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ANCHORING INFLATION EXPECTATIONS IN SELECTED ASIAN COUNTRIES: THE ROLE OF MONETARY POLICY CREDIBILITY

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ABSTRACT

Inflation targeting has become a widespread monetary policy framework in many developing countries, and this approach to achieving its goals depends on the level of trust in the central bank. As the central bank's credibility grows, it gains a greater ability to shape the public's expectations regarding inflation. The public adjusts their expectations about future inflation based on the central bank's declared targets. Still, this adjustment depends on their belief in the central bank's capacity to achieve those objectives. Credibility plays a crucial role in disconnecting these expectations from past trends, enabling them to be formed in a forward-looking manner. This study aims to examine the credibility of monetary policy and inflation in the case of selected South Asian countries like Pakistan, India, Sri Lanka, and Bangladesh. The quarterly data are used from 1990Q1 to 2021Q4, but it little bit varies from country to country. The Credibility Index (CI) is used to measure the credibility of monetary policy. The Quantile Regression (QR) is employed to test the impact of monetary policy credibility on inflation. The results indicate that all the variables are stationary at the same level and have dynamic correlations across quartiles and countries. The results from the regression analysis show that the credibility of monetary policy has a negative impact on the inflation rate. This research enhances the understanding of the vital link between credibility and monetary policy effectiveness in developing economies.

Keywords: Credibility index; Time inconsistency; Nominal anchor; Quantile regression.

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INTRODUCTION

The debate about whether rules or discretion should guide monetary policy has been around for about two hundred years (Bofinger et al., 2001; Schwartz, 2009). This discussion revolves around a fundamental question: Should a central bank actively employ tools to stabilize the economy (Elsayed et al., 2023; Telatar, 2002)? The difference is that discretion means being flexible and taking proactive actions (Barro & Gordon, 1983; Barro, 1986), while policy rules limit the flexibility of central banks. Having discretion lets monetary policy react to economic changes, but it also comes with the risk of mistakes and the "time inconsistency" problem (Belke & Polleit, 2010). This problem suggests that even if a central bank tries its best to boost the economy, the outcome might be worse than with a rule-based approach. Before the 1970s, policymakers and economists mostly supported active monetary policies to boost production and reduce unemployment. The evolution was triggered by factors such as recognizing the prolonged and unpredictable impact of monetary policy on the economy (Friedman, 1968), theories dispersing the notion of a direct trade-off between inflation and unemployment (long-term Phillips curve), the challenge of time inconsistency, and the substantial costs linked with inflation. The shift in monetary policy dynamics from active strategies to prioritizing price stability has led to a combination of discretion and structured planning in modern central bank approaches. To ensure price stability, central banks use a "nominal

anchor," an intermediate target that restricts unplanned policy expansions. This approach involves employing tools to influence the intermediate target while aiming for the ultimate goal of price stability, even though direct control over inflation is limited. Different strategies using nominal anchors include monetary targeting, exchange rate targeting, and inflation targeting. Monetary targeting, focused on controlling the money supply, faced challenges as its relationship with inflation weakened due to financial changes. Exchange rate targeting comes with downsides like loss of independent monetary policy and susceptibility to speculative attacks, impacting various economic aspects. Inflation targeting, started by the Central Bank of New Zealand in 1990, sets a numerical inflation target over the medium term. In this strategy, the central bank's intermediate target becomes the public's inflation expectations, as influencing future inflation is more feasible than immediate control. Transparent communication is vital for success. Well-anchored expectations, closely matching the target, indicate effective policy. Credible central bank objectives reduce the responsiveness of inflation expectations to new data, fostering stability, while unanchored expectations correlate strongly with recent information and past inflation rates.

The current body of research on the anchoring of inflation expectations in Turkey is notably limited. This inquiry categorizes these studies into three distinct groups. The initial cluster of studies proposes that inflation expectations lack robust anchoring in specific Asian countries. To exemplify, Baskaya et al. (2008) employ the rolling regression method to analyze data covering the years 2003 to 2007. They reveal a decrease in the sensitivity of inflation expectations to the inflation target over time, alongside an increase in sensitivity to past inflation rates. As a result, their findings highlight a diminishing level of inflation expectation anchoring, particularly starting from early 2006. Cicek and Akar (2014) investigate the realm of inflation expectations by analyzing data from 2002 to 2013 using a quantile autoregression approach. They investigate the convergence of inflation expectations towards either inflation targets or past inflation rates. Their findings show that at lower quantiles, inflation expectations tend to converge toward both inflation targets and past inflation rates. However, at higher quantiles, the convergence is predominantly observed towards past inflation rates. The second set of studies reflects the evolving anchoring of inflation expectations over time. For example, Baskaya et al. (2010) study data spanning from 2003 to 2009 and emphasize the impact of revised inflation targets in June 2008. Their employment of the rolling regression method highlights that this target revision amplifies the responsiveness to inflation targets while reducing sensitivity to past inflation rates, indicating an increased level of anchoring within inflation expectations. In another investigation by Cicek et al. (2011) covering the period from 2003 to 2010, a time-varying vector autoregressive model is used. Their consistent findings suggest a significant sensitivity to inflation targets, reflecting well-anchored inflation expectations.

Baskaya et al. (2012), focusing on the years from 2006 to 2012, apply the rolling regression technique and observe a relatively stronger sensitivity to inflation targets during high-inflation periods compared to low-inflation periods. They also note a declining sensitivity to past inflation rates over time. The third category encompasses a study with divergent results across different time frames. Bulut (2018) employs the autoregressive distributed lag method, analyzing data from 2006 to 2016. The study concludes that inflation targets exert a more substantial influence on 12-month-ahead inflation expectations than past inflation rates, indicating robust anchoring. Conversely, for 24-month-ahead inflation expectations, only past inflation rates appear to contribute to sensitivity, implying a weaker anchoring effect. In a study by De Mendonca (2018) that covers four developing economies, ordinary least squares (OLS) estimations are employed to investigate the relationship between credibility and inflation expectations. The main finding of the study emphasizes that relying solely on an inflation-focused strategy is insufficient for maintaining stable inflation expectations. Furthermore, the results suggest that lower credibility levels lead to a prevailing tendency toward backward-looking behaviour in shaping inflation expectations. Patnaik (2023) found that the credibility of the central bank has been improved after considering the flexible target inflation. Also, conclude that the expectations of inflation rate have been anchored by the central bank policy. Further, the study by Bicchal (2022) identified the asymmetric credibility of the central bank

contained a negative impact with the volatility of inflation, output volatility, volatility of interest rate, and macroeconomics volatility. De Mendonca and Trigo (2023) also checked the effect of the credibility of the central bank on the Brazilian poor class and found that credibility is the source of reducing the inflation pressure on poor society. Baker and Lam (2022) used the VAR estimation methodology and found that the negative behaviour of central bank credibility boosts the expectation of inflation both in the short and long run.

This study aims to empirically explore the extent of credibility's impact on anchoring inflation targets across four selected South Asian economies. The literature review is presented in the second section. Additionally, this study seeks to highlight the utility of employing the quantile regression approach for data analysis and to demonstrate their effectiveness as alternatives to ordinary least squares. The third section constructs a time-varying credibility index for selected Asian economies. Empirical findings concerning the substantial influence of credibility on managing inflation expectations and the type of credibility linked to inflation goals that aid in anchoring inflation expectations are detailed in section four. The conclusion and policy recommendations are outlined in section five, while the final section encompasses the appendices.

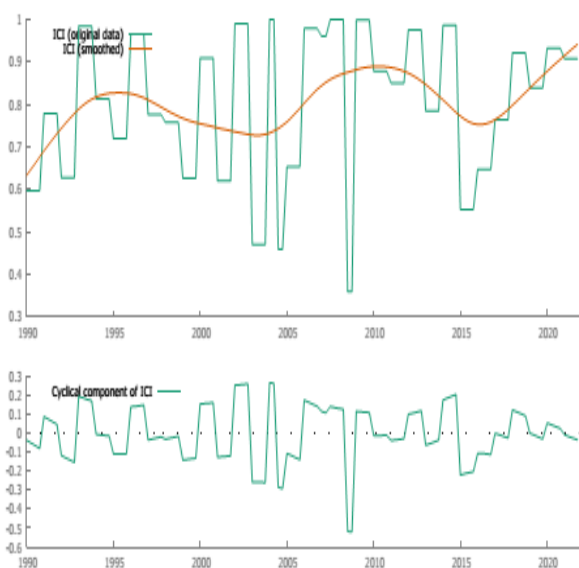
METHODOLOGY

Quantifying the Credibility of Monetary Policy

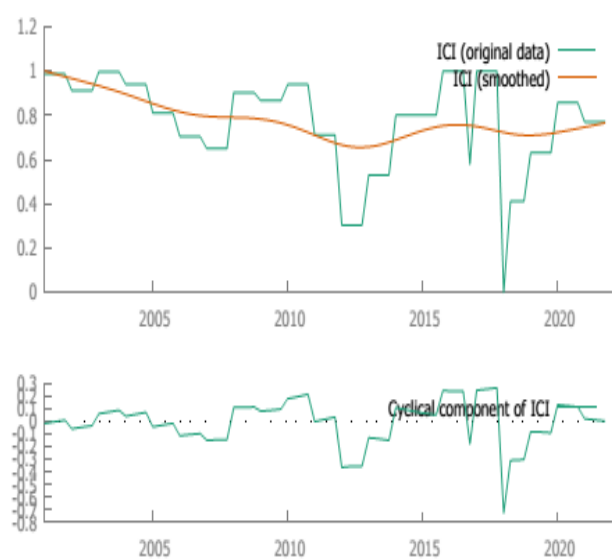
Utilizing the subsequent framework, Valentin and Rozalia (2008) present an approach for assessing the credibility of monetary policy:

$$CBCI = \begin{cases} 1 & \text{if } E[\pi] = \pi_t^T \\ 1 - \frac{|\pi^e - \pi^{\text{target}}|}{\pi^{\text{target}}}, & \text{if } |\pi^e - \pi^{\text{target}}| < \pi^{\text{target}} \\ 0 & |\pi^e - \pi^{\text{target}}| > \pi^{\text{target}} \end{cases} \quad (1)$$

In the given equation, π^e symbolizes the private sector's inflation expectations and π^{target} denotes the inflation target established by the central bank. For instance, if inflation expectations are securely anchored and precisely aligned with the target ($\pi^e = \pi^{\text{target}}$), the outcome of the equation would yield a substantial index signifying full credibility. Conversely, the credibility index would be zero, indicating no credibility, if inflation expectations significantly exceed the inflation target, exceeding it by more than twice. It's worth noting that this methodology employs a "symmetric punishment" approach. Country-wise representation of the credibility index is explained in the following Figure 1.



Pakistan Credibility Index



India Credibility Index

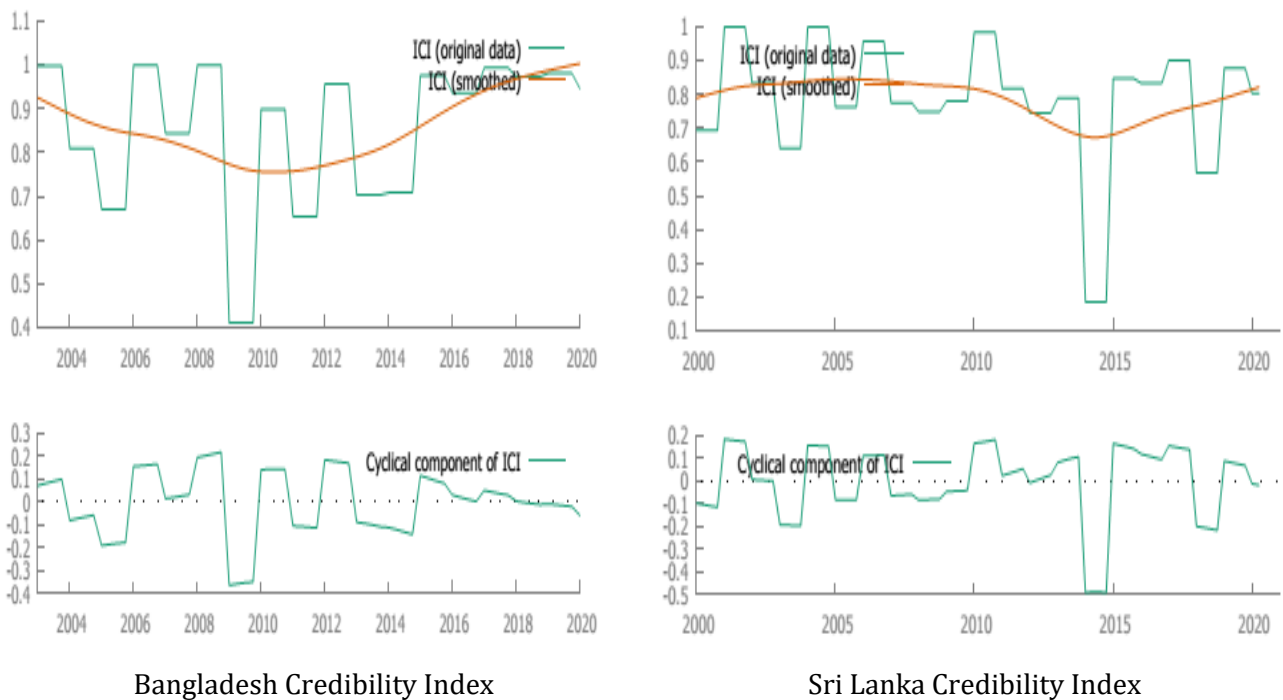


Figure 1. Country wise credibility index and cyclical component.

Materials and Research Techniques

As getting inflationary expectations nearer to the target is the fundamental principle of inflation targeting, high credibility makes aims simpler to achieve by increasing inflation expectations' anchoring power (Cukierman & Meltzer, 1986). To put it another way, more inflation targets than previous inflation rates provide the information needed to predict inflation expectations. To clarify if credibility is related to inflation expectations, several modifications to De Mendonca's (2018) version of Eq. (1) have been used to establish the OLS method and the wavelet-quantile regression model.

$$E_t(\pi_{t+q}) = \text{cred}_q \times \text{target}_{t+q} + (1 - \text{cred}_q) \times (\alpha_1 \text{inf}_{t-1} + \dots + \alpha_i \text{inf}_{t-q}) \quad (2)$$

In above equation $E_t(\pi_{t+q})$ is the inflation expectations for $t+q$, cred_q is the credibility of the first quarter ($q1$) that is used as the weight with $t+q$ in advance of target inflation (target_{t+q}), $(1 - \text{cred}_q)$ is likewise the weight assigned to past inflation and $(\alpha_1 \text{inf}_{t-1} + \dots + \alpha_i \text{inf}_{t-q})$ indicates inflation of previous quarters.

Equation 1 is used for this simple reason. The degree of credibility is used in the version to calculate the weight of the inflation target. The weight of inflation targets will rise, and the weight of past inflation rates will fall as credibility increases in the creation of inflation expectations.

Three separate requirements are present in this instance:

- The weight of past inflation rates in the equation is zero, even though credibility is complete ($\text{cred}=1$), meaning that inflation expectations are completely anchored to the targeted inflation.
- When credibility is low ($\text{cred}=0$), the inflation target has no impact on inflation expectations.
- The inflation expectations are then adjusted to take into consideration both the target inflation and the past inflation rates in the case of a positive credibility level.

According to this concept, the inflation target's weight in determining inflation expectations is credibility, while the weight of past inflation rates is lack of credibility (De Mendonca, 2018). For all the variables of

each country, a further Unit root has been maintained. The Dickey-Fuller test (DF) and Phillips-Perron test with constant, constant, and trend were employed in the investigation, and descriptive statistics were also taken into account. The models of the study look at are as follows:

The credibility impact on inflation expectations associated with the following is considered in the first form:

$$E(\pi) = \alpha_0 + \alpha_1 \text{ cred} + \varepsilon \quad (3)$$

The second model is as follows: It evaluates whether the strongest announcement of an inflation target is sufficient to anchor inflation expectations while ignoring the credibility impact.

$$E(\pi) = \beta_0 \text{ inf} + \beta_1 \text{ target} + \epsilon \quad (4)$$

The third model enables us to test if improving the model's validity (Equation 3) restores the forecasted performance of inflation expectations using the changed coefficient of determination (Adjusted R2).

$$E(\pi) = \gamma_0 \text{ inf} + \gamma_1 \text{ target} + \gamma_2 \text{ cred} + \xi \quad (5)$$

The fourth and final model lets us determine if giving inflation targets credibility will boost the interaction term (target*cred) that determines how well inflation expectations are anchored.

$$(\pi) = \rho_0 \text{ inf} + \gamma_1 \text{ target} + \rho_1 (\text{target} * \text{cred}) + \varsigma \quad (6)$$

Method of quantile regression

Quantile regression is a form of regression approach that requires a quantitative variable to be the forecasted variable and takes any kind of predictor variable. Koenker and Bassett's Quantile Regression offers an alternative to traditional least squares regression. We can identify different marginal responses of the dependent variable to changes in the explanatory factors at these locations by estimating conditional quantiles at various points of the dependent variable's distribution. Given is the quantile regression model:

$$Q_{y_i|x_1}(p) = \beta_0^{(q)} + \beta_1^{(q)} x_i + \varepsilon_i^{(q)} \quad (7)$$

The conditional quantiles of the response/dependent variables (denoted as q) given predictor/independent variables (denoted as xi) are estimated using a quantile regression model, which is shown mathematically in the above equation. $Q_{y_i|x_1}(p)$ represents the conditional quantile of the response variables y_i given the predictor/independent variables x_i at a specific quantile level (p). $\beta_0^{(q)}$ and $\beta_1^{(q)}$ are the coefficients associated with the intercept (β_0) and the predictor variable (β_1), respectively, at the specific quantile level (q). These coefficients represent the expected change in the quantile of the response variable corresponding to a one-unit change in the predictor variable. $\varepsilon_i^{(q)}$ represents the error term or the residual for the i th observation at the specific quantile level (q). It captures the unexplained variation in the response variables that are not captured by the predictor variables.

The goal of quantile regression is to estimate the values of $\beta_0^{(q)}$ and $\beta_1^{(q)}$ that minimize a specific loss function, typically the absolute deviation, for each quantile level q. The optimization process finds the coefficients that best fit the conditional quantiles to the observed data, considering the specific quantile level of interest.

Given is the matrix form as:

$$y_i = x_i' \beta_q + \varepsilon_{iq} \quad (8)$$

$$\text{with } Quant_q(x_i|y_i) = x_i' \beta_q$$

Here, the dependent variable is y, the vector of regressors is x, the vector of estimated parameters is β , and the vector of residuals is ε_i . $Quant_q(x_i|y_i)$ denotes the q^{th} regression quantile, and $0 < q < 1$ the solution to the following issue is;

$$Q(\beta_q) = \min_{\beta} \sum_{i=1}^n [|y_i - x_i \beta_q|] = \min [\sum_{i: y_i \geq x_i \beta} q |y_i - x_i \beta_q| + \sum_{i: y_i < x_i \beta} (1 - q) |y_i - x_i \beta_q|] \quad (9)$$

With n independent variables, the straightforward quantile model is:

$$Q_{y_i|x_1}(q) = \beta_0^{(q)} + \beta_1^{(q)} x_i + \dots + \beta_n^{(q)} x_n \quad (10)$$

Pseudo R2 Goodness of Fit

The Pseudo R² can be used to forecast the following indicators of the model's goodness of fit:

$$\text{Pseudo R}^2 = 1 - \frac{RAWS_q}{T_pASW_q} \quad (11)$$

$$RAWS_q = \sum_{y_i \geq \hat{\beta}_0(q) + \hat{\beta}_1(q)x_i + \dots + \hat{\beta}_n(q)x_n} q |y_i - \hat{\beta}_0(q) - \hat{\beta}_1(q)x_i - \dots - \hat{\beta}_n(q)x_n| \\ + \sum_{y_i < \hat{\beta}_0(q) + \hat{\beta}_1(q)x_i + \dots + \hat{\beta}_n(q)x_n} (1 - q) |y_i - \hat{\beta}_0(q) - \hat{\beta}_1(q)x_i - \dots - \hat{\beta}_n(q)x_n| \quad (12)$$

$$TASW_q = \sum_{y_i \geq q} q |y_i - \hat{q}| + \sum_{y_i < q} (1 - q) |y_i - \hat{q}| \quad (13)$$

The Pseudo R² will fall between 0 and 1 since the RAWS_q (Residual Absolute Sum of Weighted) value is always lower than the TASW_q (Total Absolute Sum of Weighted) value. The RASW provides a measure of the absolute discrepancy between observed and predicted values in regression models, incorporating weighting to account for the relative importance of different observations. The model will perform better the closer the Pseudo R² value is to one. Although Pseudo R² characteristics cannot be used to evaluate the model's overall goodness of fit, they can be used to evaluate the merits of the chosen quantile.

Data and Data Ranges

Data given below in Table 1 on the forecast and target inflation collected from different sources namely the Annual Plan of the Planning Commission of Pakistan, Sri Lanka annual reports /press release inflation by the IMF executive board, the Asian Development Bank data library, International Financial Statistics by the IMF and five-year plans of Bangladesh. The linear interpolation method can be used to produce all series and transform, putting the annual target inflation into the quarter. The inflation targets and credibility variables can be multiplied to yield the interaction term. Logarithms are used to express every variable.

Table 1. Sample countries and data ranges.

Countries	Date Range
Pakistan	1990q1 to 2021 q4
India	2000q1 to 2021q4
Sri Lanka	2000q1 to 2021q2
Bangladesh	2003q1 to 2020q1

RESULTS AND DISCUSSION

The results of the Augmented Dickey-Fuller (ADF) models are explained in Table 2. All variables are stationary at a level utilizing constant, excluding the CB credibility of Pakistan in specific countries. Pakistan's target inflation is stationary in the first difference. In the context of India, the interplay between various variables reveals a dynamic pattern of positive and negative correlations across different quantiles. This phenomenon is evident in models 1-4, as outlined in below Table 3. Interestingly, the impact of interaction terms on inflation forecasts seems to be largely insignificant, whereas the factor of credibility emerges as a significant driver. Shifting the focus to Pakistan, the analysis demonstrates that for model 1, credibility assumes a positive and noteworthy role within the 25th to 50th quantiles, underscored by its statistical significance. Surprisingly, in the 0.75 quantile, credibility's impact remains substantial but displays an intriguing negative sign, as detailed in Table 3. Additionally, when examining models 2-4, there exists a mixture of outcomes, indicating a complex relationship. In the context of Bangladesh, intriguing patterns emerge. Notably, the 50th to 75th quantiles in the initial model exhibit limited influence of credibility on forecasting inflation. However, the interaction term takes on a pivotal role, demonstrating a consistent and significant positive impact across all quantiles. Turning attention to Sri Lanka, the relationship of variables reveals interesting insights. The credibility factor, closely linked to the model's first expected inflation, experiences a positive and significant influence within the 25th to 75th quantiles. During this range, the interaction term demonstrates statistically significant differences, contributing to the nuanced dynamics at play. The findings emphasize the need for a comprehensive understanding of these dynamics to make informed policy decisions individually. Regression coefficients are produced by the estimation of a model with changing coefficients and change with time.

Table 2. Unit root test results.

Countries	Variable	At Level	Conclusion
Pakistan	cred	0.17	variables are stationary at the level
	E(π)	0.28	
	inf	0.22	
	Target	0.22	
India	cred	0.14	variables are stationary at the level
	E(π)	0.57	
	inf	0.46	
	Target	0.22	
Sri Lanka	cred	0.26	variables are stationary at the level
	E(π)	0.14	
	inf	0.62	
	Target	0.2	
Bangladesh	cred	0.33	variables are stationary at the level
	E(π)	0.11	
	inf	0.87	
	Target	0.22	

Note: *, ** and *** shows %10, %5 and 1% statistical significance level, respectively. Cred is central bank credibility, E(π) is the forecasted inflation rate, inf is actual inflation, and the target is the target inflation rate.

Table 3. Quantile regression estimation results of inflation expectations.

Countries	Credibility Effect Model (1)				Model without Credibility (2)			
	$E(\pi) = \alpha_0 + \alpha_1 \text{cred}$				$E(\pi) = \beta_0 + \beta_1 \text{target} + \epsilon$			
	Coefficients	0.25 Quantile	0.50 Quantile	0.75Quantile	Coefficients	0.25 Quantile	0.50 Quantile	0.75Quantile
Pakistan	α_0	2.64***	1.27	-0.57**	β_0	1.15***	1.06***	0.92***
	α_1	-0.55**	1	2.96***	β_1	-0.08	-0.12	0.017
	Pseudo R2	0.22	0.007	0.045	Pseudo R2	0.72	0.67	0.61
India	α_0	-1.3	-1.38***	-1.006*	β_0	0.61***	0.71***	0.69***
	α_1	2.68***	2.77***	2.65***	β_1	-0.33	0.17	-0.028
	Pseudo R2	0.07	0.18	0.07	Pseudo R2	0.37	0.42	0.49
Sri Lanka	α_0	2.02***	2.55***	0.61***	β_0	0.67***	0.82***	0.84***
	α_1	-0.07	-0.17	1.95	β_1	-0.17	0.43*	0.17
	Pseudo R2	0.32	0.14	0.031	Pseudo R2	0.36	0.46	0.4
Bangladesh	α_0	1.48*	-0.18	1.38	β_0	1.06***	1.11***	1.68***
	α_1	0.29	1.96**	1.11	β_1	0.13	0.091	-0.45
	Pseudo R2	0.02	0.01	0.04	Pseudo R2	0.29	0.44	0.45
Model with Credibility (3)					Model with Interaction Term (4)			
$E(\pi) = \rho_0 \text{inf} + \rho_1 \text{target} + \rho_2 \text{Cred}$					$E(\pi) = \rho_0 \text{inf} + \rho_1 \text{target} + \rho_2 (\text{target} * \text{Cred})$			
Pakistan	Coefficients	0.25 Quantile	0.50 Quantile	0.75Quantile	Coefficients	0.25 Quantile	0.50 Quantile	0.75Quantile
	ρ_0	1.14***	1.03***	0.93***	ρ_0	1.14***	1.03***	0.93***
	ρ_1	-0.09	-0.097	0.033	ρ_1	-0.11	-0.19	0.04
	ρ_2	0.102	0.19	-0.03	ρ_2	0.04	0.1	-0.017
India	Pseudo R2	0.72	0.67	0.61	Pseudo R2	0.72	0.67	0.61
	ρ_0	0.87***	0.52*	0.28	ρ_0	0.81***	0.72***	0.64*
	ρ_1	-0.19	0.22	0.66	ρ_1	-0.42***	0.12	0.56
	ρ_2	0.6	-0.66	-0.89*	ρ_2	0.33***	0.04	-0.35
Sri lanka	Pseudo R2	0.4	0.43	0.54	Pseudo R2	0.41	0.42	0.52
	ρ_0	0.51***	0.59***	0.83***	ρ_0	0.60***	0.61***	0.83***
	ρ_1	0.094	0.41**	0.13	ρ_1	-0.68***	-0.26	0.08
	ρ_2	1.64	1.37**	0.15	ρ_2	0.95***	0.69*	0.06
Bangladesh	Pseudo R2	0.54	0.5	0.4	Pseudo R2	0.54	0.49	0.4
	ρ_0	1.60***	1.56***	1.78***	ρ_0	1.53***	1.48***	1.73***
	ρ_1	-0.03	-0.28**	-0.43**	ρ_1	-0.49***	-0.65***	-0.81***
	ρ_2	1.24***	1.15***	1.17***	ρ_2	0.61***	0.60***	0.56***
Bangladesh	Pseudo R2	0.59	0.63	0.67	Pseudo R2	0.61	0.63	0.64

Note: *, ** and *** shows %10, %5 and 1% statistical significance level, respectively.

CONCLUSIONS AND RECOMMENDATIONS

This study examines the connection between inflation expectations and the effectiveness of inflation targets as stabilizing tools. The research finds that credibility plays a vital role in monetary policy. Lowering inflation expectations boosts policy credibility. When credibility is insufficient, past inflation rates largely shape expectations. However, when credibility is strong, expectations align with inflation targets. This reveals that relying solely on monetary power to set an inflation target is not enough to manage expectations, indicating a credibility gap. Weaker credibility, as seen in countries like India, results in less effective expectation adjustment. The main takeaway is that an unsupported inflation target lacks the power to anchor expectations long-term. The study focuses on four emerging economies, Pakistan, Bangladesh, India, and Sri Lanka, to analyze the impact of monetary policy credibility on inflation expectations and target anchoring. It uses Quantile Regression to expand understanding beyond conditional mean. Credibility loss makes inflation targets lose anchor status, making past rates a guide. Connecting expectations to targets can bridge credibility gaps and enhance constructive behaviour. Building credibility is challenging but crucial; commitment to targets and consistent guidelines are key. As people become more knowledgeable about policies, they are increasingly relying on them. To ensure trust in these policies, it is imperative to have open and detailed conversations that promote transparency.

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