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Asymmetric Inflation Persistence in Latin America: Evidence from Chile, Colombia and Peru Using Quantile Autoregression Analysis*

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Abstract

This paper investigates asymmetric inflation persistence in Chile, Colombia and Peru using quantile autoregression on monthly data from 1992–2023. Unlike conventional approaches that assume uniform adjustment speeds, this method captures heterogeneous dynamics across the inflation distribution. Results indicate global stationarity but marked asymmetries: positive shocks display substantially greater persistence than negative ones. The unit root hypothesis cannot be rejected at and above the 60th, 70th, and 80th quantiles for Colombia, Chile, and Peru, respectively, implying that high-inflation episodes endure while negative deviations dissipate quickly. Robustness checks controlling for multiple structural breaks show that persistence declined significantly following the adoption of inflation-targeting regimes and improved macroeconomic management, yet asymmetric patterns remain. Findings are robust to alternative steady-state specifications. The evidence supports asymmetric monetary policy responses and offers practical guidance for central banks. Extended analysis for Brazil confirms the prevalence of these asymmetric dynamics.

Keywords: Inflation dynamics, Asymmetric persistence, Quantile autoregression, Unit root tests, Latin America.
JEL codes: C32, E31, E52.

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1. Introduction

The repercussions of COVID-19 on inflation and the 2007-2008 financial crisis have prompted policymakers, academics, and the public to question whether inflation's adjustment speed toward equilibrium depends on the magnitude and sign of shocks. Our paper addresses this critical question by employing the quantile autoregression approach developed by Koenker and Xiao (2004) to empirically examine inflation dynamics in Chile, Colombia, and Peru.

Understanding inflation dynamics is crucial given its profound economic implications and central role in monetary policy decisions aimed at ensuring price stability. One fundamental question in this area is whether inflation's adjustment speed depends on the magnitude and sign of shocks. Figure 1 illustrates 12-month inflation deviations from long-run levels for Peru, Chile, and Colombia, with long-run inflation levels set according to each country's inflation target: 2 percent for Peru and 3 percent for Chile and Colombia. This figure suggests that positive shocks appear to have longer-lasting effects than negative ones across all three economies, carrying significant policy implications for central bank responses to different types of shocks.

During the early 21st century before COVID-19, Chile, Colombia, and Peru maintained relatively low and stable inflation. However, the pandemic and subsequent global shocks triggered inflation rates well above long-term targets, beginning in late 2020 and peaking in 2022. This recent inflationary period underscores the importance of investigating whether inflation's adjustment speed depends on shock magnitude and sign.

We focus on Chile, Colombia, and Peru for several compelling reasons. First, these three economies adopted inflation targeting regimes during similar timeframes (1999-2002), providing a natural experimental setting to examine the impact of monetary policy regime changes on inflation dynamics. Second, all three countries experienced significant macroeconomic stabilization following periods of high inflation, making them ideal cases for studying persistence patterns. Third, they represent diverse economic structures within Latin America—Chile as a commodity exporter with advanced institutions, Colombia with a more diversified economy, and Peru with rapid growth and institutional development—allowing for robust comparative analysis. Fourth, these countries have successfully anchored inflation expectations, including during the post-pandemic high inflation period, as demonstrated by Quineche et al. (2024). Finally, these countries maintained relatively independent monetary policies throughout our sample period, unlike dollarized or currency board economies in the region. Most notably, Peru has achieved exceptional monetary policy performance since adopting inflation targeting in 2002, maintaining the lowest average inflation (3.15% percent annually [1]) among major Latin American economies and successfully reducing post-pandemic inflation from 8.66% in January 2023 to precisely 2.0% by December 2024—outperforming major developed economies—making it an especially valuable case for understanding effective inflation dynamics management.

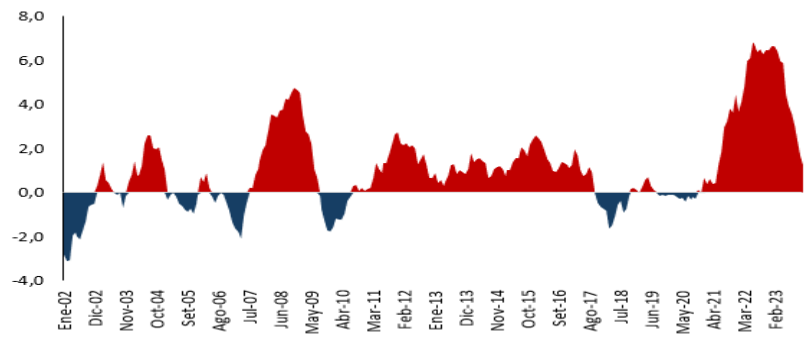
In our empirical analysis using monthly data from January 1992 to December 2023, we find that: i) inflation rates in all three countries exhibit asymmetric dynamic adjustments, with shocks persisting more at higher quantiles and less at lower quantiles; and ii) the unit root hypothesis cannot be rejected starting from the 60th, 70th, and 80th quantiles for Colombia, Chile, and Peru, respectively. Robustness analysis controlling for multiple structural breaks reveals that persistence has declined substantially following a comprehensive process of macroeconomic stabilization—encompassing inflation targeting adoption, improved crisis management, and broader institutional development—while the asymmetric pattern remains robust across all specifications. Comprehensive methodological robustness checks—including alternative steady-state definitions (historical

[1] Average annual inflation rate between 2002 and 2023.

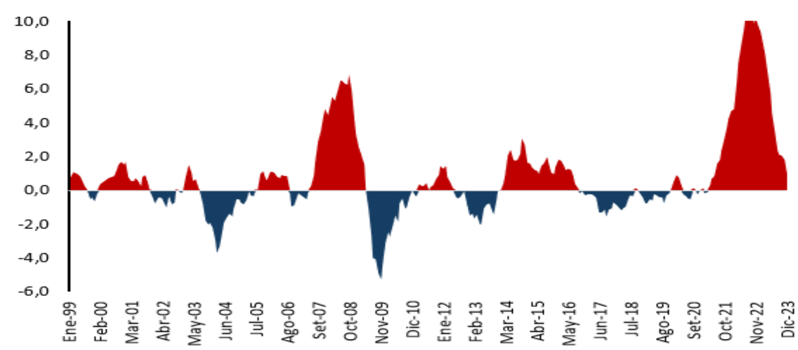
sample means, HP-filtered time-varying trends) and different structural break specifications—confirm these asymmetric patterns reflect fundamental inflation dynamics rather than measurement conventions or model specification choices.

Figure 1: *12-month inflation*

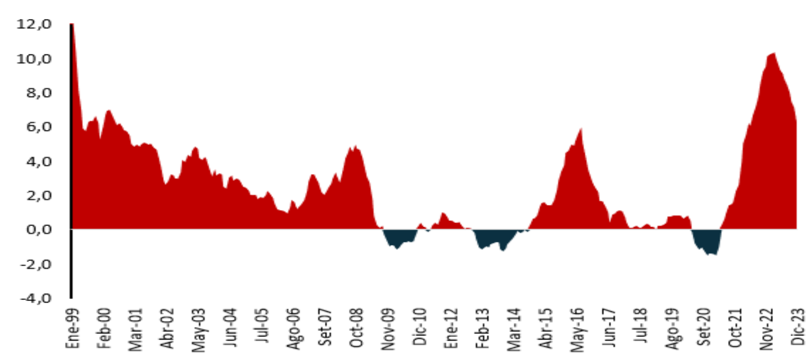
(a) Peru



(b) Chile



(c) Colombia



Note: The area highlighted in red (blue) represents the positive (negative) deviations of the 12-month inflation from the target (2 percent for Peru and 3 percent for Chile and Colombia).

This study makes several important contributions to the literature. First, we provide the first comprehensive quantile autoregression analysis of inflation dynamics for Chile, Colombia, and Peru. As a robustness check, we also extend the analysis of Gaglianone et al. (2018) for Brazil through December 2023, providing updated evidence that encompasses the post-pandemic inflationary episode and enabling systematic comparison across the four major Latin American inflation-targeting economies. Second, our multiple-break robustness analysis reveals that inflation in these economies is more fundamentally stationary than single-break specifications suggest: once we properly control for structural transitions (pre-IT stabilization episodes, external crises, and the pandemic), mean reversion is stronger and non-stationarity is confined to more extreme quantiles. Critically, the asymmetric persistence pattern—where positive shocks are more persistent than negative shocks—remains robust across all model specifications. Notably, the absence of discrete breaks at formal IT adoption dates suggests that inflation targeting implementation involved gradual credibility-building rather than abrupt regime shifts. The progressive reduction in persistence across specifications—from no breaks through single IT break to multiple breaks—while maintaining this asymmetric structure indicates that the combination of credible monetary policy frameworks, effective crisis management, and broader institutional improvements has fundamentally anchored inflation dynamics in these economies. Third, comprehensive methodological robustness analysis (Section 5.7) confirms our findings are not sensitive to steady-state specification, with the asymmetric pattern persisting across alternative measures (historical sample means, time-varying HP-filtered trends), demonstrating that our results reflect genuine inflation dynamics rather than measurement conventions. Fourth, our findings provide empirical support for asymmetric monetary policy responses, contributing to the growing literature on state-dependent policy rules. The robust asymmetric persistence pattern—where positive shocks exhibit greater persistence than negative shocks across all regime specifications—suggests that central banks should respond more aggressively to above-target inflation than to below-target inflation. Finally, our results offer practical guidance for central banks: while positive shocks require vigorous policy responses, the fundamental stationarity revealed by our analysis demonstrates that credible frameworks ultimately succeed in returning inflation to target.

The remainder of this paper is structured as follows: Section 2 reviews the related literature, Section 3 discusses quantile regression methodology, Section 4 describes our dataset, Section 5 presents empirical analysis, and Section 6 concludes with policy implications.

2. Related Literature

Inflation behavior has been extensively studied in economic literature. We review three main research strands relevant to our analysis.

One research strand focuses on whether inflation is best characterized as a stationary or unit root process. Despite numerous empirical studies, no consensus has emerged. Some researchers find insufficient evidence to reject the unit-root hypothesis in inflation rates (e.g., Nelson and Plosser 1982; Evans and Lewis 1995; Crowder and Wohar 1999; Ball et al. 1990; Ho 2009), while others present compelling evidence for mean reversion in inflation (e.g., Rose 1988; Edwards 1998; Lee and Wu 2001; Tsong and Lee 2011).

Another research line examines variations in inflation persistence. Studies document declining inflation persistence in the U.S. (Taylor, 2000; Cogley and Sargent, 2001), the Euro area (Beechey and Österholm, 2009), and China (Zhang and Clovis, 2010). Canarella and Miller (2016) find that inflation targeting implementation significantly reduced inflation persistence in both developed and emerging economies, with structural breaks coinciding with IT adoption. However, Stock (2001) and Pivetta and Reis (2007) found no clear evidence of decreasing persistence in U.S. inflation, while Batini (2006) concluded that European inflation remains sluggish. For Latin America specifically, Ferreira and Palma (2017) demonstrate that inflation uncertainty significantly affects inflation dynamics in the region, and Winkelried (2017) examines inflation expectation formation in Latin American inflation targeting countries. McKnight et al. (2020) find that among Latin American inflation targeters, Peru follows a strict inflation targeting regime prioritizing inflation stabilization, while Chile and Colombia adopt more flexible approaches with broader policy objectives including output gap stabilization, which may contribute to differences in inflation dynamics across these economies.

Building on Tsong and Lee's (2011) examination of asymmetric inflation dynamics in OECD countries, recent research has applied Koenker and Xiao's (2004) quantile autoregression approach to analyze inflation dynamics in Brazil (Gaglianone et al., 2018) and BRIC countries (Phiri, 2018). This methodology offers several advantages: i) it identifies potentially asymmetric adjustment speeds at different distribution quantiles, revealing how adjustment toward long-run equilibrium may differ with shock magnitude and sign; ii) it quantifies mean reversion tendency according to shock magnitude; and iii) it relaxes assumptions about inflation's distribution. This last point is crucial since inflation typically deviates from normal distribution (Charemza et al., 2005), and when series are not normally distributed, standard unit root tests bias results toward indicating unit roots (Koenker and Xiao, 2004).

Studies by Tsong and Lee (2011), Gaglianone et al. (2018), Phiri (2018) and Çiçek and Akar (2013) consistently find that inflation rates tend to revert to the mean with asymmetric adjustments: significant negative shocks often lead to strong mean reversion, whereas significant positive shocks do not produce the same effect. Given the asymmetric inflation dynamics documented for Brazil, a natural question emerges: would this asymmetric behavior also characterize other Latin American economies? Our paper addresses this gap in the empirical economics literature by providing the first comprehensive quantile autoregression analysis of inflation dynamics for Chile, Colombia, and Peru—three major Latin American economies that have not been jointly examined using this methodology.

3. Empirical methodology

In the ADF equation developed by Said and Dickey (1984), inflation deviations from steady-state can be modeled as:

$$z_t = \gamma_1 z_{t-1} + \sum_{j=1}^{q} \gamma_{j+1} \Delta z_{t-j} + e_t, \qquad t = 1, 2, \ldots, T \tag{1}$$

where $z_t = \pi_t - \hat{\mu}_\pi$, π_t is the inflation rate, $\hat{\mu}_\pi$ is its steady-state level, and e_t is an $i.i.d.$ error term. The autoregressive coefficient γ_1 indicates persistence magnitude: if $|\gamma_1| = 1$, then z_t is persistent, and if $|\gamma_1| < 1$, then z_t is stationary[2].

The ADF equation has a natural limitation: it does not allow modeling nonlinear behavior in coefficients associated with shock magnitude and sign. We therefore apply the quantile autoregression model developed by Koenker and Xiao (2004), which identifies mean reversion speeds under different shock magnitudes and signs across the different τth quantiles. To discern whether inflation is stationary or has a unit root depending on shock characteristics, we use the $t_n(\tau)$ test developed by Koenker and Xiao (2004).

This statistic is the ADF test equivalent in a quantile autoregression framework[3]. Following Gaglianone

[2] A non-stationary (stationary) process is also known as a first-order (zero-order) integrated process.
[3] The authors demonstrate power gains compared to the ADF test when series exhibit non-normal behavior and heavy tails.

et al. (2018), Tsong and Lee (2011), and Çiçek and Akar (2013), we model inflation using quantile regressions without structural controls, focusing on distributional properties of inflation's internal dynamics rather than causal inference. This approach allows us to characterize persistence and asymmetry patterns across the conditional distribution.

3.1. The quantile autoregression model

The AR(q) process of inflation dynamics at quantile τ conditional on past information set Ω_{t-1}, can be described as a quantile autoregression QAR(q):

$$Q_{z_t}(\tau|\Omega_{t-1}) = Q_e(\tau) + \gamma_1(\tau)z_{t-1} + \sum_{j=1}^{q} \gamma_{j+1}(\tau)\Delta z_{t-j} \tag{2}$$

Let $\gamma_0(\tau) = Q_e(\tau)$ and $\gamma_j(\tau)$ with $j = [1, 2, 3, \ldots, q+1]$, the vectors $\gamma(\tau) = (\gamma_0(\tau), \gamma_1(\tau), \ldots, \gamma_{q+1}(\tau))$ and $x_t = (1, z_{t-1}, \Delta z_{t-1}, \ldots, \Delta z_{t-q})'$. Then, equation (2) becomes:

$$Q_{z_t}(\tau|\Omega_{t-1}) = x_t'\gamma(\tau) \tag{3}$$

To obtain $\gamma(\tau)$ estimators, we minimize the sum of asymmetrically weighted absolute deviations:

$$\min_{\gamma} \sum_{t=1}^{n} \psi_\tau \left| z_t - x_t'\gamma(\tau) \right| \tag{4}$$

where $\psi_\tau = (\tau - I(z_t - x_t'\gamma(\tau) < 0))$, with $I(.)$ denoting the indicator function. Consistent with Tsong and Lee (2011), we interpret quantile-specific intercepts $\gamma_0(\tau)$ as deviations from long-run equilibrium rather than structural shocks, capturing conditional inflation behavior across quantiles.

3.2. The unit root statistical test for each quantile

With estimators $\hat{\gamma}(\tau) = (\hat{\gamma}_1(\tau), \hat{\gamma}_2(\tau), \ldots, \hat{\gamma}_p(\tau))$, the $t_n(\tau)$ statistic tests the unit root null hypothesis $\gamma_1(\tau) = 1$:

$$t_n(\tau) = \frac{f(\widehat{F^{-1}(\tau)})}{\sqrt{(1-\tau)\tau}} (\Pi_{-1}' P_x \Pi_{-1})^{\frac{1}{2}} (\hat{\gamma}_1(\tau) - 1)) \tag{5}$$

where Π_{-1} is the vector of lagged dependent variables (z_{t-1}), P_x is the projection matrix onto the space orthogonal to $X = (1, \Delta z_{t-1}, \ldots, \Delta z_{t-q})$, and f and F represent the probability and cumulative density functions of the error e_t. The consistent estimator $f(\widehat{F^{-1}(\tau)})$ is:

$$f(\widehat{F^{-1}(\tau)}) = \frac{\tau_i - \tau_{i-1}}{x_t'(\hat{\gamma}(\tau_i) - \hat{\gamma}(\tau_{i-1}))} \tag{6}$$

with $\tau_i \in \Gamma = [0.1, 0.2, \ldots, 0.9]$. For the τ-th conditional quantile, $t_n(\tau)$ is the ADF test counterpart.

3.3. The unit root statistical test across all quantiles

Koenker and Xiao (2004) extend the Kolmogorov-Smirnov test to the quantile autoregression process (QKS). The QKS statistic takes the supremum value of t_n over $\tau \in \Gamma$:

$$QKS = \sup_{\tau \in \Gamma} |t_n(\tau)| \tag{7}$$

Given that the QKS test is non-standard and sensitive to nuisance parameters, we employ bootstrapping methods to approximate small-sample distributions following Koenker and Xiao (2004).

4. Data description

We collect monthly Consumer Price Index (CPI) data from the national statistical institutes of Chile and Colombia, and the Central Bank of Peru. The data range covers the period from January 1992 to December 2023. All CPI series were seasonally adjusted using the TRAMO/SEATS procedure.

Seasonal adjustment is necessary because monthly inflation data often contain both deterministic and stochastic seasonal components. Deterministic seasonality arises from predictable calendar-related fluctuations—such as school-year expenditures in March, mid-year bonuses in July, and holiday demand in December—which, if left unadjusted, can artificially inflate persistence measures by introducing spurious autocorrelation. Stochastic seasonality, or seasonal unit roots, represents recurring shocks at seasonal frequencies that behave like unit roots and can bias conventional unit root tests toward non-rejection (Hylleberg et al., 1990; Canova and Hansen, 1995). By applying TRAMO/SEATS, we filter out both deterministic and stochastic seasonal variation, ensuring that seasonal unit roots do not distort persistence estimates. Importantly, this adjustment targets only seasonal frequencies and does not impose stationarity on the non-seasonal component or alter the underlying persistence structure of trend inflation. Evidence for Peru further supports this choice: Quineche et al. (2025) document systematic seasonal patterns in the CPI between 2002-2024, showing that seasonal adjustment improves the accuracy of inflation monitoring and prevents misinterpretation of predictable calendar effects as persistent shocks.[4]

The CPI data is converted into annual inflation rates π_t using the following formula:

$$\pi_t = 1200 \times \left(\frac{\text{IPC}_t}{\text{IPC}_{t-1}} - 1 \right)$$

It is worth noting that all three countries experienced significant inflationary pressures during the early years of our sample, though with different patterns and intensities. Peru faced severe hyperinflation during 1992-1993. Colombia experienced more prolonged elevated inflation throughout most of the 1990s, with rates consistently above 20% until 1998. Chile had more moderate but still significant inflationary episodes, particularly during 1992-1995. Similar to Brazil's experience with hyperinflation before the Real Plan implementation in 1994 (Gaglianone et al., 2018), these countries faced substantial macroeconomic instability during their transition toward more stable monetary frameworks. An important advantage of our quantile autoregression approach is its inherent robustness to such extreme observations compared to traditional unit

[4]Similar findings are reported for Argentina (Burdisso et al., 2017) and in broader methodological studies (Maravall, 2006; Eurostat, 2024), reinforcing the analytical soundness of our approach.

root tests (Koenker and Xiao, 2004). While these high inflation episodes might bias conventional unit root tests toward non-rejection of the unit root hypothesis, quantile regression methods provide more reliable inference about the underlying inflation dynamics by focusing on the conditional quantile functions rather than conditional means, making our methodology particularly suitable for analyzing inflation persistence during periods that include both high and low inflation regimes.

Table 1 shows the mean, median, standard deviation, skewness, kurtosis, and the Jarque Bera (JB) test statistic for the inflation rates. For Chile, Colombia and Peru, the Jarque-Bera test strongly rejects the null hypothesis of normality. This finding is consistent with the well-documented tendency of inflation series to exhibit non-normal distributions (Charemza et al., 2005). The departure from normality is particularly relevant for our analysis because Koenker and Xiao (2004) demonstrate that traditional unit root tests can produce biased results when applied to non-normally distributed series. Therefore, the use of quantile regression methods, which are robust to distributional assumptions, is particularly well-suited for our inflation persistence analysis.

Table 1: *Summary statistics for inflation rates*

Country	Mean	S.D.	Skewness	Kurtosis	JB stat
Peru	6.306	10.054	3.082	11.137	2623.702*
Chile	4.657	4.835	0.864	2.155	124.385*
Colombia	8.285	6.727	1.078	0.249	76.040*

Note: JB stat. denotes the Jarque–Bera normality test, which is $\chi^2(2)$ distributed asymptotically.
* Significant at 1 % level.
** Significant at 5 % level.
*** Significant at 10 % level.

5. Empirical Analysis

This section presents the results from analyzing inflation dynamics in Peru, Chile, and Colombia measured as deviations from their respective steady-state levels. We begin with standard unit root tests as a baseline assessment, followed by a detailed application of the quantile autoregression framework that enables identification of distinct inflation behaviors across different distribution quantiles. Finally, we examine how inflation dynamics evolved during the transition from high-inflation episodes to inflation-targeting regimes, using both policy-motivated single-break specifications and data-driven multiple-break analysis to assess robustness and distinguish regime transitions from within-regime persistence. For the quantile-based tests ($t_n(\tau)$ and QKS), we follow Koenker and Xiao (2004) and employ bootstrapping methods with 500 simulations to approximate the small-sample distributions.

5.1. Standard Unit Root Tests

To establish a baseline for comparison with our quantile autoregression analysis, we conduct $DF\text{-}GLS$ and $M\text{-}GLS$ tests for the full sample period.[5] We also analyze two sub-periods for each country, with breakpoints

[5] Standard unit root tests are applied to inflation rates π_t rather than deviations from target. Since subtracting a constant does not affect unit root test outcomes, this approach follows conventional practice in the literature and facilitates comparison with other studies. The quantile autoregression analysis requires explicit specification of deviations from a steady-state reference point. The

corresponding to inflation targeting implementation: January 2002 for Peru and September 1999 for Chile and Colombia.

Table 2 shows that for the full sample period (January 1992-December 2023), both test statistics fail to reject the unit root hypothesis in any country, suggesting non-stationary inflation processes[6]. However, sub-period analysis provides more nuanced insights. Table 2 shows that during the pre-inflation targeting period, all three countries exhibit non-stationary inflation dynamics. In contrast, for the post-inflation targeting period, both tests strongly reject the unit root hypothesis for Chile and Colombia at conventional significance levels, indicating a shift toward stationary processes after inflation targeting implementation. For Peru, the evidence is weaker when using January 2002[7].

To enhance the robustness of our findings, we conduct a moving window analysis that considers different end dates for the full sample tests. The results, presented in Appendix A, confirm the non-stationarity of inflation series across all three countries for the full sample period. Moreover, the moving window analysis of the post-inflation targeting samples reinforces our finding that inflation processes became more stationary following the implementation of inflation targeting regimes, particularly for Chile and Colombia.

These results suggest inflation rates exhibit nonlinear dynamics associated with structural regime changes from inflation targeting frameworks. However, as noted in Section 1 and Figure 1, there appears to be asymmetry in shock persistence depending on sign and magnitude—a nonlinearity that standard unit root tests cannot capture. To investigate this feature, we proceed with the quantile autoregression framework.

Table 2: *Unit root tests for inflation rates*

Country	Test	Full sample	Before Inflation Targeting	After Inflation Targeting
		1992Jan - 2023Dec	**1992Jan - 2001Dec**	**2002Jan - 2023Dec**
Peru	DF−GLS	0.64	0.47	-0.85
	MZa−GLS	-0.10	0.17	-1.10
		1992Jan - 2023Dec	**1992Jan - 1999Aug**	**1999Set - 2023Dec**
Chile	DF−GLS	-0.57	-0.76	-3.25*
	MZa−GLS	-0.43	-1.61	-11.07**
		1992Jan - 2023Dec	**1992Jan - 1999Aug**	**1999Set - 2023Dec**
Colombia	DF−GLS	-0.01	0.49	-2.78*
	MZa−GLS	0.13	-0.07	-8.54**

Note: The Modified Akaike Information Criterion (MAIC) is employed to select the optimal lag length in both tests. For Peru, January 2002 is taken as the onset of the inflation-targeting regime, whereas for Colombia and Chile the adoption date is September 1999.
* Significant at 1% level.
** Significant at 5% level.
*** Significant at 10% level.

These results suggest that inflation rates exhibit time-varying dynamics, with the adoption of inflation targeting frameworks representing a structural regime change. However, standard unit root tests cannot capture

$DF\text{-}GLS$ and $M\text{-}GLS$ tests are preferred over standard unit root tests because they offer improved power properties (Elliott et al., 1996; Ng and Perron, 2001).

[6]The $MZa\text{-}GLS$ statistic is presented as a representative of the $M\text{-}GLS$ family of statistics. The results are similar for the other $M\text{-}GLS$ statistics. The results displayed on Table 2 consider only an intercept as the deterministic component. The results are similar when considering an intercept and a trend in the deterministic component.

[7]For Peru, the null hypothesis is rejected when February 2002 and subsequent months are considered as the starting point.

a potentially distinct form of dynamic behavior: the asymmetric response of inflation to shocks of different signs and magnitudes. As illustrated in Figure 1, positive inflation deviations appear more persistent than negative deviations across all three countries—an asymmetry that may exist both before and after the inflation targeting regime shift. To investigate this within-regime nonlinear behavior more thoroughly, we proceed with the quantile autoregression framework, which is specifically designed to identify asymmetric adjustment patterns across different quantiles of the conditional distribution.

5.2. *Quantile Autoregression Results*

Unlike the standard unit root tests in Section 5.1, which examine the stationarity properties of inflation levels, the quantile autoregression framework requires us to specify deviations from a steady-state reference point. We construct these deviations as:

$$z_t = \pi_t - \hat{\mu}_\pi \tag{8}$$

where $\hat{\mu}_\pi$ represents the steady-state inflation level.

Following the policy-oriented focus of our analysis, we use the formal inflation targets as our baseline specification: 2% for Peru and 3% for Chile and Colombia. This choice has several advantages for our research question. First, it provides a policy-relevant benchmark: central banks evaluate their performance relative to announced targets, and our specification directly captures deviations that would trigger policy responses. Second, it ensures cross-country comparability: using a common target-based reference allows direct comparison of persistence patterns across the three economies. Third, these targets represent the equilibrium these economies converged toward during our sample period, even in pre-IT years when stabilization efforts were already underway.

An alternative approach would use the sample mean $\bar{\pi}$ as the steady state. However, for our sample period (1992-2023), historical means would be heavily influenced by early high-inflation episodes and would differ substantially across countries (6.3% for Peru, 4.7% for Chile, 8.3% for Colombia—see Table 1), potentially obscuring systematic patterns. Moreover, as noted by Tsong and Lee (2011), the quantile autoregression framework estimates quantile-specific intercepts $\gamma_0(\tau)$ that capture systematic level differences across the conditional distribution. These intercepts absorb any persistent deviations between realized inflation and the chosen reference point, allowing the autoregressive coefficients $\gamma_1(\tau)$ to capture true persistence dynamics. To ensure our findings are not sensitive to this specification choice, Section 5.7 presents comprehensive robustness analysis using alternative steady-state definitions.

Table 3 presents results from our quantile autoregression analysis across different percentile levels. For each country, we report the estimated constant term ($\gamma_0(\tau)$), autoregressive coefficient ($\gamma_1(\tau)$), and QKS test outcomes. Following Tsong and Lee (2011) and Çiçek and Akar (2013), we calculate half-lives (HLs) to quantify mean reversion speed at each quantile, computed as $\frac{\log(0.5)}{\log(\hat{\gamma}_1(\tau))}$.

In stark contrast to standard unit root tests, the QKS test provides compelling evidence of global mean reversion in inflation rates for all three countries at the 1% significance level, highlighting the importance of methodologies that accommodate nonlinearities in inflation dynamics.

The estimated constant term $\gamma_0(\tau)$ represents inflation shock magnitude at various quantiles[8]. Negative values of $\gamma_0(\tau)$ correspond to adverse shocks, while positive values reflect favorable shocks. Consistently across all countries, $\gamma_0(\tau)$ increases monotonically with quantile level τ, with the highest quantile corresponding to the largest positive shock and the lowest to the greatest negative shock. At the median quantile (50%), shock magnitude is not significantly different from zero for any country, suggesting symmetry around the median.

The estimated autoregressive coefficients $\gamma_1(\tau)$ reveal a consistent pattern: at higher quantiles, coefficients approach or exceed unity, indicating greater persistence of positive inflation shocks. At lower quantiles, inflation exhibits clearer mean-reverting behavior, indicating negative shocks dissipate more quickly. However, specific quantile thresholds at which the unit root hypothesis cannot be rejected differ across countries:

- For Peru, the unit root hypothesis is rejected at the 1% significance level up to the 70th quantile, but not at higher quantiles.
- For Chile, rejection holds up to the 60th quantile at the 1% significance level, beyond which inflation behaves more persistently.
- For Colombia, there is no statistical evidence of a unit root up to the 50th quantile at a 5% significance level, with non-rejection at higher quantiles.

The QKS test demonstrates that mean-reverting properties at lower quantiles enable the entire process to eventually return to long-term equilibrium, even when higher quantiles exhibit unit root characteristics.

Table 3: *Results for quantile unit root tests on inflation rates*

Country	τ	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Peru	$\gamma_0(\tau)$	-3.520*	-2.225*	-1.284*	-0.451***	0.206	0.920*	1.562*	2.788*	4.001*
	$\gamma_1(\tau)$	0.688*	0.730*	0.780*	0.778*	0.794*	0.806*	0.867*	0.980	1.125
	HLs	1.853	2.201	2.785	2.763	3.005	3.208	4.873	34.484	∞
	QKS	10.628*								
Chile	$\gamma_0(\tau)$	-3.805*	-2.290*	-1.456*	-0.443***	0.320	1.037*	1.908*	3.427*	4.732*
	$\gamma_1(\tau)$	0.537*	0.546*	0.570*	0.658*	0.709*	0.754*	0.855	0.871	0.914
	HLs	1.114	1.146	1.235	1.658	2.013	2.450	4.408	5.019	7.708
	QKS	7.951*								
Colombia	$\gamma_0(\tau)$	-2.086*	-1.339*	-0.718*	-0.430*	0.226	0.702*	1.198*	1.656*	2.543*
	$\gamma_1(\tau)$	0.763*	0.849*	0.904*	0.944***	0.936**	0.961	0.961	1.010	1.076
	HLs	2.565	4.222	6.838	12.006	10.429	17.199	17.288	∞	∞
	QKS	6.234*								

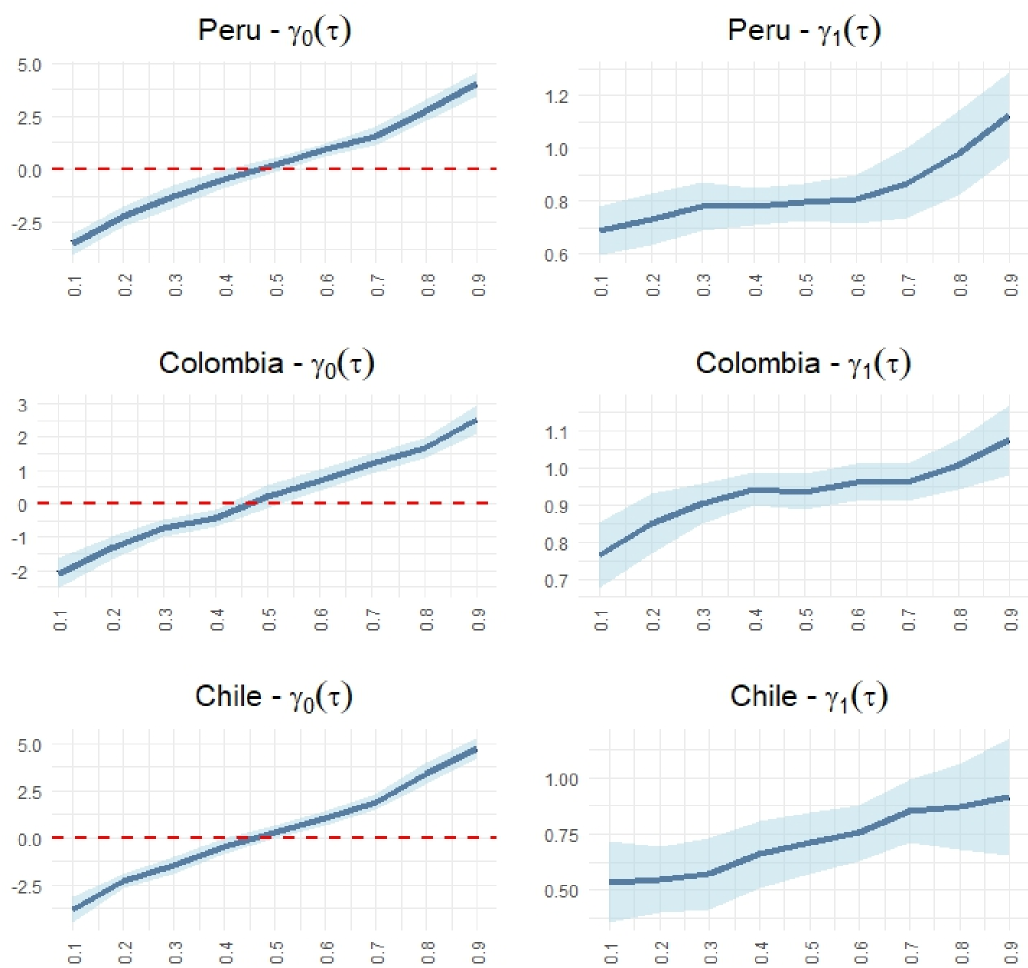
Notes: For $\gamma_0(\tau)$, the null of zero is tested with the student-t test, while for $\gamma_1(\tau)$, the unit-root null is tested with the $t_n(\tau)$ statistic.
* Significant at 1% level.
** Significant at 5% level.
*** Significant at 10% level.

Our findings align with and extend the results of Gaglianone et al. (2018) for Brazil, who also documented asymmetric inflation persistence using quantile autoregression. However, our results reveal important cross-country variation within Latin America. While Brazil showed unit root behavior starting from the 80th quantile with a critical quantile of $\tau_{crit} = 0.72$ and non-stationary periods comprising 28% of the sample, we find distinct thresholds across our three countries: Chile (70th quantile), Colombia (60th quantile), and

[8] Following Gaglianone et al. (2018), Tsong and Lee (2011), and Çiçek and Akar (2013), we interpret quantile-specific intercepts as deviations from long-run equilibrium rather than structural shocks, focusing on distributional properties of inflation's internal dynamics.

Peru (80th quantile). Notably, Peru's threshold matches Brazil's, suggesting these two economies may share similar inflation persistence characteristics. The variation in critical quantiles across Chile, Colombia, and Peru demonstrates that despite similar quantile autoregression methodology and regional proximity, specific persistence patterns differ across Latin American economies, potentially reflecting differences in monetary policy effectiveness, economic structures, and institutional quality. These asymmetric patterns are consistent with earlier findings by Çiçek and Akar (2013) for Turkey and Tsong and Lee (2011) for OECD countries, confirming the broader applicability of quantile autoregression in detecting inflation asymmetries across diverse economic contexts.

Figure 2: *Quantile intercepts and autoregressive coefficients*



Note: The vertical axis indicates the values of these estimated coefficients, while the horizontal line represents quantiles. The light blue area represents the 95% confidence levels, which are obtained through resampling techniques with 500 simulations.

Half-life calculations illuminate asymmetric adjustment speeds. At the 10th quantile (large negative shocks), half-lives are short: 1.11, 1.85, and 2.57 months for Chile, Peru, and Colombia, respectively, indicating rapid mean reversion. At the 90th quantile (large positive shocks), inflation in Peru and Colombia does not revert to the mean (infinite half-life), while Chile's half-life extends to 7.71 months. These findings confirm that both sign and magnitude of inflation shocks significantly influence adjustment speed to long-term equilibrium.

Figure 2 graphically illustrates these results, showing that $\gamma_0(\tau)$ estimators have a positive slope and intersect zero near the 50th quantile, while $\gamma_1(\tau)$ estimators display an increasing trend across percentiles, demonstrating asymmetric response of inflation to shocks.

5.3. Quantile Autoregression and the implementation of the Inflation Targeting

It is important to distinguish between two forms of dynamic behavior in our analysis. First, the quantile autoregression framework captures within-regime nonlinearity—the asymmetric response of inflation to shocks of different signs and magnitudes, as reflected in the varying persistence across quantiles. This nonlinearity represents the intrinsic adjustment mechanism of inflation and can exist in any policy regime. Second, the adoption of inflation targeting represents a structural break—a shift in the policy regime that may alter the overall level of persistence and the degree of asymmetry, but does not itself generate the nonlinear dynamics. In this section, we examine whether this structural regime change has affected the persistence parameters while recognizing that the fundamental asymmetric adjustment pattern captured by the QAR methodology may persist across both regimes.

Following Tsong and Lee (2011) and Çiçek and Akar (2013), we initially examine a single structural break at IT adoption as a natural benchmark. Section 5.4 extends this analysis by endogenously detecting multiple structural breaks to assess robustness.

The adoption of inflation targeting frameworks by central banks has facilitated reductions in both the level and volatility of long-term inflation in Chile, Colombia, and Peru (Vega and Winkelried, 2005). Furthermore, (Perron, 1989) demonstrated that neglecting structural breaks in unit root tests can lead to overestimation of process persistence. Therefore, in this section, we explicitly incorporate the initiation of inflation targeting regimes as structural breaks to assess their impact on inflation dynamics.

We adjust equation (1) as follows:[9]

$$x_t = \gamma_1 x_{t-1} + \sum_{j=1}^{q} \gamma_{j+1} \Delta x_{t-j} + \epsilon_t \tag{9}$$

where

$$x_t = \pi_t - \hat{\mu}_\pi - \hat{\mu}_s D_t \tag{10}$$

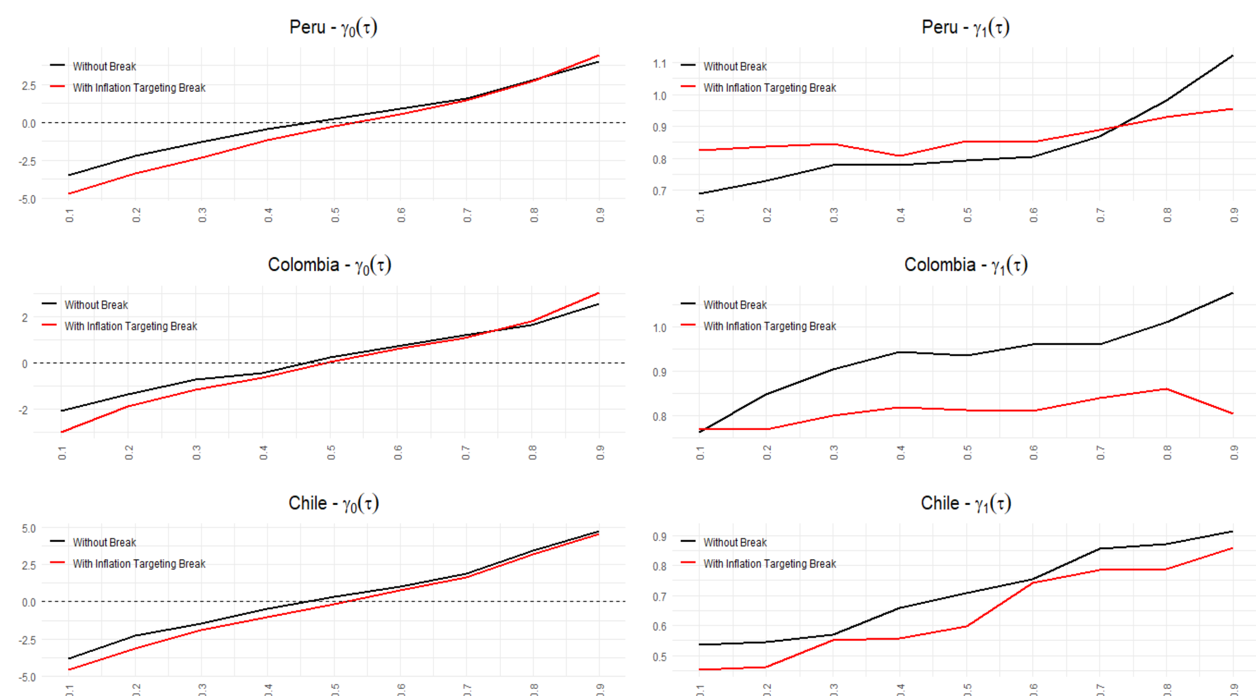
Here $\hat{\mu}_\pi$ and $\hat{\mu}_s$ are the ordinary least squares (OLS) estimates of μ_π and μ_s obtained from the regression of π_t on $(1, D_t)'$. The dummy variable D_t equals zero for periods $t < s_t$ and one for periods $t \geq s_t$, where s_t represents the known structural break date: September 1999 for Chile and Colombia, and January 2002 for Peru.

[9] Our methodology mirrors the approach of Çiçek and Akar (2013) and Tsong and Lee (2011) by adopting separate QAR estimations for pre- and post-inflation targeting periods without interaction terms, relying on two-period comparison to infer regime effects. We enhance this framework by providing bootstrapped half-lives and confidence intervals for increased transparency.

Table 4 presents the estimation results from this adjusted model. The QKS test consistently indicates that inflation rates globally revert to the mean across all three countries, aligning with our findings from the model without structural breaks (see Table 3). The values of $\gamma_0(\tau)$ estimators differ slightly from those in Table 3 but maintain the same fundamental patterns: i) the highest quantile of τ corresponds to the largest positive shocks, while the lowest quantile represents the largest negative shocks, and ii) these values increase monotonically as the quantile rises.

The persistence of inflation rates continues to exhibit asymmetry, influenced by both the magnitude and direction of shocks. However, as illustrated in Figure 3, the estimated values for $\gamma_1(\tau)$ are generally lower across most quantiles, particularly at higher ones—compared to the scenario without structural breaks. These findings align with those of Çiçek and Akar (2013) and Tsong and Lee (2011), demonstrating that inflation targeting regimes contribute significantly to reducing inflation persistence while maintaining the fundamental asymmetric adjustment pattern. Figure 4 provides a detailed visualization of the estimators of $\gamma_0(\tau)$ and $\gamma_1(\tau)$, along with their confidence bands, from the quantile regression incorporating monetary policy changes. These graphs further support our conclusion that persistence has declined while preserving the asymmetric adjustment dynamics.

Figure 3: *Quantile intercepts and autoregressive coefficients with Inflation Targeting break and without break*



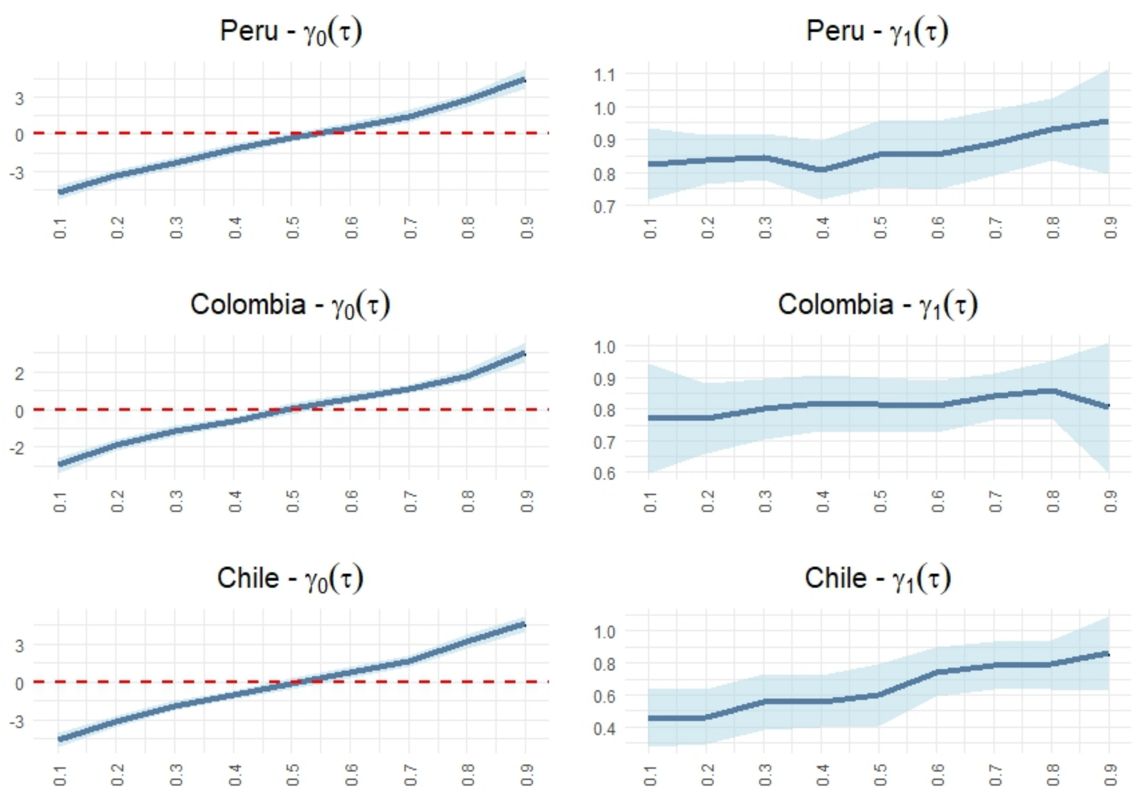
While these results demonstrate that IT adoption reduced persistence while maintaining asymmetry, Section 5.4 examines whether these patterns are robust to controlling for additional structural breaks beyond the IT adoption date.

Table 4: *Quantile unit root test results when the implementation of the inflation targeting scheme is considered as a structural break*

Country	τ	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Peru	$\gamma_0(\tau)$	-4.716*	-3.382*	-2.354*	-1.148*	-0.280	0.534***	1.416*	2.737*	4.452*
	$\gamma_1(\tau)$	0.826*	0.838*	0.846*	0.806*	0.854*	0.851*	0.890*	0.930	0.954
	HLs	3.615	3.911	4.136	3.219	4.392	4.309	5.919	9.551	14.785
	QKS	6.439*								
Chile	$\gamma_0(\tau)$	-4,582*	-3.140*	-1.881*	-1.034*	-0.141	0.747*	1.615*	3.176*	4.564*
	$\gamma_1(\tau)$	0.452*	0.461*	0.552*	0.558*	0.597*	0.742*	0.784***	0.789***	0.860
	HLs	0.872	0.895	1.168	1.189	1.342	2.322	2.841	2.917	4.578
	QKS	6.978*								
Colombia	$\gamma_0(\tau)$	-2.974*	-1.865*	-1.165*	-0.652*	0.025	0.595*	1.095*	1.782*	3.021*
	$\gamma_1(\tau)$	0.770***	0.770*	0.799*	0.818*	0.813*	0.810*	0.840*	0.860***	0.805***
	HLs	2.645	2.648	3.092	3.448	3.346	3.284	3.976	4.592	3.194
	QKS	4.754*								

Notes: For $\gamma_0(\tau)$, the null of zero is tested with the student-t test, while for $\gamma_1(\tau)$, the unit-root null is tested with the $t_n(\tau)$ statistic.
* Significant at 1% level.
** Significant at 5% level.
*** Significant at 10% level.

Figure 4: *Quantile intercepts and autoregressive coefficients when the implementation of the inflation targeting scheme is considered as a structural break*



Note: The vertical axis indicates the values of these estimated coefficients, while the horizontal line represents quantiles. The light blue area represents the 95% confidence levels, which are obtained through resampling techniques with 500 simulations.

5.4. Robustness to Multiple Structural Breaks

A potential concern with our single inflation-targeting break specification is that the 1992-2023 period encompasses additional macroeconomic regime shifts beyond IT adoption, including disinflation episodes in the 1990s, the 2008 global financial crisis, and the COVID-19 pandemic. To assess whether our results depend on this modeling choice, we conduct a data-driven structural break analysis and re-estimate our quantile autoregression framework under alternative regime specifications.

We apply the Bai and Perron (2003) sequential procedure to identify endogenous structural breaks in the mean of inflation series, imposing a minimum segment length of 10% of the sample and employing Newey-West robust standard errors. Testing at significance levels up to 10%, the procedure identifies:

- Peru: 3 breaks (February 1995, July 1998, October 2020)
- Chile: 1 break (May 1996)
- Colombia: 4 breaks (June 1998, September 2001, December 2008, October 2020)

These detected breaks reveal several important patterns about the structural evolution of inflation in these economies. The breaks correspond primarily to three distinct phenomena.

- Pre-IT stabilization episodes during the 1990s: Peru's February 1995 break coincides with the consolidation of the post-hyperinflation stabilization program (inflation had declined from 7,650% in 1990 to 15.4% in 1994, reaching 10.2% in 1995).[10] Chile's May 1996 break reflects the consolidation of its gradual disinflation process that had been underway since the late 1980s, with inflation declining from double digits in the early 1990s to single digits by 1996.
- Major global and regional shocks: The July 1998 breaks for Peru and Colombia coincide with the Asian financial crisis (1997) and Russian crisis (August 1998), which affected emerging markets globally and occurred during a period when both countries were transitioning toward more formal monetary frameworks. Colombia's December 2008 break clearly corresponds to the global financial crisis following Lehman Brothers' collapse in September 2008. The October 2020 breaks for Peru and Colombia reflect the COVID-19 pandemic's impact on inflation dynamics.
- Possible IT regime consolidation: Colombia's September 2001 break occurs exactly two years after formal IT adoption (September 1999), potentially capturing the consolidation phase of the new monetary framework, though this timing also coincides with the Argentine crisis of 2001, making attribution ambiguous.

A critical finding from the Bai-Perron analysis is that the procedure does not identify discrete structural breaks at the exact dates of formal IT adoption for any of the three countries (January 2002 for Peru, September 1999 for Chile and Colombia). This absence is informative rather than problematic: it suggests that inflation targeting implementation involved gradual institutional changes and progressive credibility building rather than abrupt discrete shifts in the inflation process detectable by mean-break tests. This interpretation is consistent with the inflation targeting literature, which emphasizes that IT effectiveness depends on gradually-built credibility and anchored expectations rather than immediate discrete effects (Vega and Winkelried (2005)). The single IT-break specification in our main analysis captures the cumulative effect of this gradual institutional transformation by comparing the pre- and post-IT periods, even though the transition itself was smooth

[10] Inflation correspond to December-to-December year-over-year rates.

rather than abrupt.

The cross-country heterogeneity in detected breaks is also notable: Chile exhibits only one pre-IT break, consistent with its relatively smooth and early disinflation trajectory, while Colombia displays the most complex break structure with four discrete shifts, reflecting its more volatile macroeconomic history including domestic financial stress, external crises, and the pandemic.

To ensure our findings are robust to regime specification, we re-estimate the quantile autoregression models incorporating all Bai-Perron detected breaks. Specifically, we modify equation (10) to include break-specific dummy variables for all identified structural changes. Table 5 presents the results.

Table 5: *Quantile unit root test results controlling for Bai-Perron detected structural breaks*

Country	τ	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Peru	$\gamma_0(\tau)$	-5.080*	-3.091*	-2.056*	-0.893*	-0.080	0.791*	1.779*	2.841*	4.457*
	$\gamma_1(\tau)$	0.941	0.795*	0.724*	0.636*	0.609*	0.651*	0.693*	0.739*	0.786**
	HLs	11.326	3.015	2.144	1.530	1.397	1.613	1.890	2.293	2.877
	QKS	8.734*								
Chile	$\gamma_0(\tau)$	-4.648*	-2.915*	-1.913*	-1.146*	-0.177	0.813*	1.774*	3.114*	4.586*
	$\gamma_1(\tau)$	0.406*	0.423*	0.474*	0.489*	0.552*	0.742*	0.737**	0.764***	0.872
	HLs	0.769	0.805	0.929	0.969	1.165	2.324	2.271	2.575	5.051
	QKS	6.951*								
Colombia	$\gamma_0(\tau)$	-2.793*	-1.828*	-1.266*	-0.571*	0.017	0.455*	1.028*	1.676*	2.816*
	$\gamma_1(\tau)$	0.402*	0.516*	0.595*	0.672*	0.668*	0.638*	0.741*	0.742**	0.683
	HLs	0.761	1.049	1.334	1.741	1.720	1.541	2.312	2.322	1.817
	QKS	5.672*								

Notes: This specification controls for all structural breaks detected by the Bai and Perron (2003) sequential procedure at 10% significance level with minimum segment length of 10% of sample and Newey-West robust standard errors. Peru: 3 breaks (Feb-1995, Jul-1998, Oct2020); Chile: 1 break (May-1996); Colombia: 4 breaks (Jun-1998, Sep-2001, Dec-2008, Oct2020). For $\gamma_0(\tau)$, the null of zero is tested with the student-t test, while for $\gamma_1(\tau)$, the unit-root null is tested with the $t_n(\tau)$ statistic.
* Significant at 1% level.
** Significant at 5% level.
*** Significant at 10% level.

The multiple-break specification yields several important findings that reveal both common patterns and country-specific dynamics.

First, regarding asymmetric persistence, we observe qualitatively different patterns across countries that provide insights into their distinct inflation histories. Chile and Colombia exhibit the expected monotonically increasing pattern in $\gamma_1(\tau)$, confirming that positive shocks demonstrate greater persistence than negative shocks across the entire conditional distribution. Peru displays a U-shaped pattern: persistence coefficients decrease from the 10th quantile (0.941) through the 50th quantile (0.609), then increase toward the 90th quantile (0.786). This distinctive pattern likely reflects Peru's unique inflation history during the sample period. In the early-to-mid 1990s, Peru experienced sustained disinflation following hyperinflation, with inflation exhibiting a marked downward trend rather than mean reversion to a stable level. During this disinflation period, observations in the lower quantiles-representing inflation rates below the (still elevated) mean-would correspond to the persistent downward trajectory as inflation gradually declined toward its new, lower equilibrium. The high persistence at lower quantiles $(\gamma_1(0.1) = 0.941)$ captures this sustained disinflation process, where negative deviations from the high mean persisted until inflation stabilized at lower levels by the late 1990s. Once we control for the structural breaks identified by the Bai-Perron procedure (February 1995 and July 1998, both during the disinflation period), this pattern becomes apparent: lower quantile observations during disinflation exhibit high persistence not because negative shocks fail to dissipate, but because they represent a persistent regime shift toward lower inflation rather than temporary deviations from a stable mean. The increasing persistence at upper quantiles (from the 50th onward) in Peru is consistent with our main finding: positive inflation shocks—particularly those driving inflation above its (now-stabilized) lower mean—exhibit greater persistence than would be suggested by a symmetric adjustment process.

Second, global stationarity is maintained across all three countries: the QKS test strongly rejects the unit root hypothesis at the 1% level (Peru: 8.734, Chile: 6.951, Colombia: 5.672), consistent with our main specification in Tables 3 and 4.

Third, comparing the multiple-break specification (Table 5) with the single IT-break specification (Table 4), we observe systematically lower autoregressive coefficients at upper quantiles in most cases: for Peru, $\gamma_1(0.9)$ decreases from 0.954 to 0.786; for Chile, $\gamma_1(0.9)$ increases slightly from 0.860 to 0.872 (but remains below unity); and for Colombia, $\gamma_1(0.9)$ decreases from 0.805 to 0.683. This pattern suggests that explicitly controlling for crisis episodes and other structural shifts reduces measured persistence at higher quantiles, where large positive shocks tend to concentrate. This indicates that the decline in inflation persistence observed in these economies reflects a combination of factors: the adoption of inflation targeting frameworks, the successful navigation of major crisis episodes, and the broader process of macroeconomic stabilization and institutional development that characterized these economies' evolution from the high-inflation 1990s to the more stable 2000s and beyond. The single IT-break specification captures the combined effect of the monetary policy regime change and these complementary improvements in policy frameworks, while the multiple-break specification further isolates the impact of specific crisis episodes.

Fourth, the critical quantiles above which the unit root hypothesis cannot be rejected reveal important differences between specifications that illuminate the nature of persistence in these economies. Peru exhibits a striking reversal given that under the multiple-break specification, unit root behavior emerges only at the 10th quantile ($\gamma_1(\tau)$ = 0.941, not significant), whereas the single IT-break specification showed unit root behavior at the 80th and 90th quantiles. This reversal is consistent with our interpretation of Peru's disinflation history: the high persistence at lower quantiles in the multiple-break model captures the sustained disinflation of the 1990s, which is properly identified as a structural regime transition once we incorporate the 1995 and 1998 breaks. Meanwhile, the upper quantiles show strong mean reversion (all significant through τ = 0.9), indicating that large positive shocks are less persistent than the single-break specification suggested. This demonstrates that explicitly controlling for the disinflation regime shifts reveals fundamentally stationary dynamics at upper quantiles—what appeared as persistent positive shocks in the single-break model were partially regime-change effects.

Chile shows remarkable consistency since the unit root hypothesis cannot be rejected only at the 90th quantile in both specifications. This stability reflects Chile's relatively smooth inflation trajectory with only one Bai-Perron detected break (May 1996), suggesting that the single IT-break specification already captures the main regime change. The similarity across specifications provides confidence that Chile's asymmetric persistence pattern is robust to different modeling approaches.

Colombia reveals enhanced mean reversion under the multiple-break specification given that while the single IT-break model showed significant coefficients across all quantiles, the multiple-break specification shows unit root behavior only at the 90th quantile ($\gamma_1(0.9) = 0.683$, not significant). This pattern indicates that Colombia's four detected structural breaks (1998, 2001, 2008, 2020) were masking the true persistence dynamics. Once we properly control for these regime shifts the data reveal that even large positive shocks (through $\tau = 0.8$) exhibit mean reversion. Only at the most extreme 90th quantile does the unit root hypothesis fail to be rejected.

These patterns collectively demonstrate that the multiple-break specification provides a more refined picture of inflation dynamics by separating regime-transition effects from within-regime persistence. For Peru, what appeared as persistent positive shocks in the single-break model were partially confounded with the structural disinflation process; controlling for this reveals stronger mean reversion at upper quantiles. For Colombia, the multiple-break framework shows that most large positive shocks do revert to the mean, with non-stationarity confined only to the most extreme observations. Chile's consistency across specifications confirms its relatively stable inflation regime.

Importantly, this enhanced precision strengthens rather than contradicts our policy conclusions. The asymmetric pattern persists across all specifications—positive shocks remain more persistent than negative shocks in all three countries. However, the multiple-break analysis suggests that inflation is more fundamentally stationary than the single-break specification implied, particularly at upper quantiles, once we properly account for discrete regime changes. This finding indicates that the comprehensive process of macroeconomic stabilization in these economies—encompassing the transition to inflation targeting frameworks, improved crisis management capabilities, and broader institutional reforms—has successfully anchored inflation dynamics. While we cannot isolate the specific contribution of each structural break (and indeed, the gradual nature of IT adoption as evidenced by the absence of discrete breaks at formal adoption dates suggests these improvements were interrelated), the consistent reduction in persistence across specifications suggests that the combination of credible monetary policy frameworks and effective policy responses to major shocks has fundamentally improved inflation dynamics in Latin America. Even very large positive shocks eventually revert to their targets in these economies, though the adjustment speed remains asymmetric.

In summary, the multiple-break specification demonstrates that our single IT-break results were conservative estimates of mean reversion: by attributing some structural regime-transition dynamics to within-regime persistence, the simpler specification slightly overstated the persistence of positive shocks. The more refined multiple-break analysis reveals that inflation in these economies is fundamentally stationary across most of the conditional distribution, with non-stationarity confined to extreme quantiles (10th for Peru due to historical disinflation, 90th for Chile and Colombia for large positive shocks). These findings demonstrate that the combination of inflation targeting adoption, effective crisis management, and broader institutional improvements has successfully anchored inflation dynamics in Latin America. While the multiple-break specification does not allow us to isolate the individual contribution of each structural change, the progressive reduction in persistence from Table 4 (no breaks) through Table 5 (single IT break) to Table 6 (multiple breaks) provides compelling evidence that both the monetary policy regime evolution and the improved management of subsequent macroeconomic challenges have contributed to fundamentally more stable inflation processes in these economies.

5.5. Robustness Check: Extended Analysis for Brazil

As a robustness check and to provide a regional benchmark, we extend our analysis to Brazil, the largest economy in Latin America and an early adopter of inflation targeting. While Gaglianone et al. (2018) comprehensively examined Brazilian inflation dynamics using quantile autoregression through 2017, we update their analysis with data through December 2023. This extension serves multiple purposes: (i) it validates our methodological approach by allowing comparison with their established findings, (ii) it assesses whether Brazil's inflation dynamics have evolved in the post-2017 period, particularly following the post-pandemic inflationary episode, and (iii) it provides a comparative benchmark for understanding inflation persistence patterns across the four major Latin American inflation-targeting economies.

We employ monthly CPI (IPCA) data from January 1995 to December 2023, following Gaglianone et al. (2018) in using 1995 as the starting point to focus on the post-Real Plan stabilization period. Brazil formally adopted inflation targeting in July 1999, which we treat as a structural break in our analysis, consistent with the timing used for Chile and Colombia in our main analysis.

Table 6, in the panel (A), presents the quantile autoregression results for Brazil over the full sample period (1995-2023). The QKS test statistic of 10.208 strongly rejects the global unit root hypothesis at the 1% significance level, indicating that Brazilian inflation exhibits global mean reversion. This finding is consistent with Gaglianone et al.'s conclusion that Brazilian inflation is globally stationary.

The estimated intercepts $\gamma_0(\tau)$ display the expected monotonic pattern across quantiles, ranging from -1.767 at the 10th quantile to 4.439 at the 90th quantile, with the intercept not significantly different from zero at the 40th quantile. This pattern confirms the presence of asymmetric shocks of varying magnitudes across the conditional distribution.

The autoregressive coefficients $\gamma_1(\tau)$ reveal important asymmetries in persistence. At lower quantiles, inflation demonstrates clear mean-reverting behavior, with $\gamma_0(0.1) = 0.613$ and $\gamma_0(0.2) = 0.645$, both statistically significant at the 1% level. The unit root hypothesis can be rejected up to the 70th quantile at conventional significance levels. At the 80th quantile, the coefficient is 0.853 (significant at 10%), and at the 90th quantile, it reaches 0.816 (not significantly different from unity). This suggests that the unit root hypothesis cannot be rejected at and above approximately the 80th quantile, indicating high persistence of large positive inflation shocks.

These findings are remarkably consistent with Gaglianone et al. (2018), who identified a critical quantile of $\tau_{crit} = 0.72$, with approximately 28% of periods exhibiting non-stationary behavior. Our results, using an extended sample that includes six additional years and the significant post-pandemic inflation shock, confirm the robustness of their conclusions about asymmetric inflation persistence in Brazil.

The half-life calculations further illustrate the asymmetric adjustment dynamics. At the 10th quantile (large negative shocks), the half-life is 1.41 months, indicating rapid mean reversion. This increases gradually through the distribution: 2.22 months at the median, 4.86 months at the 70th quantile, and 4.35 months at the 80th quantile. Interestingly, the half-life at the 90th quantile (3.41 months) appears lower than at the 80th quantile, though the autoregressive coefficient at this quantile is not statistically different from unity, suggesting high uncertainty about the true persistence at this extreme quantile.

Table 6, in the panel (B), presents results when we explicitly account for the structural break associated with inflation targeting adoption in July 1999. The QKS test continues to indicate global stationarity (9.821, significant at 1%). Notably, the autoregressive coefficients are generally lower across most quantiles compared to the specification without the structural break, particularly at higher quantiles. This reduction in persistence coefficients aligns with our findings for Chile, Colombia, and Peru, and supports Gaglianone et al.'s observation that the inflation-targeting regime contributed to a gradual reduction of inflation inertia in Brazil.

Table 6: *Quantile unit root test results for Brazil*

τ	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
(A) Quantile unit root tests without the inflation targeting break									
$\gamma_0(\tau)$	-1.767*	-1.190*	-0.524**	0.058	0.519*	1.065*	1.570*	2.494*	4.439*
$\gamma_1(\tau)$	0.613*	0.645*	0.667*	0.715*	0.731*	0.807*	0.867**	0.853***	0.816
HLs	1.414	1.583	1.711	2.068	2.216	3.227	4.856	4.353	3.405
QKS	10.208*								
(B) Quantile unit root tests with a structural break at the adoption of inflation targeting									
$\gamma_0(\tau)$	-3.367*	-2.383*	-1.589*	-0.990*	-0.344***	0.353***	1.142*	1.921*	3.850*
$\gamma_1(\tau)$	0.642*	0.652*	0.711*	0.711*	0.752*	0.793*	0.864*	0.828**	0.796
HLs	1.562	1.618	2.032	2.028	2.437	2.994	4.730	3.663	3.033
QKS	9.821*								

Notes: For $\gamma_0(\tau)$, the null hypothesis of zero is tested using the Student-t statistic. For $\gamma_1(\tau)$, the unit-root null is assessed using the $t_n(\tau)$ statistic.
* Significant at the 1% level.
** Significant at the 5% level.
*** Significant at the 10% level.

With the structural break specification, the unit root hypothesis can be rejected up to the 70th quantile at the 1% level, with $\gamma_1(0.7) = 0.864$. At the 80th and 90th quantiles, the coefficients are 0.828 and 0.796 respectively, both suggesting less persistence than in the specification without breaks, though still indicating relatively high persistence of large positive shocks. The half-lives in this specification show a similar pattern: 1.56 months at the 10th quantile, increasing to 4.73 months at the 70th quantile, with somewhat lower values at the 80th and 90th quantiles (3.66 and 3.03 months respectively).

Placing Brazil in the context of our three focal economies reveals both similarities and differences in inflation persistence patterns. All four countries exhibit global stationarity according to the QKS test, confirming that inflation-targeting regimes have been successful in anchoring inflation expectations and maintaining long-run price stability across major Latin American economies.

However, there are notable differences in the critical quantiles above which the unit root hypothesis cannot be rejected. Based on our results:

- Colombia: 60th quantile (most responsive to shocks)
- Chile: 70th quantile
- Brazil: 80th quantile (based on our results)

- Peru: 80th quantile (least responsive to positive shocks)

Brazil and Peru share similar thresholds, suggesting comparable persistence characteristics for large positive inflation shocks. Both countries exhibit unit root behavior starting from the 80th quantile, indicating that approximately 20% of inflation observations display highly persistent dynamics. Chile shows slightly lower persistence, with the critical threshold at the 70th quantile, while Colombia demonstrates the most responsive inflation dynamics among the four economies, with persistence emerging only at the 60th quantile.

The half-life patterns at lower quantiles (rapid adjustment to negative shocks) are qualitatively similar across all four countries, reinforcing our main finding that negative inflation shocks dissipate quickly while positive shocks demonstrate substantially greater persistence. At the 10th quantile, half-lives range from 1.11 months (Chile) to 2.57 months (Colombia), with Brazil (1.41 months) and Peru (1.85 months) falling in between. This consistency across countries suggests that the asymmetric adjustment mechanism is a fundamental feature of inflation dynamics in Latin American inflation-targeting economies rather than a country-specific phenomenon.

The impact of inflation targeting on reducing persistence while maintaining asymmetry is also consistent across all four countries. In each case, accounting for the structural break associated with IT adoption reduces the autoregressive coefficients at higher quantiles, though the asymmetric pattern remains present. This finding underscores the effectiveness of inflation-targeting frameworks in reducing overall inflation persistence while highlighting that the intrinsic asymmetry in inflation adjustment—where positive shocks are more persistent than negative ones—represents a deeper structural characteristic that persists across policy regimes.

These results have important implications for monetary policy coordination and learning across Latin American central banks. The similarity in asymmetric patterns suggests that policy responses developed for one country may be applicable to others, while the differences in critical quantiles indicate that the required intensity and timing of policy responses may need to be calibrated to country-specific persistence characteristics.

Interestingly, the Bai and Perron (2003) procedure identifies no statistically significant breaks in Brazil's inflation series over our sample period (1995-2023) at conventional significance levels. This contrasts with Chile, Colombia, and Peru, which exhibited multiple breaks (Section 5.4). The difference is attributable to Brazil's sample beginning in 1995, after the Real Plan stabilization, thus missing the pre-IT disinflation transitions captured in our other countries' samples. The absence of breaks suggests Brazilian inflation evolved smoothly conditional on the post-stabilization regime. Critically, the asymmetric persistence pattern persists in Brazil despite this different structural evolution, reinforcing that the asymmetry is a fundamental feature of Latin American IT economies.

5.6. Economic Mechanisms Behind Asymmetric Persistence

Our empirical finding that positive inflation shocks demonstrate substantially greater persistence than negative shocks across Chile, Colombia, and Peru raises a natural question: what economic mechanisms drive this asymmetry? While our reduced-form quantile autoregression framework cannot definitively isolate individual channels, several complementary explanations rooted in the structural characteristics of Latin American economies and monetary policy transmission mechanisms offer plausible interpretations.

Expectations formation and inflation scarring play a central role. Economic agents in these economies experienced high inflation or hyperinflation during the 1980s and early 1990s-Peru's hyperinflation peaked at $7,650\%$ in 1990, while Chile and Colombia faced sustained double-digit inflation throughout the decade. This historical experience creates "inflation scarring": heightened sensitivity to upward price movements coupled with muted responses to downward movements. Menu-cost models show that firms adjust prices upward more readily than downward under trend inflation, amplifying persistence in positive shocks (Ball and Mankiw, 1994). Staggered contract frameworks demonstrate how overlapping wage agreements generate persistence in inflation and unemployment (Taylor, 1980). Credibility-driven policy rules further emphasize that expectations of future monetary policy critically shape current inflation dynamics (Clarida et al., 1999). In emerging markets, inflation-targeting regimes strengthen credibility and anchor expectations, reducing time-inconsistency problems and attenuating responses to external shocks (Mishkin, 2000; Mishkin and Schmidt-Hebbel, 2007). Together, these literatures explain why positive shocks persist while negative shocks dissipate more quickly.

Indexation mechanisms, though substantially reduced following inflation-targeting adoption, continue to propagate positive shocks asymmetrically. Backward-looking clauses in wage contracts and regulated prices create a mechanical channel: positive CPI shocks feed into indexed wage increases, raising firms' costs and generating second-round effects. Crucially, this mechanism operates asymmetrically—negative shocks lack a comparable downward channel due to nominal wage rigidities and the absence of deflation-indexation clauses. Fischer (1983) shows that wage and contract indexation increase the impact of inflationary disturbances on the price level, even if they do not raise average inflation in the long run. Our finding that inflation-targeting adoption reduced overall persistence while maintaining asymmetry is consistent with this interpretation: IT frameworks weakened indexation but could not eliminate its fundamentally one-sided operation.

Structural features of these economies reinforce asymmetric dynamics. Latin American CPI baskets contain substantially higher shares of food and energy (typically 40-50%) compared to advanced economies, and these sectors exhibit asymmetric price adjustment. Agricultural supply shocks illustrate this clearly: droughts or adverse weather generate price increases that persist through storage behavior, market power, and delayed supply responses, while abundant harvests lead to rapid price declines through competitive pressure in spot markets. Similarly, exchange rate pass-through operates asymmetrically—currency depreciations quickly raise import prices and inflation through immediate cost increases, while appreciations generate slower disinflation as firms exercise pricing power to protect profit margins(Swamy and Thurman, 1994). These asymmetries in key CPI components naturally generate the pattern we observe: rapid mean reversion for negative shocks, prolonged persistence for positive shocks.

Monetary policy transmission itself may contribute to asymmetric persistence through both deliberate policy choices and structural constraints. Central banks facing positive inflation shocks confront a difficult tradeoff between maintaining credibility and avoiding excessive output costs. Political economy pressures, uncertainty about shock persistence, and concerns about financial stability often lead to gradual rather than aggressive tightening. Even when central banks do respond forcefully, monetary policy operates with substantial lags—typically 6-12 months in emerging economies (Mishra and Montiel, 2013)—during which expectations and indexation mechanisms propagate the initial shock. Conversely, negative shocks may prompt faster policy easing or simply dissipate through market forces while central banks maintain rates to preserve credibility. Our finding that Colombia exhibits the lowest critical quantile (60th percentile, Table 3) while Peru shows the highest (80th percentile) may reflect differences in monetary policy reaction functions, with Peru's stricter inflation-targeting approach generating stronger but still asymmetric persistence patterns.

The combination of these mechanisms explains our key robustness finding: controlling for multiple structural breaks (Table 5) reveals stronger mean reversion than single-break specifications suggest, yet asymmetric patterns remain robust. The comprehensive process of macroeconomic stabilization—encompassing inflation-targeting adoption, improved crisis management, and institutional development—successfully anchored expectations more firmly and reduced indexation, thereby lowering persistence across the distribution. However, the fundamental asymmetries in expectations formation (inflation scarring), indexation operation (upward but not downward), structural price adjustments (food/energy), and policy transmission (gradualism constraints) persist even under credible monetary frameworks. This persistence of asymmetry despite regime improvements underscores that these mechanisms reflect deep structural features of emerging economies rather than merely policy regime characteristics.

We acknowledge that our reduced-form empirical framework, while effective at identifying asymmetric patterns, cannot quantitatively decompose the relative importance of these channels. Distinguishing between expectations-driven, indexation-driven, and supply-shock-driven persistence would require structural estimation beyond our scope, potentially using micro-level price data, high-frequency survey expectations, or estimated DSGE models calibrated to Latin American economies. Such decomposition remains a promising avenue for future research and would provide additional precision for policy design.

5.7. *Alternative Measures of Long-Run Inflation*

Our baseline quantile autoregression results (Section 5.2) use formal inflation targets as the steady-state reference point for constructing deviations $z_t = \pi_t - \hat{\mu}_\pi$. While this choice is well-justified for our policy-oriented analysis and consistent with the QAR framework's ability to absorb level differences through quantile-specific intercepts, it is important to verify that our central finding-asymmetric inflation persistence with positive shocks exhibiting substantially greater persistence than negative shocks-is not an artifact of this specification choice.

The structural robustness demonstrated in Sections 5.3-5.5 provides strong evidence that the asymmetric pattern is fundamental. In this section, we complement that structural robustness with methodological robustness, examining whether the pattern persists under alternative definitions of the steady state.

We consider two alternative steady-state measures that represent different approaches in the empirical literature: i) the historical sample mean, following Tsong and Lee (2011), and ii) a hybrid time-varying measure that combines HP-filtered trend inflation for pre-IT periods with official targets thereafter, accommodating the structural transition from high inflation to inflation targeting regimes.

5.7.1 Sample Mean Approach

Following the traditional unit root literature, we first estimate the steady-state level from the ordinary least squares regression $\pi_t = \mu_\pi + \varepsilon_t$, where ε_t denotes the error term. This yields sample means of 6.31% for Peru, 4.66% for Chile, and 8.29% for Colombia. We then construct deviations as $z_t = \pi_t - \hat{\mu}_\pi$ and re-estimate the quantile autoregression model. Table 7 presents these results.

Table 7: *Quantile Unit Root Tests Using Sample Mean as Steady State*

Country	τ	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Peru	$\gamma_0(\tau)$	-4.814*	-3.432*	-2.342*	-1.323*	-0.655*	0.348	1.294*	2.654*	4.508*
	$\gamma_1(\tau)$	0.693*	0.721*	0.783*	0.813*	0.820*	0.863*	0.923***	0.970	1.154
	HLs	1.891	2.120	2.831	3.356	3.484	4.721	8.675	22.905	∞
	QKS	10.711*								
Chile	$\gamma_0(\tau)$	-4.572*	-3.042*	-2.168*	-1.008*	-0.164	0.629**	1.667*	3.213*	4.589*
	$\gamma_1(\tau)$	0.537*	0.546*	0.570*	0.658*	0.709*	0.754*	0.854	0.871	0.914
	HLs	1.114	1.122	1.235	1.659	2.024	2.450	4.407	5.019	7.712
	QKS	7.066*								
Colombia	$\gamma_0(\tau)$	-3.337*	-2.139*	-1.227*	-0.726*	-0.114	0.494*	0.990*	1.706*	2.945*
	$\gamma_1(\tau)$	0.763*	0.849*	0.904*	0.944***	0.936**	0.960	0.961	1.010	1.076
	HLs	2.565	4.223	6.839	12.011	10.422	17.195	17.295	∞	∞
	QKS	5.977*								

Notes: This specification conducts the quantile analysis using $z_t = \pi_t - \hat{\mu}_\pi$, where $\hat{\mu}_\pi$ denotes the steady-state inflation level estimated via OLS from the regression $\pi_t = \mu_\pi + \varepsilon_t$, where ε_t is an error term. For Chile, Colombia, and Peru, the sample spans the period 1992-2023, while for Brazil the sample covers 1995-2023.

* Significant at 1% level.

** Significant at 5% level.

*** Significant at 10% level.

The asymmetric persistence pattern remains clearly evident across all three countries. The QKS test strongly rejects the global unit root hypothesis at the 1% significance level for all three economies (Peru: 10.711, Chile: 7.066, Colombia: 5.977), confirming global mean reversion. More importantly, the autoregressive coefficients $\gamma_1(\tau)$ continue to exhibit the characteristic monotonic increase across quantiles that defines asymmetric persistence.

For Peru, the unit root hypothesis cannot be rejected at the 80th quantile and above ($\gamma_1(0.8) = 0.970$, not significant; $\gamma_1(0.9) = 1.154$, not significant), while it is strongly rejected at all lower quantiles including the 70th ($\gamma_1(0.7) = 0.923$, significant at 10% level). This exactly matches our baseline specification (80th quantile critical), confirming the same fundamental pattern: large positive shocks persist while negative shocks dissipate rapidly. Half-lives illustrate this asymmetry vividly: 1.89 months at the 10th quantile versus 22.91 months at the 80th quantile, with the 90th quantile exhibiting infinite half-life.

For Chile, the critical quantile remains at the 70th percentile ($\gamma_1(0.7) = 0.854$, not significant), identical to our baseline specification. The unit root hypothesis is strongly rejected at all lower quantiles (all significant at 1% level through the 60 th quantile). Halflives range from 1.11 months at the 10th quantile to 7.71 months at the 90th quantile, demonstrating the same asymmetric adjustment pattern as in our baseline results.

For Colombia, unit root behavior emerges at the 60th quantile ($\gamma_1(0.6) = 0.960$, not significant), matching our baseline specification exactly. The strong rejection of unit roots at lower quantiles combined with non-rejection at upper quantiles confirms the asymmetric pattern. Half-lives span from 2.57 months at the 10th quantile to infinite half-life at the 80th and 90th quantiles.

Notably, the quantile-specific intercepts $\gamma_0(\tau)$ maintain their expected monotonic pattern across all countries, ranging from large negative values at lower quantiles (representing large negative shocks) to large positive values at upper quantiles (large positive shocks), with values near zero around the median.

5.7.2 HP-Filtered Time-Varying Trend

Our second alternative employs a hybrid time-varying measure of long-run inflation that explicitly accounts for the structural transition from pre-targeting disinflation episodes to inflation targeting regimes. For the pre-IT period, we use HP-filtered trend inflation (with smoothing parameter $\lambda = 14,400$ for monthly seasonally adjusted CPI); for the post-IT period, we replace the trend component with official inflation targets (2% for Peru, 3% for Chile and Colombia).[11] This approach avoids imposing a single long-run inflation level on the entire sample-an assumption inconsistent with the high-inflation and disinflation dynamics observed prior to IT adoption.

Formally, we construct:

$$\hat{\mu}_{\pi,t} = \begin{cases} \hat{\mu}_t^{\text{Trend}}, & \text{if } t < T^c \\ \mu_c^{\text{IT}}, & \text{if } t \geq T^c \end{cases}$$

where $c \in \{\text{PER}, \text{CHL}, \text{COL}\}$ indexes the country, $\hat{\mu}_t^{\text{Trend}}$ denotes HP-based trend inflation, T^c represents the IT adoption date (December 2001 for Peru, October 1999 for Chile and Colombia), and μ_c^{IT} corresponds to the official inflation target. The deviation variable becomes $z_t = \pi_t - \hat{\mu}_{\pi,t}$. Table 8 presents the QAR results using this hybrid measure.

The QKS test strongly rejects the global unit root hypothesis at the 1% level for all three countries (Peru: 7.253, Chile: 7.627, Colombia: 4.441), confirming that inflation exhibits global mean reversion even when the steady state is allowed to evolve over time to reflect the structural transition from high inflation to inflation targeting regimes.

Notably, this specification reveals substantially stronger mean reversion compared to both our baseline and the sample mean approach, particularly for Peru and Colombia. For Peru, the unit root hypothesis is now rejected at conventional significance levels across all quantiles: autoregressive coefficients range from 0.519 at the 10th quantile to 0.683 at the 90th quantile, all statistically significant at 1% or 5% levels. Critically, the asymmetric persistence pattern remains robust under this specification.

Negative inflation deviations (10th quantile: $\gamma_1(0.1) = 0.519$, HL=1.06 months) dissipate substantially faster than positive deviations (90th quantile: $\gamma_1(0.9) = 0.683$, HL=1.82 months), with positive shocks taking approximately 70% longer to revert to equilibrium. The monotonic increase in autoregressive coefficients across quantiles-from 0.519 through 0.576 at the median to 0.683 at the 90th percentile-demonstrates that adjustment speeds systematically vary with both the sign and magnitude of inflation shocks.

For Chile, the critical quantile shifts to the 90th percentile ($\gamma_1(0.9) = 0.847$, not significant), with strong rejection of unit roots through the 80th quantile ($\gamma_1(0.9) = 0.751$, significant at 10%). This represents a modest upward shift from our baseline (70th quantile), though the fundamental asymmetry persists: half-lives

[11] The resulting trend price index is converted into annualized monthly inflation as

$$\hat{\mu}_t^{\text{Trend}} = 1200 \left(\frac{IPC_t^{\text{Trend}}}{IPC_{t-1}^{\text{Trend}}} - 1 \right),$$

where IPC_t^{Trend} denotes the HP-filtered trend CPI.

increase monotonically from 0.74 months at the 10th quantile to 4.18 months at the 90th quantile.

For Colombia, the HP-hybrid specification reveals an interesting non-monotonic pattern that differs from Peru and Chile. While the unit root hypothesis is rejected at all quantiles (all coefficients significant at conventional levels), the autoregressive coefficients exhibit an inverted-U shape: $\gamma_1(\tau)$ increases from 0.711 at the 10th quantile to a peak of 0.844 at the 50th quantile, then declines to 0.758 at the 90th quantile. Correspondingly, half-lives increase from 2.03 months (10th) to 4.08 months (50th-60th), then decrease to 2.50 months (90th).

This pattern suggests that extreme positive inflation deviations (90th quantile) revert to equilibrium more rapidly than moderate positive deviations (50th-60th quantiles) in Colombia. Several factors may explain this distinctive dynamics. First, truly extreme inflation spikes may trigger more aggressive policy responses from Colombia's central bank, accelerating mean reversion. Second, extreme deviations may more often reflect temporary supply shocks (food, energy) that dissipate naturally, while moderate positive deviations may reflect more persistent demand-driven or expectations-driven pressures. Third, Colombia's inflation history-characterized by sustained moderate-high inflation throughout much of the 1990s rather than discrete extreme spikes-may be reflected in the HP-hybrid trend, with moderate positive deviations representing the most persistent feature of the transition period.

Importantly, while Colombia's extreme positive shocks revert faster than its own moderate positive shocks, Colombia still exhibits slower mean reversion than Peru across all quantiles. Peru's maximum half-life (1.84 months at 80th quantile) is less than half of Colombia's maximum (4.08 months at 50th quantile), indicating that Peru's inflation dynamics exhibit uniformly stronger mean reversion under the HP-hybrid specification. This cross-country difference likely reflects the distinct nature of their inflation transitions: Peru's dramatic shift from hyperinflation to stability versus Colombia's more gradual descent from sustained moderate-high inflation.

Nevertheless, the core asymmetry persists even in Colombia's non-monotonic pattern: negative deviations (10th quantile, HL = 2.03 months) dissipate more rapidly than positive deviations of any magnitude (minimum positive HL = 2.50 months at 90th, maximum = 4.08 months at 50th). This confirms that the fundamental asymmetric adjustment mechanism—where positive shocks exhibit greater persistence than negative shocks—remains present even when the relationship between shock magnitude and persistence is more complex.

The methodological robustness analysis confirms our central finding: asymmetric inflation persistence is a fundamental feature of inflation dynamics in Chile, Colombia, and Peru. Across all steady-state definitions—policy targets (baseline), sample means, and HP-hybrid time-varying measures—negative inflation shocks consistently dissipate more rapidly than positive shocks of comparable magnitude. This pattern persists even when overall persistence declines substantially (as under the HP-hybrid specification where Peru and Colombia become stationary at all quantiles), demonstrating that the asymmetry reflects deep structural characteristics of inflation adjustment rather than artifacts of steady-state specification.

Table 8: *Quantile Unit Root Tests Using HP-Filtered Trend (Pre-IT) and Inflation Targets (Post-IT)*

Country	τ	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Peru	$\gamma_0(\tau)$	-4.075*	-2.580*	-1.606*	-0.284	0.285	0.949*	1.664*	2.938*	4.867*
	$\gamma_1(\tau)$	0.519*	0.582*	0.592*	0.567*	0.576*	0.591*	0.598*	0.686*	0.683**
	HLs	1.055	1.279	1.321	1.221	1.258	1.317	1.349	1.836	1.820
	QKS	7.253*								
Chile	$\gamma_0(\tau)$	-4.143*	-2.732*	-1.558*	-0.753*	0.172	0.945*	1.797*	3.339*	4.681*
	$\gamma_1(\tau)$	0.391*	0.414*	0.367*	0.487*	0.523*	0.703*	0.739**	0.751***	0.847
	HLs	0.739	0.786	0.691	0.965	1.070	1.964	2.294	2.420	4.184
	QKS	7.627*								
Colombia	$\gamma_0(\tau)$	-2.491*	-1.515*	-0.784*	-0.374**	0.320	0.894*	1.408*	2.165*	3.445*
	$\gamma_1(\tau)$	0.711*	0.774*	0.778*	0.833**	0.844**	0.828*	0.833**	0.821**	0.758***
	HLs	2.034	2.702	2.767	3.795	4.080	3.666	3.783	3.518	2.504
	QKS	4.441*								

Notes: This specification conducts the quantile analysis using long-run inflation that is constructed using a hybrid measure that applies HP-based trend inflation prior to the adoption of inflation targeting and the official inflation targets thereafter.
* Significant at 1% level.
** Significant at 5% level.
*** Significant at 10% level.

Combined with the structural robustness demonstrated in Sections 5.3-5.5—where asymmetric patterns persist across different structural break specifications (IT adoption, multiple Bai-Perron breaks) and in independent cross-country validation (Brazil)—these findings provide compelling evidence that positive and negative inflation shocks follow fundamentally different adjustment dynamics in Latin American inflation-targeting economies. This multidimensional robustness supports our interpretation in Section 5.6 that the asymmetry reflects structural features including expectations formation shaped by inflation history, asymmetric indexation mechanisms, commodity price dynamics, and differential monetary policy transmission.

6. Conclusions

This paper investigated inflation dynamics in Peru, Chile, and Colombia using quantile autoregression analysis. This methodology revealed important asymmetries in inflation adjustment mechanisms depending on shock magnitude and direction.

We found robust evidence that both sign and magnitude of shocks significantly affect inflation's adjustment speed to long-term equilibrium. Negative inflation shocks revert rapidly to the mean, while positive shocks demonstrate considerably more persistence. The unit root hypothesis cannot be rejected at and above the 60th, 70th, and 80th quantiles for Colombia, Chile, and Peru respectively, indicating that high-inflation episodes persist while negative deviations dissipate rapidly. This asymmetric pattern is consistent across all model specifications, confirming it is a fundamental feature of inflation dynamics rather than an artifact of model specification.

Inflation persistence has declined substantially following a comprehensive process of macroeconomic stabilization across all three economies, though careful interpretation requires acknowledging important nuances revealed by our structural break analysis. The Bai and Perron (2003) procedure does not identify discrete breaks at the exact dates of formal IT adoption for any country. Instead, detected breaks correspond to pre-IT stabilization episodes (Peru's 1995 post-hyperinflation consolidation, Chile's 1996 disinflation), major external shocks (1998 Asian/Russian crises, 2008 GFC, COVID-19), and possible IT consolidation (Colombia's 2001 break). The absence of discrete breaks at IT adoption dates suggests that inflation targeting implementation was a gradual institutional process involving progressive credibility building rather than an abrupt regime shift, consistent with the inflation targeting literature.

These findings have important implications for monetary authorities:

- **Asymmetric Monetary Policy Response**: Central banks should respond more aggressively to above-target inflation given positive shocks' greater persistence. This asymmetric reaction function could help counterbalance the natural asymmetry in inflation dynamics.
- **Pre-emptive Policy Action**: Strong persistence of positive inflation shocks suggests central banks should act pre-emptively when early inflationary pressure emerges. However, our robustness analysis demonstrates that even large positive shocks exhibit mean reversion under credible frameworks, though adjustment may require sustained policy effort.
- **Risk Assessment Framework**: Monetary policy committees should incorporate asymmetric dynamics into risk assessment, emphasizing upside inflation risks given their persistent nature.
- **Communication**: Clear communication about asymmetric dynamics—explaining why central banks respond more forcefully to positive inflation shocks—enhances credibility and helps anchor expectations during inflationary episodes.

Critically, the asymmetric persistence pattern remains robust across all model specifications—from no breaks through single IT break to multiple breaks—indicating this is a fundamental characteristic of inflation dynamics rather than an artifact of regime specification. This robustness strengthens the case for asymmetric policy responses.

The recent post-COVID inflationary episode underscores these findings' practical importance. All three countries experienced inflation increases that proved more persistent than initially anticipated, consistent with our results on asymmetric persistence. However, by late 2024, inflation largely returned to target ranges (Peru notably achieving exactly 2.0% by December 2024), demonstrating the fundamental stationarity documented in our multiple-break analysis.

Our findings highlight the importance of considering asymmetric inflation dynamics when formulating monetary policy. The progressive reduction in persistence across model specifications—combined with the fundamental stationarity revealed when all regime transitions are controlled—demonstrates that comprehensive macroeconomic stabilization has fundamentally transformed inflation dynamics in these Latin American economies compared to the high-inflation episodes of the early 1990s. While we cannot decompose individual contributions of monetary frameworks, crisis management improvements, and institutional development, their combined effect successfully anchored inflation expectations and reduced persistence while maintaining the fundamental asymmetric adjustment pattern.

Future research could examine whether these asymmetric patterns exist in other emerging economies with different monetary frameworks, investigate the microeconomic foundations of asymmetric adjustment, and assess whether accounting for asymmetric dynamics improves inflation forecasting accuracy. Such research could provide additional policy guidance for economies pursuing macroeconomic stabilization.

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A. Appendix

Table A.1: *Moving window analysis taking as starting point Jan 1992*

Sample	**Peru**		**Colombia**		**Chile**	
Jan92 -	DF−GLS	MZa−GLS	DF−GLS	MZa−GLS	DF−GLS	MZa−GLS
Dec-2019	0.63	0.01	0.52	0.51	-0.36	-0.58
Jun-2020	0.67	0.13	0.73	0.76	-0.28	-0.33
Dec-2020	0.62	0.08	0.62	0.39	-0.34	-0.77
Jun-2021	0.54	-0.17	0.46	0.41	-0.39	-0.51
Dec-2021	0.42	-0.21	0.22	0.09	-0.63	-1.03
Jun-2022	0.34	-0.39	-0.13	-0.10	-0.79	-1.25
Dec-2022	0.45	-0.22	-0.23	-0.27	-0.77	-1.08
Jun-2023	0.58	0.04	-0.11	-0.01	-0.63	-0.84
Dec-2023	0.64	-0.10	-0.01	0.13	-0.57	-0.43

Note: The Modified Akaike Information Criterion (MAIC) is used to determine the optimal number of lags in both tests. The data samples begin in January 1992, with the initial column representing the end date of each sample.
* Significant at 1% level.
** Significant at 5% level.
*** Significant at 10% level.

Table A.2: *Moving window analysis taking as starting point the implementation of the inflation targeting scheme for each country*

Sample	**Peru**		**Colombia**		**Chile**	
IFT -	DF−GLS	MZa−GLS	DF−GLS	MZa−GLS	DF−GLS	MZa−GLS
Dec-2019	-1.56	-0.42	-1.76*	-2.46	-3.68***	-16.74***
Jun-2020	-1.51	-0.65	-1.47	-1.26	-3.73***	-17.35***
Dec-2020	-1.20	-0.57	-1.63*	-2.88	-3.80***	-17.18***
Jun-2021	-1.32	0.57	-1.87*	-3.17	-3.84***	-17.84***
Dec-2021	-1.53	0.52	-3.23***	-7.81*	-3.40***	-13.55**
Jun-2022	-0.02	1.90	-2.62***	-8.22**	-2.26**	-7.33*
Dec-2022	-1.81*	0.36	-2.05**	-6.30*	-2.50**	-8.40**
Jun-2023	-2.00**	-0.88	-2.64***	-8.35**	-3.24***	-11.79**
Dec-2023	-0.85	-1.10	-2.78***	-8.54**	-3.25***	-11.07**

Note: IFT denotes the beginning of the inflation targeting regime for each country. The Modified Akaike Information Criterion (MAIC) is used to determine the optimal number of lags in both tests. The data samples begin in January 2002, with the initial column representing the end date of each sample.
* Significant at 1% level.
** Significant at 5% level.
*** Significant at 10% level.