Introduction

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This book brings together a number of studies which are part of a joint research agenda carried out by several central banks in the region within the framework of the CEMLA's Central Banks Researchers Network. The research aims at enhancing our knowledge about inflation persistence of inflation and price formation in our countries. These issues have been central to the research agenda of both macroeconomists and central banks in the last few years on two grounds. On the one hand, the downward trend in inflation recorded in developed and emerging economies in the last decade of the 20th century and the first decade of the 21st century might have caused sustantial changes in inflation dynamics, which lead to a revision of the notion of inflation as a highly persistent process.[1] On the other hand, the widespread use of macroeconomic models based on assumptions of nominal rigidity raised the need to corroborate the support of these assumptions on an empirical basis.

Part I comprises six studies which focus on the analysis and measurement of inflation persistence following different methods.

From an intuitive perspective, persistence stands for the speed at which a variable returns to its trend or long-run value after a shock. During many decades, inflation was considered a highly persistent process. From a policy perspective the immediate consequence of this feature of inflation is a high sacrifice ratio in terms of percentage points of unemployment required to curtail inflation, if inflation returns slowly to its trend value. This was reflected in the first versions of the Phillips curve

[1] See in this respect Cogley and Sargent (2005), Cogley, Primicieri and Sargent (2009), Stock and Watson (2007), Cogley and Sbordone (2008), Angeloni et al. (2006) and Levin and Pigier (2004), among others.

which included an inertial component as a proxy for adaptative expectations based on a nominal rigidity pattern.

The modeling of inflation as an inertial process was challenged by rational expectations (RE) models. During the 1980s, Taylor (1982), Rotemberg (1982 and 1983), and Calvo (1983), among others, developed price formation RE models with price-level stickiness, in an attempt to reconciliate the theory with the observed behavior of the time series. During the 1990s, Furher and Moore (1995) showed that these models implied a degree of persistence much lower than that present in the data, making clear that further research was required to get a better understanding of inflation dynamics and different sources of persistence and in particular, it was relevant to disentangle intrinsic inflation persistence, which may derive from a price formation process from that derived from the dynamics of the GDP and from monetary policy itself.

As noted by Furher (2011), it is worth striking the difference between *reduced-form* persistence, which stands for an empirical property of the inflation time series, and the structural persistence of inflation which arises from identifiable macroeconomic sources, such as the behavior of GDP or monetary policy. Recently, the empirical research has focused on the relation between macroeconomic sources of inflation persistence, and the time series properties of inflation. Such evidence shows, to a significant extent, that *reduced-form* persistence has fallen in recent years in line with the adoption of regimes that –focused on inflation anchoring– managed to shrink persistence on a substantial and permanent basis.[2] Such evidence implicitly suggests that the long-run or trend inflation is not necessarily constant and that its value may be related to changes in the central bank policy function.

Based on this evidence, Cogley and Sbordone (2008) study inflation persistence assuming that long-run inflation is not constant but rather has a trend. Furthermore, Cogley and Sargent (2005), and Cogley, Primicieri and Sargent (2010) study inflation dynamics using models with variable coefficients that assume learning rather than rational expectations, in which the value of long-run inflation is subject to change. Cogley and Sargent (2005) find a high positive correlation between inflation persistence and trend inflation for the United States. They further corroborate that the persistence of inflation fell once the Federal Reserve adopted a more active policy to maintain inflation under control by the mid 1980s.

[2] See in this regard Levin and Pigier (2004) and Benati (2008).

Part I comprises six studies that focus on the analysis and measurement of inflation persistence, providing a rich empirical evidence on the dynamics of inflation in the region. Some papers use different methodologies to assess the presence of changes in trend inflation and measure inflation persistence. In others, regime switching models are developed to identify regime changes and measure inflation persistence. Finally, one of them studies the transmission of common shocks to aggregate inflation through the dynamics of sectorial inflation rates. A common finding across almost all the studies is the presence of breaks in trend inflation and the reduction of persistence that came along with the lowering of inflation in the region in the 1990s and 2000s. Table 1 sums up the findings of the six studies concerned with inflation dynamics in the region.

Castagnino and D'Amato analyze inflation dynamics in Argentina and the United States over the period ranging from 1960 to 2006. Using a dynamic factor model and frequency domain analysis they study the transmission of aggregate shocks to inflation based on sectorial inflation dynamics. They find that the impact of aggregate shocks translates into an increase of the comovement of sectorial inflation rates, but their incidence depends on the inflationary environment. When inflation is high shocks lead to strong comovements among sectorial inflation which tend to perpetuate; where inflation is low, the adjustment of relative prices prevails over the comovements, shocks rapidly dissipating.

In the case of Costa Rica, Carlos Chaverri Morales and Carlos Torres Gutiérrez study the presence of structural breaks in inflation and its relation with persistence. They find that, in the case of Costa Rica, inflation persistence is sharply reduced when evaluated in terms of the deviations from a changing mean. They attribute their findings to the high weight of a long-lasting period of low inflation exhibited in their sample. Indeed, the assessment of inflation persistence over the latest period (1997-2009) reveals that the estimated persistence is higher. They further evaluate the level of inflation persistence in terms of the mean duration of shocks.

D'Amato and Garegnani study inflation persistence in Argentina over a long period of time: 1961- 2006. They analyze the relation between changes in the mean of inflation and its autoregressive component and changes in the monetary regime. By using tests for multiple structural breaks and recursive estimation they identify changes in trend inflation that coincide with regime changes. They find that in Argentina inflation was a highly persistent process during the 1970s and 1980s, close to a random walk. On the contrary, persistence fell dramatically when inflation

TABLE 1. INFLATION PERSISTENCE

Study	*Country*	*Sample*	*Methodology*	*Persistence*	*Comments*
D'Amato – Garegnani	Argentina	1960-2006	Evaluate changes in mean and estimate persistence with constant and changing mean	Constant mean: $\rho = 0.78$ Non-constant mean $\rho = 0.31$	Persistence decreases along with the lowering of inflation
Castagnino– D'Amato	Argentina and the USA	1960-2006	Study the transmission of aggregate shocks to inflation focusing on the dynamics of sectoral inflation rates: Frequency domain analyisis and factor model	High inflation induces a generalized comovement among sectoral inflation rates that persists over time	
Echavarría - López - Misas	Colombia	1990-2010	Regime switching model	Inflation: ρ between 0.336 and 0.226 Inflation gap: $\rho = 0.88$	Do not find changes in persistence across regimes
Echavarría - Rodíguez – Rojas	Colombia	1979-2010	Unobserved components model	Evaluated using impulse response functions:persistence increases between 1979-1989 and 1989-1999 and decreases between 1999 and 2010	
Chaverri Morales - Torres Gutiérrez	Costa Rica	1953-2009	Evaluate changes in mean and estimate persistence with constant and changing mean. Also estimate persistence through the mean life of shocks	Constant mean: $\rho = 0.78$ Non-constant mean $\rho = 0.31$	Results biased toward low inflation due to the high weigth of a low inflation period within the sample: Increases to 0.31 (for the period 1997-2009 and with a changing mean)
Oliveira – Petrassi	23 developed and 17 underdeveloped countries	From 1995 onwards	Estimate reduced form inflation models: AR(p) models, New Keynesian hybrid Phillips curve, and an inflation reduced-form model with wage rigidity	Reduced and stable persistence in general and lower for developed economies	Persistence is lower in those economies that experienced hyperinflation in the recent past

sharply decreased in the early 1990s. With the introduction of the managed floating exchange rate scheme in 2002, inflation persistence slightly increased. Their findings corroborate the relevance of assessing structural breaks for modeling inflation dynamics and, particularly, for estimating its persistence. Their results also indicate that persistence, in the case of Argentina, is not inherent to inflation but dependent on the monetary regime.

Juan Echavarría, Norberto Rodríguez and Eduardo Rojas study inflation persistence in Colombia over a long period: 1979-2010. They estimate an unobserved component model for inflation that allows for regime changes and use it to estimate the persistence of the inflation-gap. They identify statistically significant changes in the persistence of inflation which, defined in terms of impulse-response functions increased between 1979 and 1989 and between 1989 and 1999, to then decrease to its lowest level during the 1999-2010 period with the adoption of inflation targeting in 1999.

Juan Echavarría, Enrique López and Martha Misas also study inflation persistence in Colombia over the period ranging from 1990 to 2010 by using a regime change model for both inflation and the inflation gap, bearing in mind, as suggested by Cogley, Primicieri and Sargent (2010), that the persistence of inflation could be caused by the persistence of the monetary authority's inflation target. Even though, they find evidence that inflation went down and became less volatile as from the adoption of an inflation targeting regime in 1999, they cannot account for a statistically significant reduction in the persistence of inflation.

Finally, Fernando Olivera and Myrian Petrassi estimate inflation persistence in several industrial and emerging countries since 1995 onwards using different *reduced-form* models of inflation: autoregressive models, a New Keynesian Phillips curve and a *reduced-form* inflation model with wage rigidity. Their findings reveal that the persistence of inflation has been reduced and remains stable in both groups of countries in the recent past, being lower in industrial economies.

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