sum_{i=1}^{p} \beta_i \pi_{t-i} + \eta_t \ . \tag{1}$$

Andrews and Chen propose as a persistence measure the sum of the autoregressive coefficients in (1)

$$\rho = \sum_{i=1}^{p} \beta_i \ . \tag{2}$$

Marques (2004) and Angeloni et al. (2006) emphasize the fact that the persistence concept is associated to the speed at which inflation returns to its long-run value after a shock. In this sense, Marques (2004) suggests that a proper representation of this process would be to rewrite (1) as an equilibrium correction mechanism in terms of deviation from its long-run value.

$$\pi_t - \mu = \sum_{i=1}^{p-1} \varphi_i \Delta(\pi_{t-i} - \mu) + \rho(\pi_{t-1} - \mu) + \eta_t \ , \tag{3}$$

where

$$\mu = \frac{\alpha}{1-\rho} \ , \tag{4}$$

is the unconditional mean of inflation. The higher the absolute value of ρ, the slower inflation returns to its equilibrium value. A critical issue to be determined prior to calculation of any persistence measure is whether it is appropriate to assume a constant long-run value for inflation.

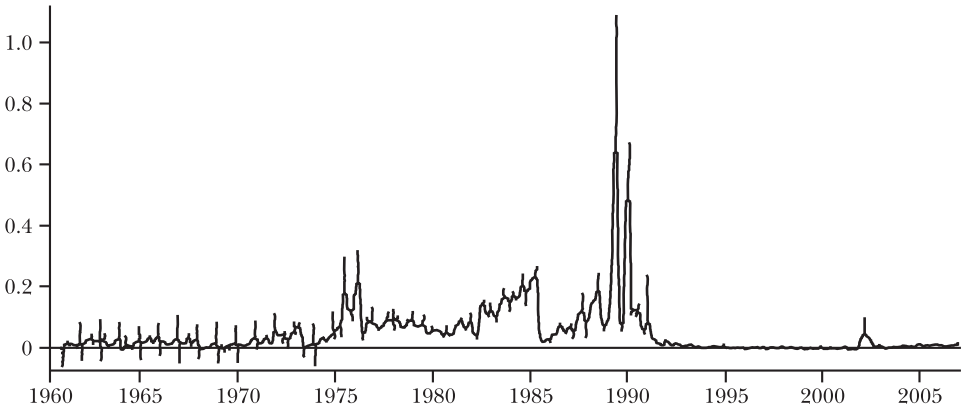
3. INFLATION PERSISTENCE AND MONETARY REGIMES

3.1 Inflation Dynamics in Argentina

As we previously mentioned, the assumption of a constant equilibrium value for the inflation rate is not reasonable in the case of Argentina. In this respect, Capistrán and Ramos-Francia (2006) provide evidence on inflation persistence for the ten largest countries of Latin America and find that, in the Argentine case, the degree of inflation persistence decreased between 1980m1 and 2007m2.

As shown in Figure 1, a simple visual inspection suggests that the trend inflation experienced substantial changes between 1961 and 2006.

FIGURE 1. MONTHLY INFLATION, 1961-2006 (%)



During the 1960s, inflation in Argentina remained at moderately high levels. Successive devaluation episodes imposed an increasing trend to inflation. After the inflationary outbreak known as *Rodrigazo*, in 1975, inflation increased substantially and did not return to its previous level. High inflation was a phenomenon widely spread in Latin America during the 1970s and 1980s. The monetary financing of fiscal imbalances was a common feature among the countries that went through hyperinflationary episodes such as Argentina.

Nevertheless, the Argentine case presents some particular features. Since mid-1970s, the public sector maintained high budget deficits. By the end of such decade, a crawling peg to the US dollar was adopted, a scheme that attempted to a convergence of domestic to international inflation. In those years, like in other economies in the region, Argentina started a

process of trade and financial liberalization. The peso experienced a persistent real appreciation and the economy ran into sustained current account deficits. The sharp increase in the international interest rate in 1982 led to a severe debt crisis in the region, which seriously damaged Argentina. The peso was devaluated and the government took over a significant portion of private external debt, what deepened the already existent fiscal imbalances. In the following years, inflation accelerated significantly. In 1985, an attempt to stabilize inflation through a program known as Plan Austral resulted in a temporary reduction of the inflation rate. The program did not succeed and inflation accelerated afterwards, ending up in two hyperinflationary episodes in 1989 and 1990.

In April 1991, the adoption of a currency board regime and a hard peg to the US dollar by law, managed to anchor inflation expectations and caused a permanent reduction of the inflation rate that, for such decade, was on average near zero. The adoption of this policy scheme was accompanied by a drastic reform of the public sector including the privatization of the main public enterprises. The country gained access to international financial markets and, with better fiscal results at the beginning, the government replaced monetary financing with the issue of debt in international markets. This policy combination was successful in anchoring inflation expectations and stabilizing inflation at very low levels. However, the fiscal reform was incomplete. With an overvalued domestic currency, the country started to experience persistent current account deficits, increasing its external debt, both private and public. After the Asian crisis in 1997 and the Russian crisis in 1998, the economy entered a prolonged recession. The Brazilian devaluation of January 1999 led to a deepening of the recession. Increases in international interest rates led to a higher burden of interest payments in the fiscal accounts, while at the same time tax revenues decreased due to the recession. The government and the private sector's external debt increased over time and began to be perceived as unsustainable. Toward 2001, a financial and external crisis broke out, which resulted in the abandonment of the Convertibility regime and a devaluation of the Argentine peso, entailing a dramatic change in relative prices and resulting in inflation acceleration, which reached a peak in April 2002, to then decrease, even though at a slightly higher level than that prevailing under the Convertibility regime. By the end of 2004, when the economy started to recover on a sustained basis from the recession it had been immersed in for several years, inflation began to slightly accelerate up to the end of the sample.

3.2 Descriptive Analysis

The brief description of the historical inflation behavior in Argentina in the preceding Section suggests the presence of important structural breaks and disruptive episodes such as hyperinflations.

However, it is reasonable to expect that shocks to this variable have no permanent effect, to the extent that macroeconomic policy in general and monetary policy in particular acts providing the economy with some nominal anchor to stabilize inflation. In this sense, it is expected for unit root tests to reject the null hypothesis of a unit root for inflation when its time series properties are studied for a sufficiently long period of time. However, as stated in Section 2, it is possible for trend inflation to experience changes throughout long periods of time, if economies are subject to regime changes. In this case, no stationary behavior may be expected for this variable, but attributable to changes in its long-run value and not to the presence of a unit root.

In this section, we review the time series properties of inflation and assess the presence of breaks in its mean value. In the next section, we use different techniques to identify the presence of breaks both in the mean and in the autoregressive component of inflation, for the purpose of identifying and controlling for them in the calculation of measures of inflation persistence.

From Table 1, it can be seen that both the mean and volatility of inflation changed across the sample. In this respect, the descriptive statistics for the complete period are not informative about inflation behavior from 1961 to 2006. It is possible to identify a low inflation period from 1961

TABLE 1. DESCRIPTIVE ANALYSIS OF MONTHLY INFLATION, 1961-2006 (%)

Period	*Mean*	*Standard deviation*
1961m01-1975m05	0.021895	0.030503
1975m06-1976m05	0.181004	0.080249
1976m06-1979m12	0.077641	0.022908
1980m01-1989m03	0.103108	0.061452
1989m04-1990m03	0.443025	0.299911
1990m04-1991m02	0.113582	0.051173
1991m03-1992m12	0.020829	0.021575
1993m01-2006m12	0.004420	0.010522
1961m01-2006m12	0.051648	0.092957

to 1975m05, then a severe inflation episode, known as Rodrigazo, between 1975m06 and 1976m05, followed by a high inflation period from 1976m06 to 1979m12 and a very high inflation one between 1980m01 and 1989m03.

From 1989m04 to 1990m03 there were two hyperinflationary episodes, then there was a transition period between 1990m04 and 1991m02, followed by a disinflation period from 1991m03 to 1992m12 after the implementation of the Convertibility regime. Both, the *Rodrigazo* and the hyperinflation episodes as well as the transition and disinflation periods are considered in this analysis as temporary episodes of little interest for the study of a phenomenon such as persistence, and therefore, they are set aside or controlled when calculating measures of inflation persistence.

The rest of the sample, covering the 1993m01-2006m12 period, seems to be, from a statistical point of view, a low inflation period, briefly interrupted by an inflationary episode after the peso devaluation in January 2002. As can be seen in Figure 1 in the preceding section, the peak in inflation caused by the devaluation in January 2002 turns out to be insignificant if compared to the hyperinflation values. However, there was a monetary regime change in this period whose effects on inflation dynamics cannot be captured by the descriptive analysis. We will study it more in depth in the following sections.

In order to analyze the time series properties of inflation and assess the presence of breaks in its mean value, the Dickey-Fuller's test was used to evaluate the presence of a unit root, controlling for the significance of the constant and a deterministic trend (see Table 2). In all cases the presence of a unit root is rejected. These tests allow verifying that from 1961m01 to 1989m03 the inflation mean was significantly different from zero (positive). On the contrary, the null hypothesis of a mean equal to zero between 1993m01 and 2006m12 is not rejected. Besides, no statistically significant deterministic trend is identified in either period.

TABLE 2. DICKEY-FULLER TEST, 1961-2006

Period	*H_0: unit root*
1961m01-1989m03	–4.86[a]
1993m01-2006m12	–4.749[a]
1961m01-2006m12	–2.718[a]

[a] H_0 is rejected at 1% of significance.

These results suggest that even though inflation does not have a unit root, it can neither be considered a stationary process, to the extent that significant changes are identified in its mean value. In the following section, we complement the descriptive analysis with tests assessing the presence of structural breaks both in the mean and in the autoregressive component of inflation rate.

3.3 Assessing the Presence of Breaks in Trend Inflation

In the following two sections, the purpose is to identify the presence of breaks both in the mean and in the autoregressive component of inflation and to study their relation with the occurrence of changes in the monetary regime. This is done through a recursive analysis and by implementing the Bai-Perron test.

3.3.1 Recursive Analysis

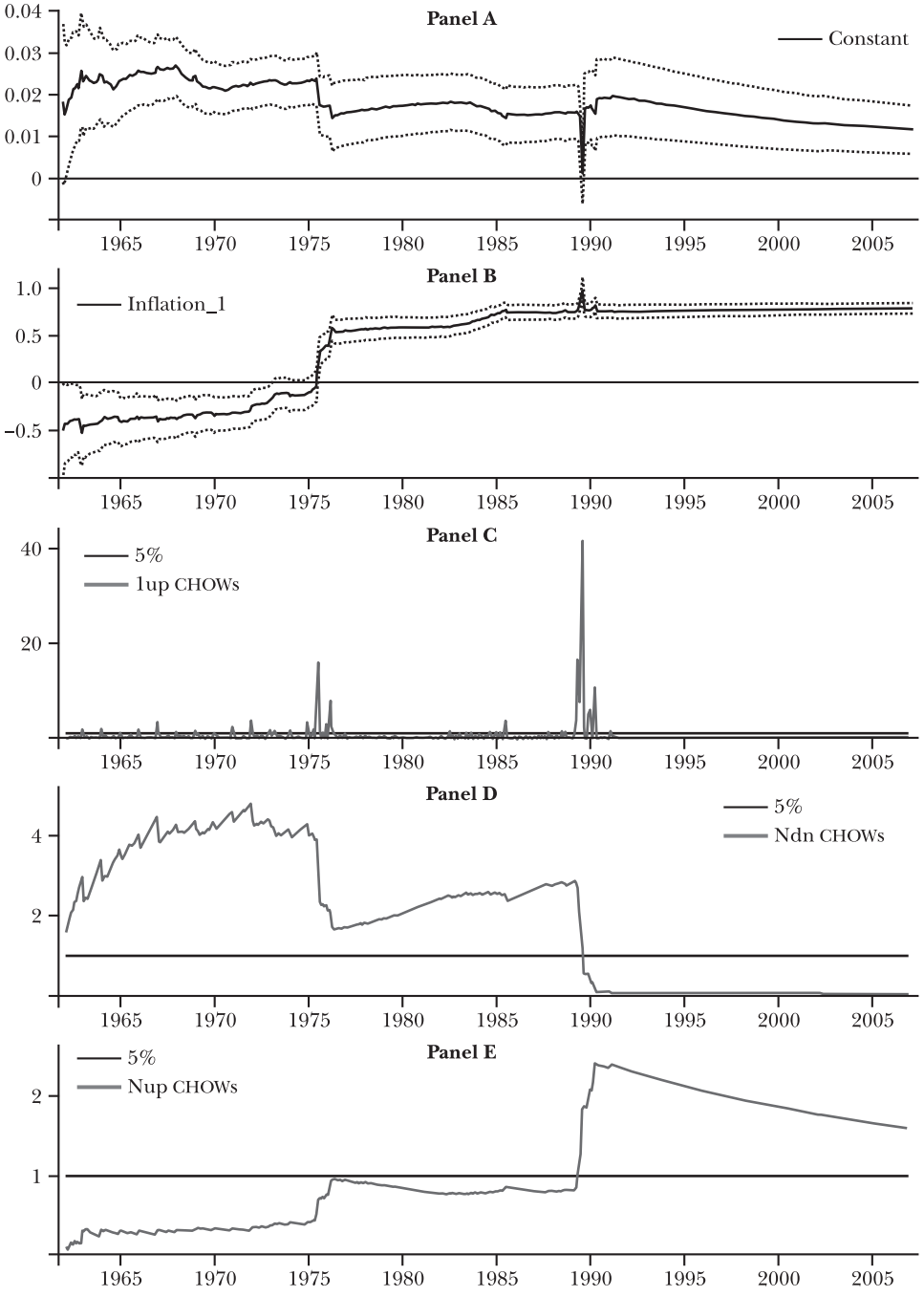
First, we recursively estimate Equation (1) and evaluate the presence of breaks both in the constant and in the autoregressive coefficient, using structural change tests. In Figure 2, panels A and B show that both coefficients, constant and autoregressive component, are outside the interval of ±2 times the previous standard deviations in the surroundings of the inflationary episode known as Rodrigazo, in 1975, and the hyperinflations. Chow tests, in Figure 2, panels C and E. (*forecast horizon* descendent, ascendant and one-step), confirm the presence of a break at the 5% critical value in the Rodrigazo episode and in the hyperinflation period.

To sum up, there is evidence of a change in inflation dynamics in the surroundings of the Rodrigazo inflationary episode and the hyperinflation episodes that ended up in the adoption of the Convertibility regime. Probably due to the magnitude of the hyperinflationary episodes, and to the volatility generated by them, it is not possible to identify a significant break in inflation dynamics after the abandonment of such regime. Therefore, we study such subperiod separately below.

3.3.2 Assessing the Presence of Multiple Breaks: The Bai-Perron Test

In order to evaluate the presence of multiple structural breaks in inflation dynamics we use the test developed by Bai and Perron (2003). In relation to the preceding analysis, the Bai-Perron methodology is more

FIGURE 2. RECURSIVE ANALYSIS, 1961m01-2006m12



general. It allows identifying the presence of multiple breaks, and proposes tests to evaluate the null hypothesis of no breaks vs. the presence of multiple breaks, as well as a procedure to assess the null hypothesis of n breaks versus $n + 1$ breaks. It also generates confidence intervals for dates of break, thus allowing data and errors to have different distributions among the segments into which the test separates the sample, or eventually imposes a common distribution. This flexibility is interesting in the Argentine case given the assumption of a non-constant variance throughout the period under study.

We conducted the test assessing the presence of breaks in the mean (3.A) and in the mean and autoregressive coefficient (3.B). Results are shown in Table 3.

We started by considering the possibility of up to five breaks in the mean (3.A) and in the mean and autoregressive coefficient (3.B). The four tests reported in Table 3 identify the presence of three breaks at the 1% level of significance. The different criteria proposed by Bai and Perron: SupF sequential procedure, Bayesian information criterion (BIC) and Liu, Wu and Zidek (LWZ) confirm that in the case of the mean, three breaks are identified: in November 1974, which may be associated to the inflationary episode known as the Rodrigazo, June 1982, associated to the debt crisis, and the adoption of the Convertibility regime in April 1991. Confidence intervals for breaks were calculated allowing for heteroskedasticity and serial correlation in the residuals.

When assessing changes in the mean and the autoregressive coefficient, the test identifies breaks in September 1974, August 1982 and July 1989. The first two are in the surroundings of those identified for changes in the mean, whereas the last one corresponds to the beginning of the first hyperinflationary episode.

4. INFLATION PERSISTENCE

Taking into account the previous descriptive analysis and considering the breaks identified both in trend inflation as well as in its autoregressive component in subsections 3.3.1 and 3.3.2, we construct a non-constant mean for inflation, to then estimate an autoregressive model according to Equation (3). Here, we follow Marques (2004) and use dummy variables to identify changes in trend inflation as suggested by the descriptive

TABLE 3. BAI-PERRON TEST (1961M01-2006M12)

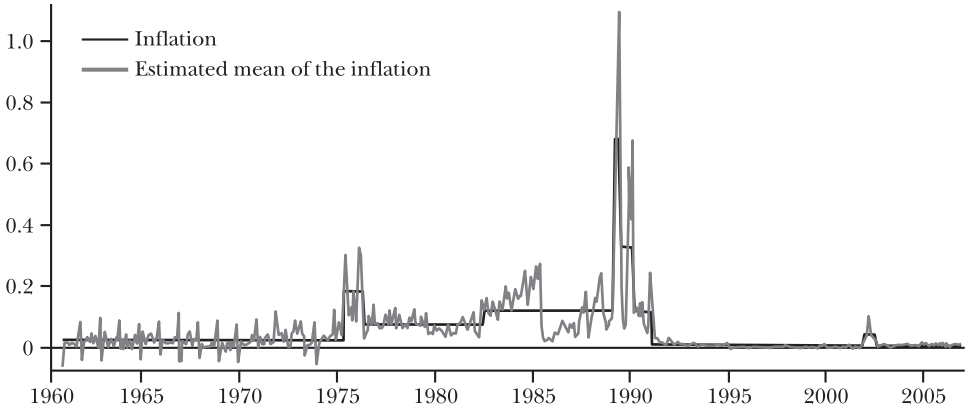
A. Changes in Mean (α_1)			
Tests			
SupF T(3)	*UDmax*	*WDmax*	*SupF T(2/3)*
100.2013	100.2013	135.3968	102.4602
Number of breaks			
Sequential	*BIC*		*LWZ*
3	3		2
Dates of breaks			
T_1	T_2		T_3
November 1974	June 1982		April 1991
Estimated parameters			
α^1	α^2	α^3	α^4
0.0209	0.0954	0.1928	0.0239

B. Changes in Mean (α_1) y autoregressive coefficient (β_1)			
Tests			
SupF T(3)	*UDmax*	*WDmax*	*SupF T(2/3)*
143.5629	311.7505	311.7505	106.8836
Number of breaks			
Sequential	*BIC*		*LWZ*
3	3		2
Dates of breaks			
T_1	T_2		T_3
September 1974	August 1982		July 1989
Estimated parameters			
α^1 ; β^1	α^2 ; β^2	α^3 ; β^3	α^4 ; β^4
–0.1192 0.0233	0.0380 0.5911	–0.0602 1.5453	0.0141 0.3778

analysis in previous sections. Thus, the inflation values estimated according to Equation (5) represent the trend inflation shown in Figure 3.[7]

$$\underset{(HCSE)}{\pi_t} = \underset{(0.0023)}{0.0219} + \underset{(0.0235)}{0.1591}\, d_1 + \underset{(0.0037)}{0.0499}\, d_2 + \underset{(0.008)}{0.0965}\, d_3 + \underset{(0.1463)}{0.6575}\, d_4 + \underset{(0.0805)}{0.3029}\, d_5 + \tag{5}$$
$$+ \underset{(0.0157)}{0.0917}\, d_6 - \underset{(0.0025)}{0.0171}\, d_7 + \underset{(0.008)}{0.0352}\, d_8$$

FIGURE 3. INFLATION AND ESTIMATED MEAN OF INFLATION, 1961-2006



According to equation (5) and to linear restrictions tests, a positive and statistically different from zero value (2.2% monthly) for trend inflation is obtained between January 1961 and May 1975, of 18.1% between June 1975 and May 1976, of 7.2% between June 1976 and July 1982 and of 11.7% between August 1982 and March 1989. During the two hyperinflationary periods, there is a 67.9% mean from April to September 1989 and 32.5% from August 1989 to March 1990, which goes down to 11.4% from April 1990 to February 1991. After the adoption of the Convertibility regime, the inflation rate decreased sharply, resulting statistically not different from zero until the end of the sample. However, during this last period and after the abandonment of the Convertibility regime in January 2002, inflation accelerated after the sharp peso devaluation, reaching a 10% monthly peak in April 2002, to then decelerate. Nevertheless, this inflation outbreak is small if compared to the Rodrigazo and the hyperinflationary episodes. When assessing the linear restriction of a different mean

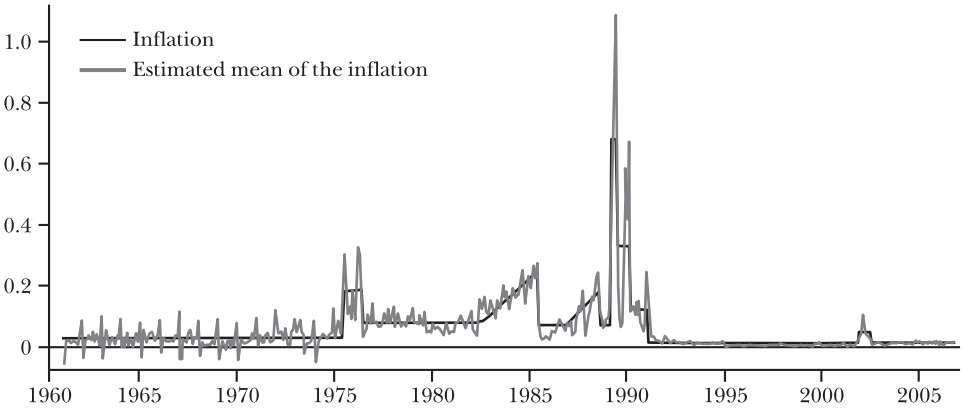
[7] Where d_1 corresponds to a dummy variable for the 1975m06-1976m05 period, d_2 for 1976m06-1982m07, d_3 for 1982m08-1989m03, d_4 for 1989m04-1989m07, d_5 for 1989m08-1990m03, d_6 for 1990m04-1991m02, d_7 for 1991m03-2006m12 and d_8 for 2002m01-2002m08.

from January to August 2002 with respect to the 1991-2006 period, we are close to rejecting the null hypothesis of equal means, and this suggests that this transition period may be considered an outlier within the low inflation period and, in this sense, it is reasonable to control for its presence, since it is a transitory episode. Section 4.1 studies separately and in depth the low inflation period, setting aside the disinflation period following the implementation of the Convertibility regime and when doing so, it is possible to detect changes in trend inflation after the adoption of a managed float regime.

In addition, the presence of positive deterministic trends in the high inflation period was evaluated. Equation (6) incorporates both trends to (5).[8]

$$\underset{(HCSE)}{\pi_t} = \underset{(0.0023)}{0.0219} + \underset{(0.0235)}{0.1591} d_1 + \underset{(0.0037)}{0.0499} d_2 + \underset{(0.0061)}{0.0406} d_3 + \underset{(0.1465)}{0.6575} d_4 + \underset{(0.0805)}{0.3029} d_5 + \tag{6}$$
$$+ \underset{(0.0157)}{0.0917} d_6 - \underset{(0.0025)}{0.0171} d_7 + \underset{(0.0082)}{0.0352} d_8 + \underset{(0.0003)}{0.0049} t_1 + \underset{(0.001)}{0.0055} t_2$$

FIGURE 4. INFLATION AND TREND INFLATION, 1961-2006



Having obtained a non-constant mean for inflation (μ_t), according to (6), the following step is to calculate deviations of inflation with respect to such mean, which we will call z_t , to then estimate Equation (3) and calculate a persistence measure considering a non-constant mean. In Table 4, we compare the persistence measure obtained from the estimation of

[8] Where t_1 corresponds to a deterministic trend for 1982m07-1985m06 and t_2 for 1987m01-1988m08 periods.

equation (3) using a non-constant mean (μ_t) with respect to the measure obtained if a constant mean (μ) is assumed.

It can be seen from Table 4 that assuming a constant mean, inflation would be a highly persistent process (0.78). On the contrary, if we allow for a non constant mean, the degree of persistence reduces remarkably (0.31). Both persistence measures are statistically different, and this allows us to conclude that once breaks in the inflation mean are identified and controlled, inflation appears to be a rather less persistent process.

TABLE 4. INFLATION PERSISTENCE, 1961m01-2006m12

	No changes in mean	*Changes in mean*
ρ	0.78	0.31
HCSE	(0.156)	(0.106)
	(1 lag)	(1 lag)

A second issue to evaluate is if, associated to changes in the inflation mean, changes are also identified in the autoregressive component of the series. Both, the recursive analysis and the Bai-Perron tests presented in the preceding section, identify changes in the autoregressive coefficients of inflation associated to breaks in the mean. Recent evidence for other countries suggests that once inflation is reduced, its degree of persistence decreases.[9]

In order to calculate a persistence measure that takes into account the previously identified changes in inflation dynamics, we estimate an autoregressive model of z_t (inflation deviations from its non-constant mean estimated according to equation 6) including dummies multiplying the levels and differences of z_t: equation 7 shows the estimated model and Table 5 presents the persistence measures obtained as from such equation.[10]

$$z_t \underset{(HSCE)}{=} \underset{(0.009)}{0.051} z_{t-1} + \underset{(0.006)}{0.057} \Delta z_{t-1} + \underset{(0.080)}{0.171} d_{1'} z_{t-1} + \underset{(0.165)}{0.419} d_1 \Delta z_{t-1} + \underset{(0.016)}{0.064} d_{2'} z_{t-1} + \quad (7)$$

$$+ \underset{(0.104)}{0.214} d_{2'} \Delta z_{t-1} + \underset{(0.162)}{0.824} d_{3'} z_{t-1} + \underset{(0.172)}{0.676} d_{4'} \Delta z_{t-1} + \underset{(0.115)}{0.360} d_{5'} z_{t-1} + \underset{(0.095)}{0.283} d_{6'} \Delta z_{t-1}$$

[9] See in this respect Angeloni et al. (2006), and Capistrán and Ramos Francia (2006).

[10] In (7), d_1, corresponds to 1961m01-1975m05, d_1, as in (5) to 1975m06-1976m05, d_2, to 1976m06-1979m12, d_3, to 1980m01-1989m03, d_4, to 1989m04-1990m03, d_5, to 1991m03-1992m12 and d_6, to 1993m01-2006m12.

Results indicate that except for the Rodrigazo episode, inflation was not much persistent until the 1980s.

During the *high inflation* period, between 1980m01 and 1989m03, the inflation process is highly persistent (0.93), a value even greater than that obtained when a constant mean is assumed for the whole sample. Subsequent periods in Table 5 correspond to the two hyperinflationary episodes (1989m04-1990m03), transition (1990m04-1991m02) and the disinflation (1991m03-1992m12) following the implementation of the Convertibility regime. Even though we are not interested in measuring the degree of inflation persistence in such episodes, we had to control for them in the estimation to properly measure persistence in relevant periods. During the *low inflation* period, the degree of persistence is markedly reduced to 0.39.

TABLE 5. INFLATION PERSISTENCE, 1961m01-2006m12

1961m01-1975m05	0.2791
1975m06-1976m05	0.5277
1976m06-1979m12	0.3863
1980m01-1989m03	0.9323
1989m04-1990m03	0.7843
1990m04-1991m02	0.1077
1991m03-1992m12	0.4676
1993m01-2006m12	0.3910

To sum up, the preceding analysis indicates significant changes both in the inflation mean and its autoregressive component during the period under analysis. Controlling for these changes, we find that inflation was a little persistent process in the 1960s and part of the 1970s, and a highly persistent process in the high inflation period (near to a random walk). After the two hyperinflationary episodes Argentina underwent by the end of the 1980s, inflation persistence sharply declined once inflation became stable at significantly lower levels. There is also evidence that changes both in the mean and in the autoregressive component are related to the Rodrigazo episode and the adoption of such a peculiar regime as the Convertibility. The fact that inflation dynamics became close to the behavior of a random walk during the high inflation period seems to be consistent with the difficulties found by economic policy during such period to anchor inflation expectations and make inflation return to a long-run

equilibrium value. Undergoing such a traumatic episode as hyperinflation seems to have generated the necessary adjustments, mainly on the fiscal side, so that an anchorage such as the currency board regime (Convertibility) managed to stabilize the inflation rate at very low levels. The change of regime entailed by the abandonment of such currency scheme cannot be captured when an atypical period such as hyperinflation is included; therefore, the 1993-2006 subperiod is analyzed separately in the following section.

4.1 A Detailed Analysis of the Low Inflation Period

As stressed in the previous section, the dramatic volatility entailed by the hyperinflationary episode restricts the possibility of identifying additional breaks in the inflation series and, in particular, the potential break associated to the abandonment of the currency board regime, and the adoption of a managed float regime in 2002. Therefore, in this section we analyze separately the low inflation period, where two potentially different subperiods could coexist given the change introduced in the monetary policy scheme in January 2002, since vast empirical evidence studying the relationship between money and prices suggests that inflation dynamics is not independent of the monetary scheme adopted by central bank authorities.[11]

In order to study the extent up to which the adoption of a managed float regime in January 2002, entailed changes in inflation dynamics, this subperiod is analyzed separately. The recursive analysis allows for the identification of a break both in the mean and in the autoregressive component of the AR(1) model coincidentally with the abandonment of the Convertibility regime in January 2002. The break in the autoregressive component suggests that the degree of persistence may have changed between both regimes.

These results are confirmed by the Bai-Perron test (see Table 6), identifying a break in January 2002 when we test breaks in trend inflation, and in May 2002 when we evaluate changes in the mean and in the autoregressive coefficients.

Upon identifying the presence of at least one break in trend inflation, we construct a non constant mean for such period. Equation (8) shows the results of the estimation.

[11] See in this respect, McCandless and Weber (1995), De Grawue and Polan (2002) and Gabrielli et al. (2004) and Basco et al. (2006) for the Argentine case.

FIGURE 5. RECURSIVE ANALYSIS, 1993m01-2006m12

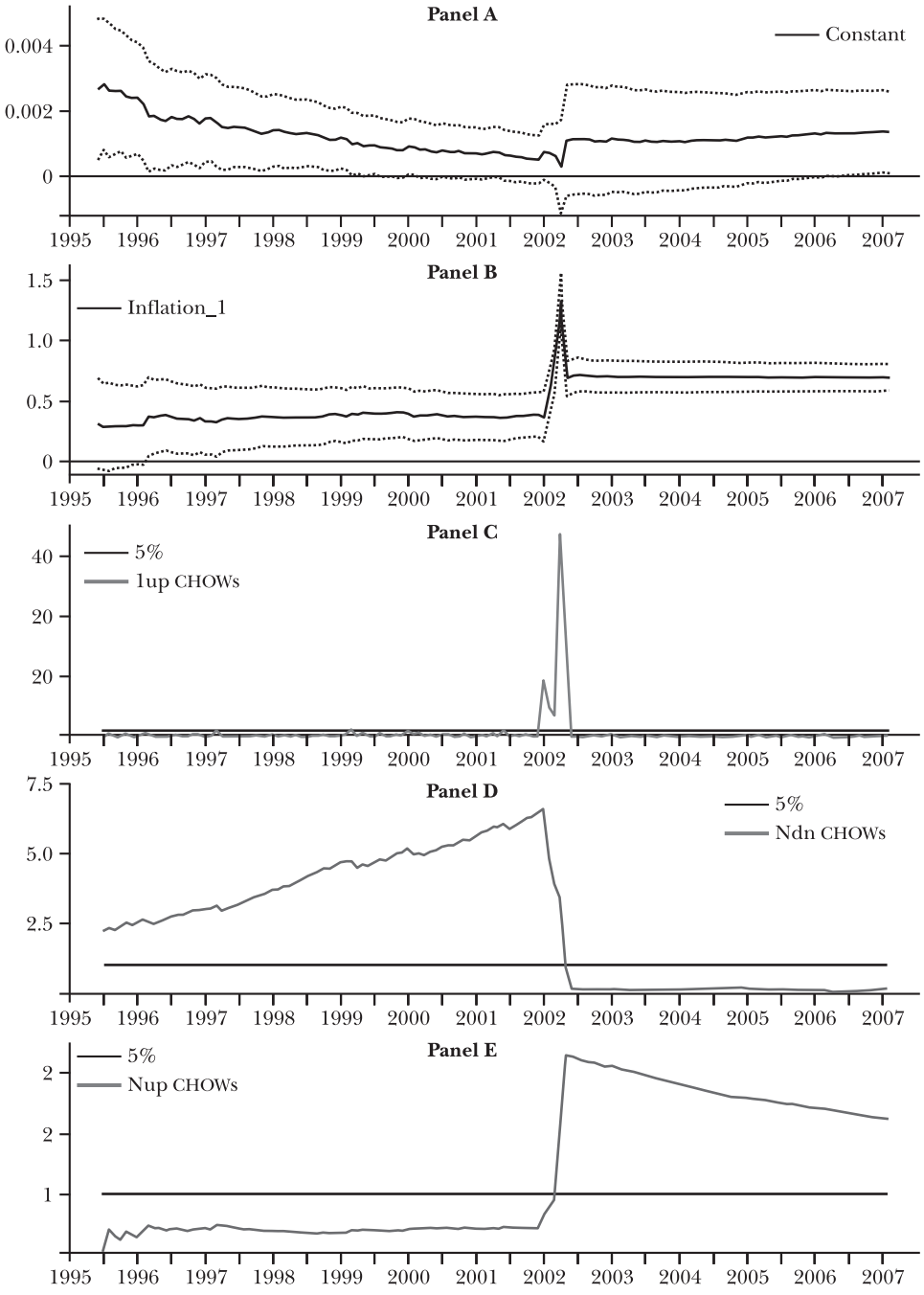


TABLE 6. BAI-PERRON TEST

A. Changes in Mean (α_1)

Tests		
SupF T(1)	*UDmax*	*WDmax*
6.60	6.60	6.60

Number of breaks		
Sequencial	*BIC*	*LWZ*
1	1	1

Dates of breaks
T_1
January 2002

Estimated parameters	
α^1	α^2
0.0008	0.01

B. Changes in Mean (α_1) and Autoregressive Coefficients (β_1; β_2)

Tests		
SupF T(1)	*UDmax*	*WDmax*
65.33	65.33	65.33

Number de breaks		
Sequencial	*BIC*	*LWZ*
1	1	1

Dates of break
T_1
May 2002

Estimated parameters	
α^1 ; $\beta^1{}_1$; $\beta^1{}_2$	α^2 ; $\beta^2{}_1$; $\beta^2{}_2$
0.0001	0.0029
1.1700	0.3060
–0.3160	0.2130

$$\underset{(HCSE)}{\pi} = \underset{(0.0003)}{0.00087} + \underset{(0.0078)}{0.0362}\, d1 + \underset{(0.0006)}{0.0053}\, d2 \,. \tag{8}$$

It can be seen that trend inflation was slightly different from zero during the Convertibility period. Then, during the crisis following the devaluation in January 2002, trend inflation rose to 3.6% monthly to then decline to a 0.5% mean rate, which is positive and statistically different from zero. Thus, upon considering the low inflation period, it is possible to identify a break that seems to be associated to the change of regime entailed by the abandonment of the Convertibility scheme. An atypical period is also identified in the months after the devaluation of January 2002, when inflation experienced a temporary jump. We also control for such period when calculating the inflation mean according to equation (8).[12]

Table 7 shows the results of calculating persistence measures for the 1993m1-2006m12 period using a constant mean and a non constant mean. A significant reduction in estimated persistence is observed when considering the breaks identified according to (8).

TABLE 7. INFLATION PERSISTENCE, 1993M01-2006M12

	Constant mean	*Non-constant mean*
ρ	0.69557	0.18291
HCSE	(0.207)	(0.082)
	(1 lag)	(1 lag)

Finally, when we try to identify the presence of changes in the autoregressive coefficients of inflation that might be associated to the regime change, we find a very low degree of persistence (0.15) during the Convertibility period, which is significantly increased (0.27), after adoption of the managed float regime (see 9).

$$\underset{(HSCE)}{z_t} = \underset{(0.0688)}{0.1493}\, z_{t-1} + \underset{(0.1157)}{0.236}\, d_3 z_{t-1} + \underset{(0.0755)}{0.1437}\, d_3 \Delta z_{t-1} + \underset{(0.0003)}{0.0115} d_{951} + \\ + 02 \text{ crisis dummies} \,. \tag{9}$$

To sum up, the results obtained analyzing the low inflation period separately indicate a change in the inflation process both in terms of its mean value and its autoregressive component, thus observing a higher degree of persistence in the last subperiod of the managed float regime.

[12] In Equation 8 d_1 corresponds to a dummy variable for the 2002m01-2002m09 period and d_2 for the 2002m10-2006m12 period.

5. CONCLUSIONS

Recent empirical evidence has revealed that persistence may not be an inflation inherent characteristic of inflation and that inflation dynamics may change depending on the monetary regime prevailing in the economy. These studies also reveal the importance of considering the possibility that the long-run value of inflation may experience breaks. Besides, they show that upon reduction of inflation as a rather extended phenomenon among economies, its dynamics also seems to have changed and, in particular, inflation persistence has declined.

In the Argentine case, the presence of breaks in the long-run value of inflation is evident. Inflation was moderate in the 1960s, high in the 1970s and very high in the 1980s. During the last two periods fiscal dominance precluded monetary policy to control inflation. After two hyperinflationary episodes by the end of the 1980s, Argentina adopted a currency board regime (known as Convertibility regime) which managed to stabilize the inflation rate rather permanently at reduced levels. Under such regime, the monetary policy was passive and inflation dynamics was mainly governed by external factors. The Convertibility regime was abandoned after the peso devaluation at the beginning of 2002, when a floating exchange rate regime was adopted. The peso devaluation was followed by a brief inflation acceleration and then inflation reached again lower levels, even though somewhat higher than those prevailing throughout the Convertibility period.

We study inflation dynamics during the 1961-2006 period and, in particular, inflation persistence. Using recursive methods and the structural change tests developed by Bai and Perron, we identified breaks in trend inflation that coincide with regime changes: *i)* A high inflation regime after the 1975 inflationary episode, *ii)* a very high inflation regime after the 1982 debt crisis, *iii*) two hyperinflationary episodes (1989 and 1990), *iv)* a low inflation regime after the adoption of the Convertibility regime in 1991 and *v)* the abandonment of such regime in January 2002, when analyzing the low inflation period separately. Given the presence of changes in trend inflation, we calculate deviations from such mean that evolves according to discrete breaks. We then use this deviations to calculate inflation persistence measures. We find that inflation was a highly persistent process during the high inflation period, near to a random walk. On the contrary, upon inflation decline following the adoption of the currency board regime, persistence markedly decreased. After the implementation

of a managed float scheme and controlling for the inflationary episode unleashed by the peso devaluation in 2002, we find that inflation shows again a more persistent behavior.

These results confirm the importance of evaluating the presence of structural breaks when modeling the inflation dynamics and, in particular, when attempting to estimate persistence. They also confirm that in the Argentine case persistence is not an intrinsic characteristic of inflation, but rather depends on the monetary regime.

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