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Examining the Impact of State Bank of Pakistan's Autonomy on Macroeconomic Stability: An Analysis of Pre-Autonomy and Post-Autonomy Periods

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ABSTRACT

The study examines the effect of the autonomy of the State Bank of Pakistan (SBP) on its macroeconomic stability by using data from 1972 to 1993 (as a pre-autonomy era) and 1994-2022 (as a post-autonomy era). The study used inflation volatility (as a proxy to measure the macroeconomic stability) as a dependent variable while the independent variables are eight different indices of central bank independence (CBI), democracy, GDP per capita, trade openness, exchange rate volatility, and interest rate. By examining the pre and post-analysis, the study concluded that during the pre-autonomy era, on average the inflation rate (price stability) was about 6%, on the other hand, in the post-autonomy era, the average inflation was about 4%. It means price stability exists in the economy after the autonomy of the SBP. Likewise, under the pre-autonomy regime, the maximum inflation rate is 15.48%. By contrast, under the post-autonomy regime, the maximum inflation rate is 14.03%, which is below the inflation rate under the pre-autonomy regime. Based on the ARDL technique, the study found that CBI, trade openness, and interest rate have a negative relationship with inflation volatility. In contrast, democracy, GDP per capita, and exchange rate volatility have a positive effect on inflation volatility. The study recommends that the government should promote higher CBI levels.

1. Introduction

The State Bank of Pakistan was established on July 1, 1948, following the enactment of the State Bank of Pakistan Order 1948. Initially, the State Bank had the responsibility of regulating the issue of bank notes and keeping reserves to safeguard monetary stability in Pakistan. The bank

was also required to supervise the country's banking and credit system. The State Bank of Pakistan Act 1956 significantly expanded the mandate of the central bank following the need to manage the newly independent state's financial and macroeconomic dynamics to advance national interests. As such, the institution was mandated to maintain the economic system by ensuring both the safety of the financial system and the most efficient use of the country's production resources. In the context of reforming the financial sector, the autonomy of the State Bank of Pakistan increased in February 1994. Its reinforcement occurred on January 21, 1997, when three Amendment Ordinances were passed, which were subsequently ratified by the Parliament in May 1997. These Ordinances amended the State Bank of Pakistan Act 1956, the Banking Companies Ordinance 1962, and the Banks Nationalization Act 1974.

The State Bank of Pakistan is the nation's central bank; it performs a critical and significant role in traditional central banking and supports the government and selected state-owned development finance institutions with financial assistance. The central bank also facilitates funds through refinancing operations to diverse financial institutions for combining purposes like backing for exports, helping small-size enterprises, and funding of high-priced locally manufacturer equipment. The SBP eventually guides the credit allocation by the setting of demanding credit calls to banks with a unique focus on the priority sectors. The functions of the SBP have extended over time and extra duties have been completed on the SBP. In the past, the Ministry of Finance and the Pakistan Banking Council SBP shared the overseeing and regulatory powers, predominantly for Nationalized Commercial Banks and DFIs until the late part of the 1990s. Also overseeing non-banking financial institutions was executed on the SBP, but currently, it has autonomous powers in partnership with the Corporate Law Authority overseeing specific parts of the NBIF sector, particularly on non-deposit-taking NBIFs. The State Bank Act faced amendments in early 1997 which increased SBP's liberty. The SBP has recently maximized its prudential regulations and is comprehensive on the safety steer of the system.

A striking aspect of contemporary macroeconomic conversations is the shift from a focus on stability versus growth to stable growth. This variation is significantly linked to the notion that high inflation is a critical barrier to a long-term economic growth path. Therefore, there has been growing research over the last few years on the effectiveness of monetary policy as a possible corrective measure in managing inflation. Money is not neutral, especially in the short to medium term, given that if monies are injected into the economy today, inflation occurs, but it may take time for that to manifest. Unfortunately, central banks are still unobtrusive in their attempts to control inflation. Indeed, in the most recent two decades, many countries have experienced global imbalances characterized by contagious effects and a global liquidity crisis similar to those encountered during the Great Depression. This indicates how dismal monetary specialists have been at recognizing the role money plays in the long term and how money may influence the actual sectors. One may wonder how an economy that is rapidly building may suddenly collapse. The response is that the interaction of people's expectations is defined as a self-fulfilling prophecy and a central banker's fallacy of composition. For instance, considerations of future economic development noticeably influence the general population's capital investment decisions and GDP Cukierman et al., 1992, Alesina and Summers, 1993; Loungani and Sheets, 1997; D' Amato et al., 2009). Additionally, developing nations find it increasingly difficult to handle higher commodity prices in general, as they also face rising import prices due to free trade and either disruption or price volatility in their primary food grain plants (Arnone et al., 2009). Furthermore, these factors, as well as a fall in power production and inability to capitalize on outcomes, as well as deficiencies in budget enforcement, all contribute

to central banks' issues in sustaining price stability (Rogoff, 1985).

In conclusion, there is a range of possible measures for central bankers in their endeavor to maintain an appropriate inflation rate that fosters economic development. Firstly, they can resort to discretionary monetary policy that entails the absence of a precise framework. However, such measures would not be sufficient to counterbalance obstacles related to varying money demand. Secondly, central banks can consider exchange rate control, which may be inefficient and dependent on import countries' policies, and presupposes sound financial and economic conditions. Thirdly, a rule-based monetary policy requiring income targeting and avoiding any dependencies on money or prices can be adopted. Additionally, central bankers may decide to focus solely on inflation via explicit inflation-targeting, which implies transparent conditional forecasting and enforces accountability. It is important to consider that there is no ideal monetary policy, and the strategies mentioned will work best in a particular country's context and under changing conditions. Achieving price stability is impossible without a sound monetary policy, favorable institutional frameworks, and commitment to responsible fiscal practice (Eijffinger and Schaling, 1993).

The study's primary research question is: what are the effects of granting autonomy to the State Bank of Pakistan (SBP) on inflation volatility, both before and after autonomy? The specific objective of the study is to evaluate the effect of granting the State Bank of Pakistan (SBP) autonomy on the volatility of inflation, both before and after that autonomy.

2. Literature Review

This section gives an overview of the previous studies on central bank autonomy and its effects on macroeconomic stability. It entails a detailed literature review of the past research done to identify the research gap of the current study. A review of the past research on inflation and CBI is shown in Table 1.

Table 1: Studies on Central Bank Independence and Inflation

Reference(s)	Country/Area	Time Period/Observation	Methodology	Main Results
Garriga and Rodriguez (2023)	Developing Nations	1980-2014	fixed effect model	The study's empirical findings demonstrated that lower inflation volatility in developing nations is directly and unconditionally correlated with legal central bank independence (CBI).
Yin et al., (2023)	Developing	1970-2019	two-way	The study found

	countries		fixed effect model and GMM technique	that gender equality had a positive and significant impact on central bank independence (CBI).
Chee-Hong (2023)	17 Asian-Pacific Region	1995-2014	feasible generalized least squares (FGLS)	The findings of the FGLS indicated a favorable correlation between CBI and the expansion of the financial market.
Strong (2021)	Africa	1980-2009	GMM	The study found that a higher turnover rate (TOR) leads to a higher inflation rate.
Garriga and Rodriguez (2020)	Developing Countries	1980-2013	Panel Regressions	The study found that higher central bank independence (CBI) was associated with a lower inflation rate.
Lim (2021)	147 Developing countries	1970-2022	2SLS	The findings of the study indicated that central bank independence is negatively correlated with inflation.
Kokoszczyński and Mackiewicz- Łyziak (2019)	51 countries (24 advanced and 27 non-advanced)	1992-2012	Arellano-Bond difference generalized method of moments	According to the findings, the CBI significantly and negatively affects inflation,

			estimator and the panel fixed effects model	especially in less developed nations.
Klomp and Haan (2010)	100 Countries	1980-2005	applied random coefficient model	The study found an insignificant negative relationship between central bank independence (CBI) and inflation.
Carlstrom and Fuerst (2009)	Developing nations	1988-2000	Pooled Regression	found a negative relationship between central bank independence and inflation.
Jácome and Vázquez (2008)	Latin-America and Caribbean	1985-2002	Panel Regressions	The study found a negative relationship between central bank independence (CBI) and inflation.
Brumm (2006)	Developing countries	1973-1994	OLS	The findings of the study indicated that there is a strong and positive relationship between central bank independence (CBI) and inflation.
Jácome and Vázquez (2005)	Latin-America and Caribbean	1990-2002	Panel Regressions	The study found a negative relationship between central bank

				independence (CBI) and inflation.
Jácome (2001)	Latin-America	1999-2001	Panel Regressions	The study found a moderate and negative relationship between central bank independence and inflation.

The lack of research on the dynamics of the relationship between Central Bank Independence and its repercussions on the macroeconomic stability of Pakistan raises an important gap in the existing literature. Although several studies have looked into the issue in different countries and regions, there has been a lack of comprehensive reporting on how CBI affects macroeconomic stability from the lens of Pakistan. It is particularly considerable given the unique political and economic circumstances in Pakistan, as it faces severe economic challenges. Addressing this empirical facet is of vital importance for policymakers, considering the country's highly volatile inflation, fluctuating currency exchange rate, and fiscal disparity. As a result, a thorough investigation into the CBI's impact on macroeconomic stability would not only be informative in its findings but also will be another step to improve the understanding of how CBI influences the economic stability of various economies.

3. Model Specification and Research Methodology

After the data and measures have been chosen, the next step is to find or select the appropriate technique to find the results. The current study will organize the analysis in two stages. In the first stage, we applied preliminary analysis to analyze the pre and post-autonomy impact of the State Bank of Pakistan on macroeconomic stability. In the second stage, we would utilize the Auto Regressive Distributive Lag (ARDL) technique to analyze the impact of central bank independence on inflation volatility.

3.1. Preliminary Analysis

In the preliminary analysis, we use average, maximum, and minimum values and graphical analysis to examine the impact of pre and post-autonomy on macroeconomic stability.

3.2. Econometric Analysis of the Determinants of Inflation Volatility

In the second stage, we would do the econometric analysis to determine the impact of central bank independence on inflation volatility by using the Auto Regressive Distributive Lag (ARDL) model. To investigate the effect of central bank independence on inflation volatility, the following model has been developed.

$$Infvol = f(CBI_i, DEM, GDPPC, TRADE, ERVOL, INT) \quad \textbf{(1)}$$

Where i=1, 2,3,4,5,6,7,8

CBI_1 = is the new index, known as CBI-extended, gives details on 42 central bank institutional

design criteria spread over six dimensions: (1) Governor and Board of the Central Bank; (2) Monetary Policy and Resolution of Conflicts; (3) Goals; (4) Restrictions on Government Lending; (5) Financial Independence; and (6) Reporting and Disclosure.

CBI_2 =is the CBI index (CBIBoard), which bases independence on the governor and central bank board.

CBI_3 = is the CBI index (CBIPolicy), which bases independence on monetary policy and dispute resolution.

CBI_4 =is the CBI index (CBIReport), which bases independence on reporting and disclosure,

CBI_5 =is the CBI indicator (GMT) suggested by Gilli et al. (1991).

CBI_6 =is the CBI indicator (LVAU) suggested by Cukierman et al. (1992).

CBI_7 = is the CBI index (LVAW) proposed by Cukierman et al.'s (1992).

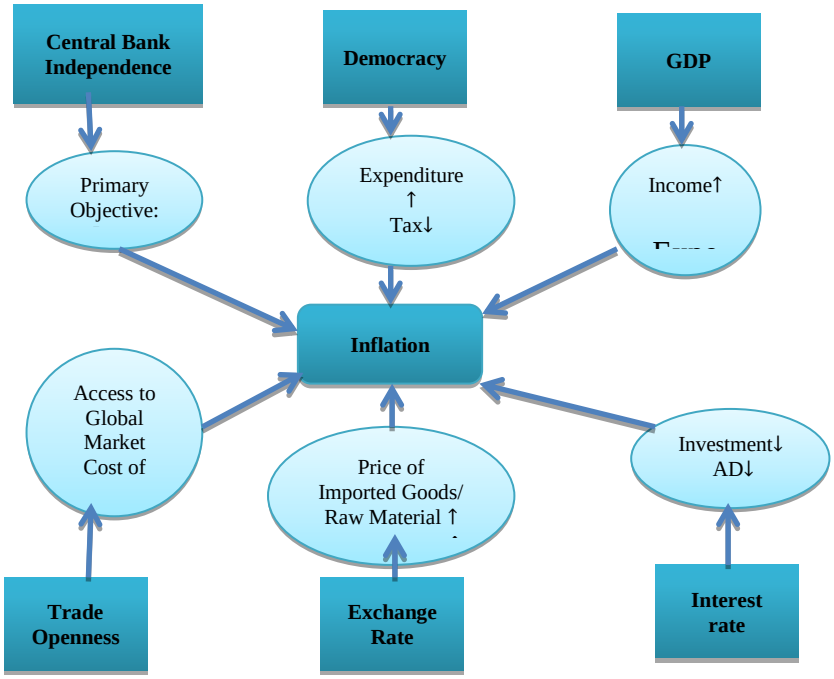
CBI_8 =is the CBI index (CWNE) proposed by Jácome and Vázquez (2008).

The aim of the model is the predict the effect of central bank independence, democracy, gross domestic product per capita, trade openness, exchange rate volatility, and interest rate on inflation volatility. The econometric form of the model is given as:

$$Infvol = \beta_0 + \beta_1 CBI_i + \beta_2 DEM + \beta_3 GDPPC + \beta_4 TRADE + \beta_5 ERVOL + \beta_6 INT + \varepsilon_t \quad \textbf{(2)}$$

Figure 1, shows the conceptual framework of how CBI along with other factors affects inflation volatility.

Figure 1: Conceptual Framework of Central Bank Independence and Inflation Volatility



3.3. Data

The data used in this study has been acquired from different sources. The data on gross domestic product per capita, trade openness, exchange rate, and interest rate are acquired from World Development Indicators while the data on Central Bank Independence (CBI) are acquired from (QOG) database. The Regime Authority Characteristics and Transitions Datasets for Polity IV are the source of the democracy index data. The index's range is -10 (autocracy) to +10 (democracy). The indicator has been standardized to scale from zero (autocracy) to one (democracy).

3.4. Description of Variables

Infvol=Inflation Volatility
CBI=Central Bank Independence
DEM=Democracy Index
GDPPC=Gross Domestic Product Per Capita
TRADE=Trade Openness
ERVOL=Exchange Rate Volatility
INT=Interest Rate

3.5. ARDL Approach to Cointegration

Several methodologies have been employed in empirical research to investigate the factors that influence inflation in different nations. A simultaneous equation methodology has been used in several studies, yet endogeneity and homogeneity issues have drawn criticism for this method. To estimate the determinants of inflation volatility, some studies have used a variety of cointegration techniques; however, these methods have flaws as well and are inappropriate for this study because of the degree of freedom issue because there are many determinants of inflation. For the following reasons and benefits, we are employing the autoregressive distributed lag model (ARDL) technique in this study:

i) One equation is used in the ARDL technique and co-integration to concurrently identify the short- and long-term impacts.
ii) The co-integration estimations from ARDL are efficient and unbiased
iii) This method eliminates the endogeneity and serial correlation issues (Pesaran et al., 2001).
iv) Narayan and Narayan (2007) noted that whereas other approaches to co-integration do not perform well in small samples, the ARDL approach can be used in these situations. In contrast to the Johansen-Juselius co-integration approach, which requires a high sample size for good results, Pesaran and Shin (1998) suggested that the ARDL approach to co-integration is reliable with small sample sizes.
v) All variables do not need to be integrated in the same order for the ARDL technique to co-integration to work. This method allows the variables to be either stationary I(0), integrated of order one I(1), or a combination of both. This is a useful feature because the unit root test has low power in figuring out the variables' integration order. Pesaran et al. (2001) created the ARDL technique for co-integration in order to address the shortcomings of the Engle-Granger and Johansen co-integration approaches. This methodology combines distributed lag with autoregressive models.

3.6. ARDL Model Specification

The unrestricted Error Correction Models related to determinants of inflation volatility in Pakistan are given as:

$$\Delta(INFVOL)_{it} = \gamma_0 + \gamma_1(INFVOL)_{t-1} + \gamma_2(CBI_i)_{t-1} + \gamma_3(DEM)_{t-1} + \gamma_4(GDPPC)_{t-1} + \gamma_5(TRADE)_{t-1} + \gamma_6(ERVOL)_{t-1} + \gamma_6(INT)_{t-1} + \sum_{t=1}^{p_1}\eta_1\Delta(INFVOL)_{t-i} + \sum_{t=0}^{p_2}\eta_2\Delta(CBI_i)_{t-i} + \sum_{t=0}^{p_3}\eta_3\Delta(DEM)_{t-i} + \sum_{it=1}^{p_1}\eta_4\Delta(GDPPC)_{t-i} + + \sum_{t=0}^{p_2}\eta_5\Delta(TRADE)_{t-i} + \sum_{t=0}^{p_3}\eta_6\Delta(ERVOL)_{t-i} + \sum_{t=0}^{p_3}\eta_7\Delta(INT)_{t-i} + \varepsilon_t \quad \textbf{(3)}$$

The parameters corresponding to long-run multipliers, η_i are short-term dynamics in the ARDL model, are the error term, and Δ is the first difference.

3.7. Bounds Testing Procedure

Before constructing long-run coefficients and error correction models, it is imperative to test the existence of long-run relationships. The Ordinary Least Squares (OLS) method is utilized to determine the Wald Statistic or F value for the joint significance of the lagged variables' parameters, i.e.

$$H_0 = \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0 \quad \text{(No Cointegration)} \quad \textbf{(4)}$$

$$H_0 = \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq 0 \quad \text{(Cointegration)} \quad \textbf{(5)}$$

According to the null hypothesis, there is no cointegration or long-term relationship when the parameters of the lagged variables in equations are simultaneously equal to zero. According to the alternate hypothesis, there is a long-term relationship or cointegration if at least one of the lagged variables' parameters is not equal to zero.

The F-statistic is used to test the null hypothesis against the alternative hypothesis. Depending on whether the variables included in the ARDL model are integrated of order I(0), I(1), or a combination of I(0) and I(1), the F-statistic has a non-standard distribution. The calculated F is contrasted with the Pesaran et al. (1996) suggested critical values. The null hypothesis that there is no long-term relationship is rejected if the calculated F statistic is higher than the upper bound critical value. Second, if the F-statistic is less than the lower bound critical values, the null hypothesis holds, meaning that there is no long-term link or cointegration. In the last instance, if the F-statistic is between the lower and upper bounds of critical values, the test of the desired confidence level cannot be determined. The following formulas can be used to calculate the long-term parameters in the case a long-term relationship is established.

$$INFVOL = \chi_0 + \sum_{t=1}^{p_1}\xi_1\Delta(INFVOL)_{t-i} + \sum_{t=0}^{p_2}\xi_2\Delta(CBI_i)_{t-i} + \sum_{t=0}^{p_3}\xi_3\Delta(DEM)_{t-i} + \sum_{t=0}^{p_4}\xi_4\Delta(GDPPC)_{t-i} + \sum_{t=0}^{p_4}\xi_5\Delta(TRADE)_{t-i} + \sum_{t=0}^{p_4}\xi_6\Delta(ERVOL)_{t-i} + \sum_{t=0}^{p_4}\xi_7\Delta(INT)_{t-i} + \varepsilon_t \quad \textbf{(6)}$$

By using the following equations, we can estimate the short-run dynamics.

$$\Delta INFVOL_t = \pi_0 + \sum_{t=1}^{p_1}\vartheta_1\Delta(INFVOL)_{t-i} + \sum_{t=0}^{p_2}\vartheta_2\Delta(CBI_i)_{t-i} + \sum_{t=0}^{p_3}\vartheta_3\Delta(DEM)_{t-i} + \sum_{t=0}^{p_4}\vartheta_4\Delta(GDPPC)_{t-i} + \sum_{t=0}^{p_5}\vartheta_5\Delta(TRADE)_{t-i} + \sum_{t=0}^{p_6}\vartheta_6\Delta(ERVOL)_{t-i} + \sum_{t=0}^{p_6}\vartheta_7\Delta(INT)_{t-i} + \varepsilon_t \quad \textbf{(7)}$$

4. Results and Discussion

The study's findings and analysis are presented in this section.

4.1. Preliminary Analysis

The State Bank of Pakistan has had a significant role in the fiscal and monetary policy formulation of the country. However, the bank's agenda has been compromised by political interference making it ineffective in managing the needed trust in macroeconomic stability. Consequently, the Government in 1994 gave SBP independence to align its role with the constitution. This section explains the status of macroeconomic stability before and after SBP independence.

1. Pre-Autonomy Era

Before autonomy central bank faced macro stability challenges in the economy due to political interference. According to Arnone et al. 2009, the pressure of the politicians to make the SBP avoid using its powers to get effective control of inflationary pressures. The political influence forced the SBP to retain a low interest rate, which meant, expansionary monetary policy, which subsequently inflated the currency and resulted in macroeconomic instability. Government borrowing from the SBP enhanced political benefit. Cukierman et al. 1992, argue that it was politically driven such that it reduced private sector borrowing to make investments which affected economic growth. External pressure also imposed challenges on the SBP to execute monetary policy. Making the country maintain an overvalued exchange rate to meet special interest groups was economically harmful. It further threatened the export sector through eroding competitiveness that eventually terminated the foreign exchange reserve (Rogoff, 1985). A comparison of the two periods under study is shown in Table 2.

2. Age of Post-Autonomy

Autonomy had an essential objective of improving SBP's efficiency in safeguarding macroeconomic stability. It enabled the central bank to tame inflation by adjusting interest rates to attain a more proactive stance against inflation in the operating mechanism. Autonomy also improved fiscal discipline by reducing the government's borrowing from the SBP, eliminating fiscal dominance and ensuring that the SBP focused on its mandate (Eijffinger and Schaling. 1993). Autonomy also enhanced the market responsiveness of the SBP by enabling a more flexible exchange rate, which improved risk management and reduced external imbalances but also brought about currency rate volatility that affected consumers and businesses. In the post-autonomy phase from 1994-2022, central bank autonomy had improved significantly, giving SBP a greater role in monetary policy control, and lower average inflation rates (Hanif, 2014). However, exchange rate volatility increased to levels that indicated a volatile foreign exchange market environment, while interest rates increased slightly. Democracy remained the same, and economic well-being measured by GDP per capita was comparable to the pre-autonomy period, and income discrepancies persisted. The post-autonomy phase was, thus, characterized by more central bank independence and inflation stability, while other economic and political indicators were statically indifferent.

Table 2: Pre and Post-Autonomy Analysis

Years	Variable	Pre-Autonomy Era (1972-1993)			Years	Post Autonomy Era (1994-2022)		
		Average	Maximum	Minimum		Average	Maximum	Minimum
1972-1976	CBI1	0.31	0.31	0.31	1994-1998	0.30	0.30	0.30
1977-1981		0.31	0.31	0.31	1999-2003	0.31	0.33	0.30
1982-1986		0.31	0.31	0.31	2004-2008	0.33	0.33	0.33

1987-1993		0.31	0.31	0.31	2009-2013	0.36	0.40	0.33
					2014-2018	0.40	0.40	0.40
					2019-2022	0.42	0.42	0.41
1972-1976	CBI2	0.48	0.48	0.48	1994-1998	0.55	0.55	0.55
1977-1981		0.48	0.48	0.48	1999-2003	0.54	0.55	0.53
1982-1986		0.48	0.48	0.48	2004-2008	0.53	0.53	0.53
1987-1993		0.48	0.48	0.48	2009-2013	0.53	0.53	0.53
					2014-2018	0.53	0.53	0.52
					2019-2022	0.52	0.52	0.52
1972-1976	CBI3	0.20	0.20	0.20	1994-1998	0.07	0.07	0.07
1977-1981		0.20	0.20	0.20	1999-2003	0.15	0.27	0.07
1982-1986		0.20	0.20	0.20	2004-2008	0.27	0.27	0;27
1987-1993		0.20	0.20	0.20	2009-2013	0.40	0.60	0.27
					2014-2018	0.60	0.62	0.60
					2019-2022	0.69	0.73	0.64
1972-1976	CBI4	0.24	0.24	0.24	1994-1998	0.24	0.24	0.24
1977-1981		0.20	0.20	0.20	1999-2003	0.24	0.24	0.24
1982-1986		0.20	0.20	0.20	2004-2008	0.24	0.24	0.24
1987-1993		0.20	0.20	0.20	2009-2013	0.29	0.37	0.24
					2014-2018	0.36	0.37	0.34
					2019-2022	0.36	0.37	0.35
1972-1976	CBI5	0.13	0.13	0.13	1994-1998	0.06	0.06	0.06
1977-1981		0.13	0.13	0.13	1999-2003	0.06	0.06	0.06
1982-1986		0.13	0.13	0.13	2004-2008	0.06	0.06	0.06
1987-1993		0.13	0.13	0.13	2009-2013	0.14	0.25	0.06

					2014-2018	0.24	0.25	0.22
					2019-2022	0.24	0.25	0.23
1972-1976	CBI6	0.23	0.23	0.23	1994-1998	0.22	0.22	0.22
1977-1981		0.23	0.23	0.23	1999-2003	0.23	0.25	0.22
1982-1986		0.23	0.23	0.23	2004-2008	0.25	0.25	0.25
1987-1993		0.23	0.23	0.23	2009-2013	0.29	0.36	0.25
					2014-2018	0.36	0.36	0.35
					2019-2022	0.37	0.38	0.36
1972-1976	CBI7	0.22	0.22	0.22	1994-1998	0.21	0.21	0.21
1977-1981		0.22	0.22	0.22	1999-2003	0.22	0.24	0.21
1982-1986		0.22	0.22	0.22	2004-2008	0.24	0.24	0.24
1987-1993		0.22	0.22	0.22	2009-2013	0.29	0.36	0.24
					2014-2018	0.36	0.36	0.35
					2019-2022	0.37	0.38	0.36
1972-1976	CBI8	0.22	0.22	0.22	1994-1998	0.26	0.26	0.26
1977-1981		0.22	0.22	0.22	1999-2003	0.26	0.26	0.26
1982-1986		0.22	0.22	0.22	2004-2008	0.26	0.26	0.26
1987-1993		0.22	0.22	0.22	2009-2013	0.30	0.36	0.26
					2014-2018	0.36	0.36	0.34
					2019-2022	0.35	0.36	0.35
1972-1976	DEM	0.67	0.83	0.42	1994-1998	0.71	0.75	0.67
1977-1981		0.63	0.67	0.58	1999-2003	0.62	0.63	0.61
1982-1986		0.48	0.67	0.07	2004-2008	0.68	0.78	0.63
1987-1993		0.62	0.75	0.33	2009-2013	0.72	0.73	0.71
					2014-	0.74	0.76	0.72

					2018			
					2019-2022	0.74	0.74	0.73
1972-1976	GDPPC	1.20	4.12	-1.91	1994-1998	0.75	2.28	-1.64
1977-1981		3.34	6.60	0.41	1999-2003	1.42	2.97	-0.12
1982-1986		2.97	6.60	0.41	2004-2008	3.63	5.74	-0.17
1987-1993		0.38	4.89	-0.82	2009-2013	1.27	2.82	-0.19
					2014-2018	4.63	6.2	2.60
					2019-2022	3.48	6.50	-1.30
1972-1976	TRADE	31.27	34.46	28.75	1994-1998	36.13	38.33	34.01
1977-1981		32.28	36.58	27.71	1999-2003	30.84	32.84	28.13
1982-1986		33.20	36.58	27.71	2004-2008	33.96	35.68	30.30
1987-1993		36.60	38.91	34.2	2009-2013	32.70	32.94	32.07
					2014-2018	33.22	33.93	32.71
					2019-2022	32.42	32.52	32.32
1972-1976	EXVOL	-0.23	0.09	-1.21	1994-1998	26.98	35.14	20.67
1977-1981		-0.00	-0.00	-0.00	1999-2003	46.61	52.02	39.60
1982-1986		3.15	6.75	-0.00	2004-2008	51.93	60.50	48.35
1987-1993		12.19	18.21	7.50	2009-2013	78.73	86.61	71.81
					2014-2018	90.91	98.91	83.92
					2019-2022	104.80	109.54	100.07
1972-1976	INT	10.99	12.05	9.43	1994-1998	14.55	15.42	13.91
1977-1981		11.40	11.92	10.86	1999-2003	10.92	13.55	6.99
1982-1986		10.96	11.92	10.65	2004-2008	10.40	12.93	7.25
1987-1993		11.88	13.53	10.49	2009-2013	13.99	14.53	13.47
					2014-2018	12.97	13.20	12.68
					2019-	12.48	12.94	12.37

					2022			
1972-1976	INFVOL	6.60	15.48	-3.74	1994-1998	1.25	3.92	-2.42
1977-1981		-1.27	-0.04	-3.37	1999-2003	-0.84	14.93	-7.49
1982-1986		-3.01	-0.04	-6.67	2004-2008	0.90	9.09	-2.92
1987-1993		-1.24	3.11	-5.44	2009-2013	2.86	10.71	-3.98
					2014-2018	-0.69	-0.08	-3.01
					2019-2022	0.06	0.13	0.01

Figures 1 and 2 show the central bank independence indexes before and after the autonomy era.

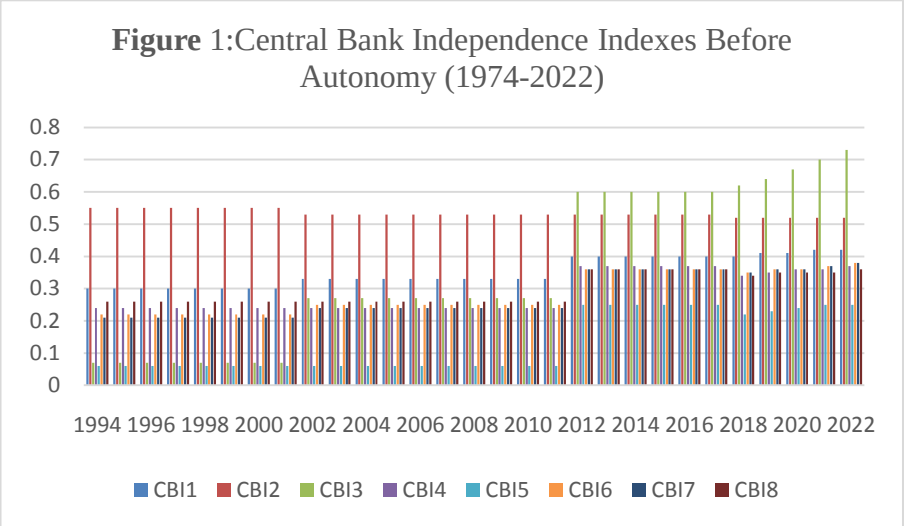


Figure 1: Central Bank Independence Indexes Before Autonomy (1974-2022)

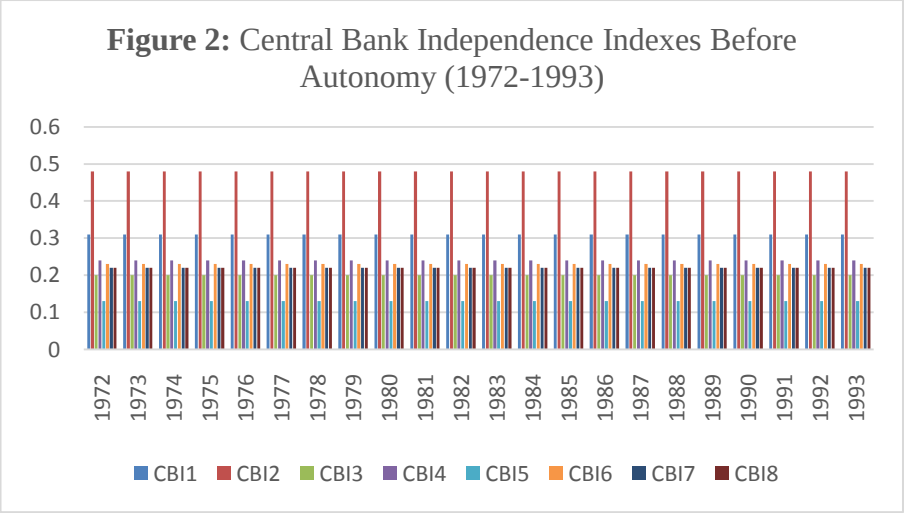


Figure 2: Central Bank Independence Indexes Before Autonomy (1972-1993)

Table 3 provides statistical measures for various economic and financial variables. The inflation volatility variable has a mean of 0.36, indicating that, on average, there is some degree of inflation volatility. The positive skewness and high kurtosis suggest a right-skewed distribution with heavier tails, indicating that there are occasional extreme fluctuations in inflation. The variables from CBI1 to CBI8 have means ranging from 0.25 to 0.51. While the means don't show extreme values, the skewness and kurtosis for some of these variables suggest non-normal distributions, meaning they may have outliers or extreme values.

Table 3: Summary Statistics

	INFVOL	CBIE1	CBIE2	CBIE3	CBIE4	CBIE5	CBIE6	CBIE7	CBIE8	DEM	GDPPC	TRADE	ERVOL	INT
Mean	0.36	0.33	0.51	0.29	0.27	0.13	0.26	0.25	0.26	0.65	2.46	33.45	39.24	12.02
Median	-0.34	0.31	0.52	0.20	0.24	0.13	0.23	0.22	0.26	0.67	2.18	33.24	31.21	12.48
Maximum	15.48	0.42	0.55	0.73	0.37	0.25	0.38	0.38	0.36	0.83	6.60	38.91	109.54	15.42
Minimum	-7.49	0.30	0.48	0.07	0.24	0.06	0.22	0.21	0.22	0.07	-1.91	27.72	-1.22	6.99
Std. Dev.	5.25	0.04	0.03	0.19	0.05	0.07	0.05	0.06	0.05	0.13	2.19	2.62	36.78	1.87
Skewness	1.38	1.22	-0.02	1.06	1.41	0.68	1.29	1.30	0.99	-2.35	0.10	-0.10	0.49	-0.70
Kurtosis	4.60	2.81	1.34	2.79	3.02	2.25	2.85	2.85	2.49	10.07	2.31	2.89	1.82	3.41
Jarque-Bera	21.66	12.80	5.88	9.67	16.88	5.11	14.25	14.51	8.98	153.14	1.10	0.11	5.03	4.51
Probability	0.00	0.00	0.05	0.01	0.00	0.08	0.00	0.00	0.01	0.00	0.58	0.94	0.08	0.11

The mean of 0.65 indicates a moderate level of the political index. The skewness of -2.35 suggests a left-skewed distribution, which could indicate that political stability is generally high but with some exceptions that lead to lower values. The mean of 2.46 suggests an average GDP per capita. The data seems to be relatively normally distributed, as indicated by a low Jarque-Bera probability. With a mean of 33.45 and a high standard deviation, this variable trade exhibits significant variability in trade. The skewness of and low Jarque-Bera probability suggest a nearly normal distribution. The mean of 39.24 and a high standard deviation of exchange rate volatility indicate substantial exchange rate volatility. Positive skewness and kurtosis suggest a right-skewed distribution with some extreme exchange rate fluctuations. The mean of 12.02 suggests a moderate interest rate. The skewness and low Jarque-Bera probability indicate a nearly normal distribution.

Table 4 shows the correlation coefficients between the variable INFVOL (Inflation Volatility) and several other variables. The variables (CBIE1, CBIE3, CBIE4, CBIE7, CBIE8, and CBIE9) exhibit negative correlations with INFVOL, ranging from -0.12 to -0.18. This suggests a weak to moderate negative linear relationship between inflation volatility and these variables. In other words, when INFVOL increases, these variables tend to decrease, and vice versa.

Table 4: Correlation Analysis

	INFVOL	CBIE1	CBIE2	CBIE3	CBIE4	CBIE5	CBIE6	CBIE7	CBIE8	DEM	GDPPC	TRADE	ERVOL	INT
INFVOL	1													
CBIE1	-0.12	1												
CBIE2	0.08	0.29	1											
CBIE3	-0.13	0.99	0.15	1										
CBIE4	-0.13	0.96	0.28	0.94	1									
CBIE5	-0.18	0.82	-0.17	0.86	0.89	1								
CBIE6	-0.13	1.00	0.29	0.98	0.98	0.85	1							
CBIE7	-0.13	1.00	0.29	0.98	0.98	0.85	1.00	1						
CBIE8	-0.08	0.93	0.59	0.87	0.94	0.68	0.94	0.94	1					
DEM	0.40	0.36	0.38	0.31	0.34	0.17	0.36	0.35	0.43	1				
GDPPC	-0.13	0.36	-0.09	0.38	0.31	0.35	0.35	0.35	0.25	-0.01	1			
TRADE	-0.05	-0.15	-0.05	-0.15	-0.12	-0.09	-0.14	-0.14	-0.13	0.12	0.01	1		
ERVOL	-0.01	0.87	0.66	0.81	0.80	0.48	0.85	0.85	0.93	0.43	0.18	-0.13	1	
INT	0.33	0.14	0.41	0.06	0.25	0.11	0.17	0.18	0.32	0.33	-0.27	0.22	0.31	1

The variables (CBIE2, CBIE10, and GDPPC) have a weaker positive correlation with INFVOL, ranging from 0.08 to 0.40. This indicates a mild to moderate positive linear relationship, suggesting that as INFVOL increases, these variables tend to increase as well. The correlations between (DEM, TRADE, ERVOL, and INT) and INFVOL are very close to zero (-0.05, -0.01, and 0.33). This implies that there is very little linear relationship between INFVOL and these variables.

The Phillips-Perron and Augmented Dickey-Fuller (ADF) tests are used to look at the integration properties of variables to determine if all of the variable series are stationary or nonstationary. Among the variables, the variables (INFVOL, CBI1, CBI4, CBI5, DEM, GDPPC, and TRADE) are stationary (I(0)). On the other hand, the variables (CBI2, CBI3, CBI6, CBI7, CBI8, ERVOL, and INT) are non-stationary (I(1)). Stationary variables have a constant mean and variance over time and are suitable for straightforward time series analysis, while non-stationary variables require further differencing or transformation to achieve stationary before meaningful analysis can be conducted. The results are displayed in Table 5.

Table 5: Augmented Dickey-Fuller and Phillips-Perron Tests for Unit Root

Variables	Augmented Dickey-Fuller						Phillips-Perron Tests						Conclusion
	Interc	La	Interc	La	No	La	Interc	La	Interc	La	No	La	

	ept	**g**	**ept and Trend**	**g**	**ne**	**g**	**ept**	**g**	**ept and Trend**	**g**	**ne**	**g**	
INFVOL	-5.42 (0.00)	0	-5.41 (0.00)	0	-5.45 (0.00)	0	-5.46 (0.00)	2	-5.50 (0.00)	3	-5.48 (0.00)	2	I(0)
CBI1	0.23 (0.07)	0	-1.43 (0.04)	0	1.14 (0.96)	0	0.39 (0.08)	3	-1.33 (0.87)	3	1.56 (0.97)	3	I(0)
CBI2	-1.52 (0.52)	0	-1.66 (0.75)	0	0.46 (0.81)	0	-1.53 (0.51)	1	-1.76 (0.71)	2	0.46 (0.81)	0	I(1)
CBI3	0.19 (0.97)	0	-1.23 (0.89)	0	1.19 (0.94)	0	0.26 (0.97)	2	-1.18 (0.90)	2	1.35 (0.95)	3	I(1)
CBI4	0.19 (0.07)	0	-1.27 (0.09)	0	1.35 (0.04)	0	-0.57 (0.07)	0	-1.77 (0.00)	0	0.89 (0.90)	2	I(0)
CBI5	-0.99 (0.05)	0	-1.41 (0.05)	0	0.06 (0.09)	0	-1.03 (0.74)	1	-1.41 (0.05)	0	0.06 (0.70)	0	I(0)
CBI6	0.04 (0.96)	0	-1.50 (0.82)	0	1.28 (0.95)	0	0.11 (0.96)	2	-1.49 (0.82)	1	1.39 (0.96)	3	I(1)
CBI7	0.01 (0.95)	0	-1.52 (0.81)	0	1.25 (0.94)	0	0.07 (0.96)	2	-1.50 (0.82)	1	1.36 (0.95)	3	I(1)
CBI8	-0.38 (0.90)	0	-2.30 (0.43)	0	1.18 (0.94)	0	-0.35 (0.91)	1	-2.30 (0.43)	0	1.26 (0.95)	2	I(1)
DEM	-3.31 (0.02)	0	-4.31 (0.01)	3	-0.50 (0.49)	0	-3.36 (0.02)	3	-3.76 (0.03)	3	-0.44 (0.52)	1	I(0)
GDPPC	-5.82 (0.00)	0	-5.84 (0.00)	0	-2.89 (0.00)	0	-5.86 (0.00)	2	-5.88 (0.00)	2	-2.74 (0.00)	3	I(0)
TRADE	-3.68 (0.01)	0	-3.63 (0.04)	0	-0.02 (0.67)	1	-3.68 (0.00)	0	-3.63 (0.04)	0	0.28 (0.76)	14	I(0)
ERVOL	1.32 (0.99)	0	-2.09 (0.54)	0	3.73 (0.99)	0	1.47 (0.99)	4	-2.01 (0.58)	5	3.65 (0.99)	2	I(1)
INT	-2.72 (0.08)	1	-2.87 (0.18)	1	-0.31 (0.57)	1	-2.74 (0.07)	3	-2.74 (0.23)	3	-0.05 (0.66)	2	I(1)

According to Table 6, in all models the value of F-statistics is greater than upper bound at 5% and 10% as well. The results suggest that there is an existence of a long-run relationship in all models.

Table 6: The F-Test for Cointegration

		5% Critique Value of Bounds		10% Critique Value of Bounds	
Models	**F-Statistics**	**I(0)**	**I(1)**	**I(0)**	**I(1)**
1	11.22	2.27	3.28	1.99	2.94
2	8.24	2.27	3.28	1.99	2.94
3	10.49	2.27	3.28	1.99	2.94
4	12.26	2.27	3.28	1.99	2.94
5	11.29	2.27	3.28	1.99	2.94
6	11.81	2.27	3.28	1.99	2.94
7	11.85	2.27	3.28	1.99	2.94
8	12.01	2.27	3.28	1.99	2.94

Table 7 presents the long-term coefficient estimations obtained through the ARDL approach. We employed eight distinct proxies to assess central bank independence (CBI), resulting in eight unique models, each utilizing different CBI proxies. In the first model, we used the CBI index proposed by (Romelli, 2020)[1], democracy, gross domestic product per capita, trade openness, exchange rate volatility, and interest rate as independent variables while inflation volatility is a dependent variable. The CBI index (CBIBoard), which bases independence on the governor and central bank board, was employed in the second model. The CBI index (CBIPolicy), which bases independence on monetary policy and dispute resolution, was employed in the third model. The CBI index (CBIReport), which bases independence on reporting and disclosure, was employed in the fourth model. We employed the CBI indicator (GMT) suggested by Gilli et al. (1991) in the fifth model. We employed the CBI indicator (LVAU) suggested by Cukierman et al. (1992) in the sixth model. We applied Cukierman et al.'s (1992) CBI index (LVAW) to the seventh model. In the eight models, we used the CBI index (CWNE) proposed by Jácome and Vázquez (2008).

The first determinant of inflation volatility is CBI, the coefficient of CBI is negative suggesting that for every one-unit increase in central bank independence, inflation volatility is expected to decrease which is statistically significant indicating the significant impact of central bank independence on reducing inflation volatility. The CBI is linked with lower inflation (Agur, 2021; Bodea and Hicks, 2015b, Garriga and Rodriguez, 2020; Fischer et al., 2002). We expect the indirect or negative effect of CBI on inflation volatility due to three reasons. Central bank independence protects monetary policy from political pressure (Barro and Gordon, 1983b; Kydland and Prescott, 1977; Rogoff, 1985). However, the electoral considerations not only create inflationary pressure but also affect inflation volatility.

Table 7: Estimated Long Run Coefficients using the ARDL Approach

	Dependent Variable: INFVOL							
	Selected Model ARDL (4, 0, 0, 0, 2, 0, 1)							
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**	**Model 8**
Variables	**CBI1**	**CBI2**	**CBI3**	**CBI4**	**CBI5**	**CBI6**	**CBI7**	**CBI8**
	-47.85	-17.41	-7.61	-30.12	-13.99	-34.21	-31.44	-72.93
CBI	(0.01)	(0.22)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

[1] This is the new index, known as CBI-extended, gives details on 42 central bank institutional design criteria spread over six dimensions: (1) Governor and Board of the Central Bank; (2) Monetary Policy and Resolution of Conflicts; (3) Goals; (4) Restrictions on Government Lending; (5) Financial Independence; and (6) Reporting and Disclosure.

DEM	7.03 (0.00)	7.27 (0.01)	7.00 (0.01)	6.76 (0.00)	6.47 (0.01)	6.89 (0.00)	6.87 (0.00)	7.46 (0.00)
GDPPC	0.14 (0.09)	0.03 (0.06)	0.11 (0.09)	0.13 (0.39)	0.10 (0.08)	0.15 (0.04)	0.15 (0.03)	0.42 (0.02)
TRADE	-0.84 (0.00)	-0.88 (0.00)	-0.85 (0.00)	-0.82 (0.00)	-0.84 (0.00)	-0.83 (0.00)	-0.83 (0.00)	-0.75 (0.00)
ERVOL	0.03 (0.02)	0.03 (0.01)	0.01 (0.04)	0.01 (0.40)	0.08 (0.41)	0.02 (0.01)	0.02 (0.02)	0.06 (0.02)
INT	0.90 (0.00)	0.86 (0.00)	0.85 (0.00)	1.05 (0.00)	1.01 (0.00)	0.95 (0.00)	0.96 (0.00)	1.51 (0.00)
C	27.27 (0.00)	6.78 (0.00)	15.11 (0.00)	17.77 (0.00)	13.83 (0.00)	19.52 (0.00)	18.46 (0.00)	17.71 (0.00)

Thus providing greater independence to the central bank can help to attain the required stability in monetary policy that would reduce inflation volatility. This concept is more relevant to democratic countries. Second, focusing on maintaining price stability renders the central bankers reactive to deviation from their inflation target (Eichengreen et al., 2020). In particular, central banks with independence have incentives to control or manage inflation, and if they fail to do so could result in them losing their jobs (Dreher et al., 2008, 2010). These motivations for central bank independence to respond promptly to deviation from the targeted inflation may limit the magnitude of these deviations, thereby reducing volatility (Dmitriev and kerstinng, 2016). Lastly, the instability of fiscal policy is another factor of inflation volatility. The CBI's fiscal side is the capacity of the central bank to impose restrictions on government borrowing or even take part in budgetary planning- promotes the stability of fiscal policy which in turn reduces inflation volatility (Bodea and Higashijima, 2017).

The second factor that affects inflation volatility is democracy, whose coefficient is positive and statistically significant, indicating that democracy is positively linked with inflation volatility. In a democratic system, politicians are motivated to implement popular policies in order to win votes and get re-elected. These policies, which strain the budget and cause inflation if they are not well managed, could include tax breaks, expenditure increases, or subsidies (Desai, 2003). Democracies tend to have relatively short periods for elected officials, which leads to a preference for short-term economic advantages over long-term stability. This may result in short-term economic stimulant policies, but long-term inflation increases (Singer, 2019). Central banks to be autonomous are free from political influences to preserve price stability in democratic systems. To promote economic growth, elected politicians occasionally exert pressure on central banks to implement expansionary monetary policies, such as lowering interest rates. When these acts are not justified by the state of the economy, inflation may result (Bittencourt, 2012). The democratic system allows the possibility of government deficit because elected politicians are likely to increase spending and decrease taxes, even if doing so results in budget deficits. Debt issuance, which can be used to finance these deficits, has the potential to cause inflationary pressures if improperly managed (Maurer, 2008).

The third factor influencing the inflation volatility is gross domestic product per capita. In all models, the coefficient of GDP per capita is positive and significant suggesting that for every one-unit increase in GDPPC, inflation volatility is expected to increase. People usually have greater incomes and purchasing power when GDP per capita rises. This may result in higher consumer spending, which may raise the demand for products and services. Demand-pull inflation may occur if the economy's ability to provide goods and services is not up to par with the growing demand. When there is an excess of money chasing a shortage of products, inflation of this kind results in rising prices (Lovell, 1960). Workers may seek greater salaries as a result of rising living expenses and affluence when GDP per capita rises. Employers may experience cost-push inflation if they grant those wage increases as well. A wage-price spiral could then result from businesses raising prices on consumers to cover these increased labor costs (Blanchard, 1986). Investing in assets like stocks and real estate may rise in parallel with an increase in GDP per capita. Rapid increases in the market value of these assets may lead to wealth effects, which make people feel wealthier and encourage

them to spend more, thereby driving up inflation (Schwartz, 2003). Expansionary monetary policies or raising government spending are two examples of how government actions can boost economic growth and raise GDP per capita. In certain cases, these measures may unintentionally fuel inflation if they are not handled appropriately (Edwards and Tabellini, 1991).

The fourth determinant of inflation volatility is trade openness. The coefficient of trade openness is negative suggesting that for every one-unit increase in trade, inflation volatility is expected to decrease which is statistically significant indicating the significant impact of trade openness on reducing inflation volatility. A country's businesses and customers can access a greater range of goods and services from global marketplaces when they open up to trade. Lower import prices may result from more competition from overseas manufacturers, which may push down domestic pricing for similar or substitute items.

This is commonly known as “import competition”, it has the potential to reduce inflation, particularly for tradable products (Mukhtar, 2010, 2012). The increase in the openness of trade may also improve the nation’s productivity and supply chain management. Aside from that, getting access to foreign technologies, even more, productive manufacturing techniques, and larger markets might also help enhance the competitiveness of domestic enterprises. Because lower production costs due to increased efficiency and lower prices cause lower rates, consumer prices and inflation might go downwards (Sachsida et al., 2003). Although it is not always apparent, trade openness might also affect a nation’s exchange rate. A nation’s currency may be influenced by variables identically to global variables when it is more open in its trade (Kwark and Lim, 2020). A stronger currency might help reduce the price of imports, thus lowering inflation. A decrease in the cost of imported goods will reduce inflation. Other potential benefits include increasing a country’s sources of supply for critical products and resources. It reduces the nation’s vulnerability to disruptions in its supply chains due to factors such as natural catastrophes, geopolitical issues, and other factors that might lead to severe instability. Since a more stable and diversified supply chain may help avoid the supply shocks that lead to price spikes, a country may reduce the risk of inflationary pressures (Sepehrivand and Azizi, 2016).

The fifth factor influencing inflation volatility is exchange rate volatility. In all models, the coefficient of exchange rate volatility is positive and significant suggesting that for every one-unit increase in exchange rate volatility, inflation volatility is expected to increase. A depreciating local currency indicates that more of the home currency is needed to buy the same quantity of foreign currency. Imported goods and services consequently increase in price. This may result in higher import product prices, which would fuel inflation. A country's total price levels may be greatly impacted by a decline in its currency if it depends substantially on imports, particularly for necessities (Shaari et al., 2012). Increased input costs might result from a declining value of the national currency for companies that import components and raw materials. Businesses may raise the prices of their products to pass on cost increases to customers. This is referred to as "cost-push inflation," and a decline in the value of the currency can cause it (Musa, 2021). Expectations of inflation can also be influenced by changes in exchange rates. People may demand greater pay to cover the anticipated rise in the cost of living if they anticipate that the currency will continue to weaken or that exchange rate fluctuations will cause inflation to soar. This could result in a self-fulfilling prophecy where price and wage rises encourage one another and drive inflation (Udoh and Egwaikhide, 2008). A central bank may decide to increase interest rates to control inflation or stabilize the exchange rate in response to a declining currency. An increase in interest rates may make borrowing more expensive for both individuals and companies, which might slow demand and hamper economic growth. However because they raise the cost of borrowing money and making investments, these increased interest rates can also affect inflation (Barbosa-Filho, 2006).

The last determinant of inflation volatility is the interest rate. In all models, the coefficient of interest rate is positive and significant suggesting that for every one-unit increase in interest rate, inflation volatility is expected to increase. The cost of borrowing money increases for both individuals and

corporations when central banks raise interest rates. When borrowing prices rise due to higher interest rates, customers find it less appealing to take out loans for large-ticket products like cars, homes, and other purchases. In a similar vein, companies may decide to forgo capital expenditure when funding expansion and new initiatives grow more costly. Reduced economic activity and decreased consumer demand may result from this cutback in borrowing and expenditure (Alvarez et al., 2001).

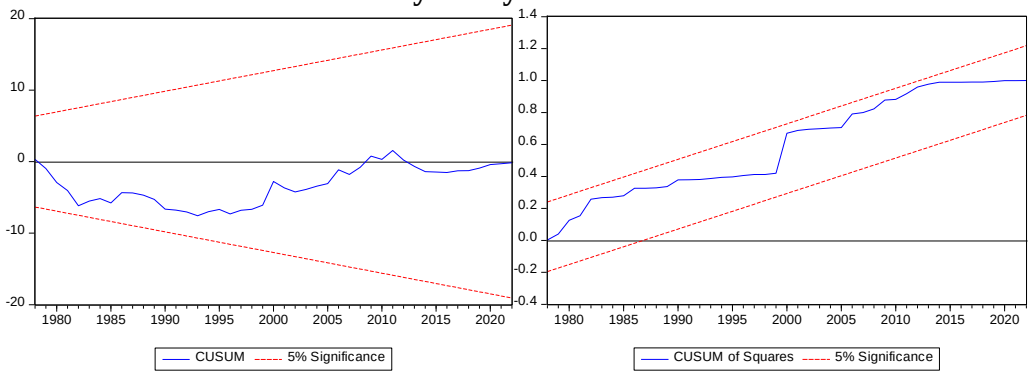
The results of our error correction estimation are shown in Table 7. It is indicated by the coefficient of error correction term (ECM) how fast or slowly the variables approach equilibrium. The phrase needs to have a negative sign and be statistically significant. A short-term shock can cause a departure from the long-term equilibrium to be corrected by more than 1.5 years, as indicated by the statistically significant negative ECM value. According to the results, it would rapidly revert to its equilibrium level and adjust at a fairly rapid rate.

Table 7: Error Correction Representation for the Selected ARDL Model

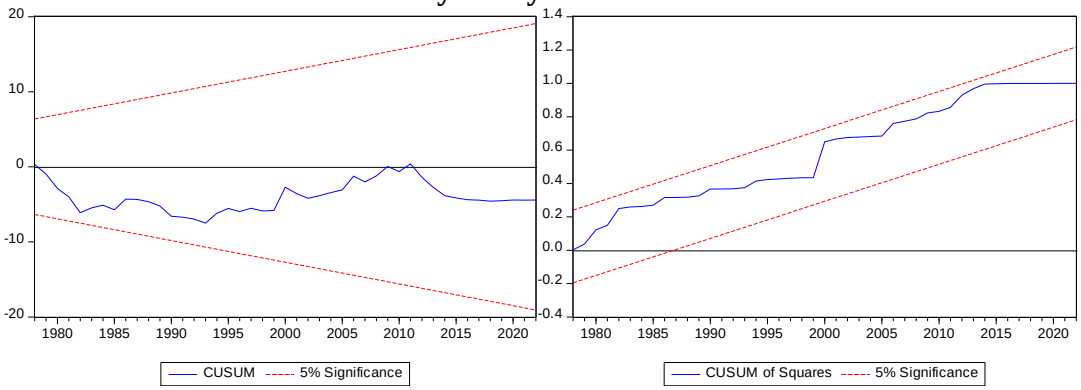
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**	**Model 8**
Variable	**CBI1**	**CBI2**	**CBEI3**	**CBEI4**	**CBI5**	**CBI6**	**CBI7**	**CBI8**
C	41.69 (0.00)	11.11 (0.44)	23.20 (0.01)	28.52 (0.00)	22.43 (0.01)	30.15 (0.00)	28.61 (0.00)	28.41 (0.01)
ECT	-1.52 (0.00)	-1.63 (0.00)	-1.53 (0.00)	-1.60 (0.00)	-1.62 (0.00)	-1.54 (0.00)	-1.54 (0.00)	-1.60 (0.00)
CBI	-73.16 (0.00)	28.50 (0.21)	-11.68 (0.00)	-48.32 (0.00)	-22.68 (0.00)	-52.84 (0.00)	-48.72 (0.00)	-116.97 (0.00)
DEM	10.74 (0.01)	11.90 (0.01)	10.74 (0.01)	10.85 (0.01)	10.50 (0.01)	10.65 (0.01)	10.66 (0.01)	11.97 (0.00)
GDPPC	0.21 (0.37)	-0.04 (0.86)	0.17 (0.48)	0.20 (0.38)	0.17 (0.47)	0.23 (0.32)	0.23 (0.33)	0.68 (0.10)
TRADE(-1)	-1.28 (0.00)	-1.43 (0.00)	-1.31 (0.00)	-1.32 (0.00)	-1.37 (0.00)	-1.28 (0.00)	-1.29 (0.00)	-1.21 (0.00)
ERVOL	0.03 (0.18)	-0.04 (0.01)	0.02 (0.42)	0.01 (0.38)	-0.01 (0.43)	0.036 (0.18)	0.03 (0.18)	0.10 (0.01)
INT(-1)	1.36 (0.00)	1.39 (0.00)	1.31 (0.00)	1.68 (0.00)	1.64 (0.00)	1.47 (0.00)	1.49 (0.00)	2.42 (0.00)
D(INFVOL(-1))	0.31 (0.06)	0.43 (0.01)	0.32 (0.06)	0.36 (0.02)	0.39 (0.01)	0.32 (0.05)	0.32 (0.04)	0.29 (0.10)
D(INFVOL(-2))	0.37 (0.00)	0.46 (0.00)	0.38 (0.00)	0.37 (0.00)	0.41 (0.00)	0.36 (0.00)	0.36 (0.00)	0.36 (0.01)
D(INFVOL(-3))	0.26 (0.00)	0.30 (0.00)	0.27 (0.00)	0.26 (0.00)	0.27 (0.00)	0.26 (0.00)	0.26 (0.00)	0.36 (0.00)
D(TRADE)	-1.03 (0.00)	-1.14 (0.00)	-1.04 (0.00)	-1.06 (0.00)	-1.08 (0.00)	-1.03 (0.00)	-1.03 (0.00)	-0.88 (0.00)
D(TRADE(-1))	0.51 (0.03)	0.50 (0.05)	0.52 (0.03)	0.46 (0.04)	0.49 (0.03)	0.49 (0.03)	0.49 (0.03)	0.37 (0.10)
D(INT)	3.01 (0.00)	3.16 (0.00)	3.04 (0.00)	3.08 (0.00)	3.148 (0.00)	3.03 (0.00)	3.03 (0.00)	0.02 (0.96)

Figure 2-9 shows the stability analysis of all models. It is shown from all the figures that the line is between the bands which means models are stable and have no structural shocks.

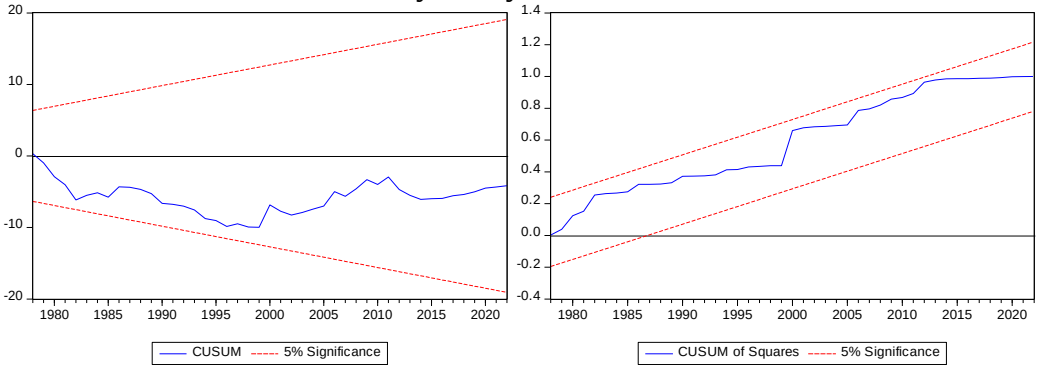
Stability Analysis for Model 1



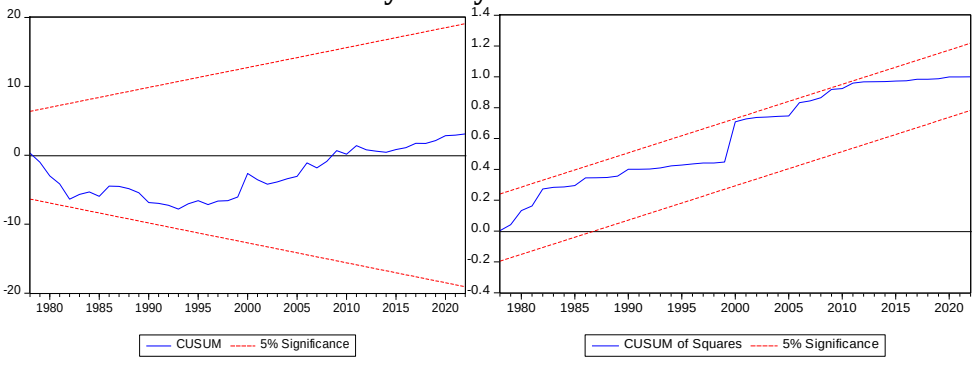
Stability Analysis for Model 2



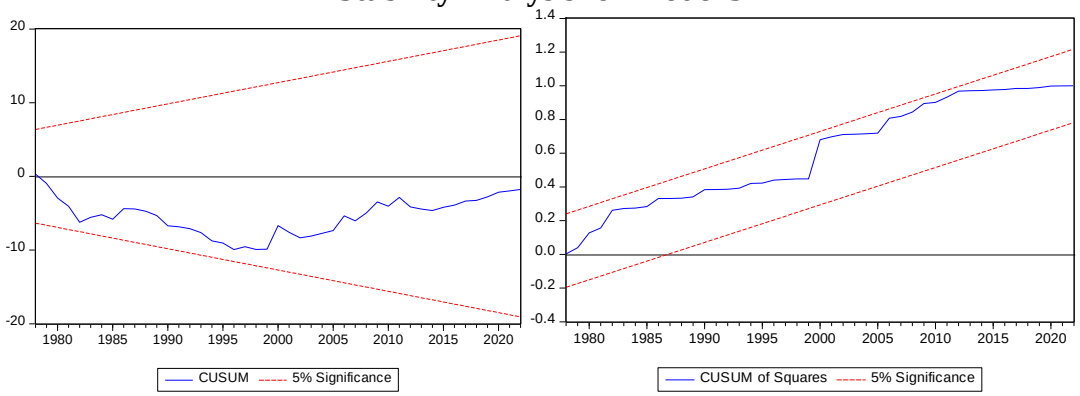
Stability Analysis for Model 3



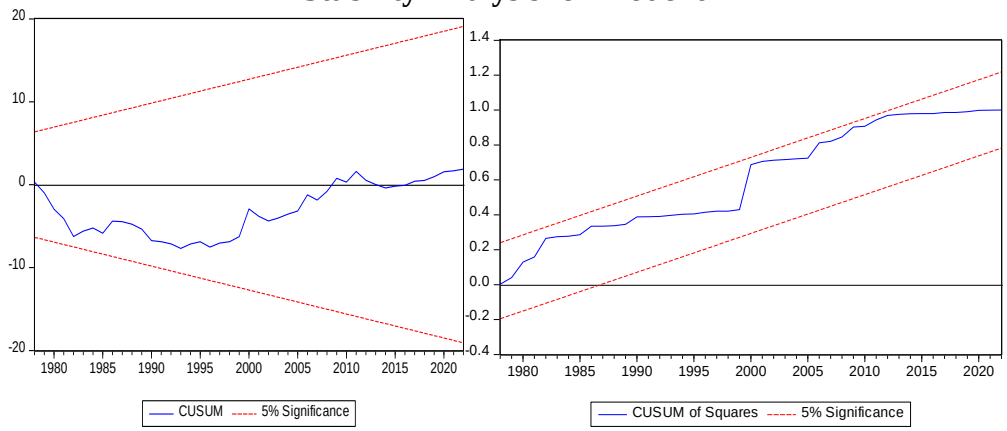
Stability Analysis for Model 4



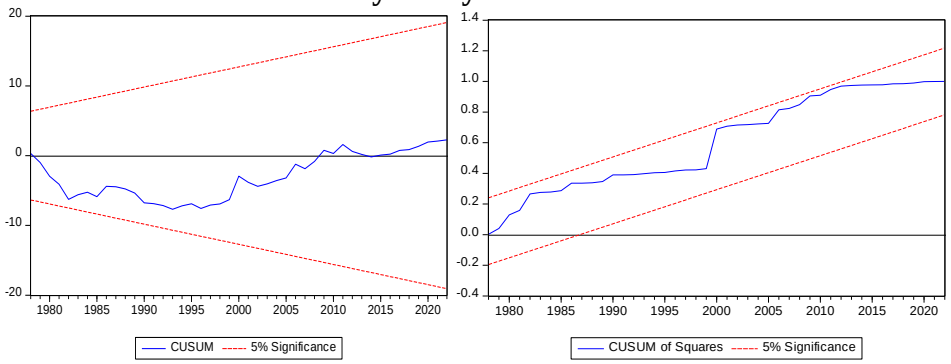
Stability Analysis for Model 5



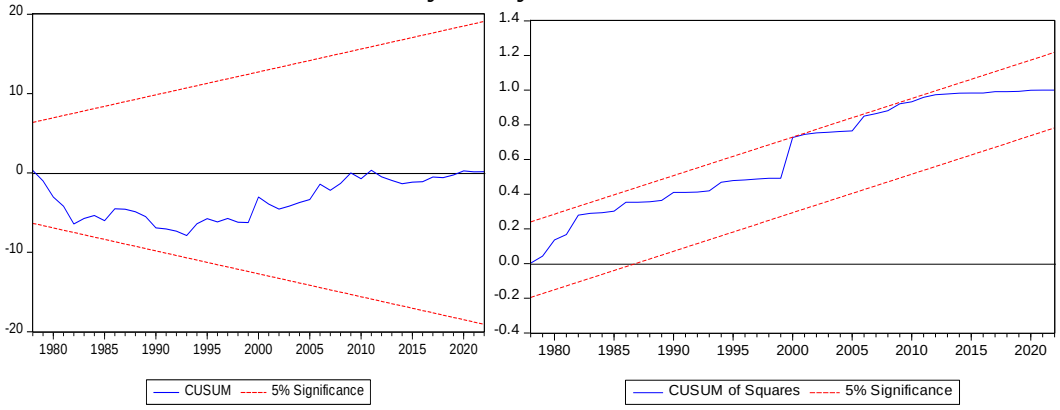
Stability Analysis for Model 6



Stability Analysis for Model 7



Stability Analysis for Model 8



6. Conclusions

In conclusion, this research has examined how the autonomy of the State Bank of Pakistan (SBP) affects macroeconomic stability, with a particular emphasis on inflation volatility as a proxy for macroeconomic stability. Utilizing the Autoregressive Distributive Lag Model (ARDL) in conjunction with different indices of central bank independence (CBI), democracy, gross domestic product per capita, trade openness, exchange rate volatility, and interest rates as independent variables, the analysis has been carried out by using the data from 1972-2022. The conclusions of this study explain several important aspects of the relationship between macroeconomic stability and SBP independence. While the pre-autonomy era might have affected some price fluctuation as evidenced by the 6% average inflation rate during this era. Post autonomy era the average inflation rate was approximately 4%, showing that price stability is increased. A plausible conclusion that could be drawn from the substantial decline in inflation rates post-SBP autonomy is that the economy's price stability is positively influenced by SBP independence. Additionally, it is noticeable that by comparing the peak inflation rates for the two eras, the post-autonomy had a lower maximum inflation rate which is about 14.03% than the pre-autonomy which is approximately 15.48% maximum inflation. The lower maximum inflation is a sign that SBP independence has created a better price environment. Furthermore, the values from the table define that the ARDL study has provided the variables that influence inflation volatility. The study found a negative relationship between interest rates, trade openness, and central bank independence (CBI), and inflation volatility.

Put differently, lower interest rates, more trade openness, and a higher degree of central bank independence are all associated with less volatility in inflation. However, there is evidence that exchange rate volatility, democracy, and GDP per capita have a positive correlation with inflation volatility, suggesting that these variables influence increased inflation volatility.

All of these results point to the State Bank of Pakistan's autonomy having a positive effect on macroeconomic stability, especially when it comes to lower inflation volatility. Increased central bank independence has made it possible to manage monetary policy more skillfully and has helped to keep prices steady. The study emphasizes the significance of interest rates and trade openness as important factors that influence macroeconomic stability in addition to CBI.

7. Policy Implications

The study recommended the following policies to reduce the inflation volatility:

- Policymakers should promote the central bank's independence. Policymakers must guarantee that the central bank functions with a significant level of independence, free from political interference. Because of their independence, central banks are better equipped to achieve their main goal of maintaining price stability.
- Policymakers and governments should encourage open markets and trade liberalization. Lower volatility in inflation is generally related to open economies. Trade policies that promote competition should be given top priority by policymakers as they can aid in reducing pricing pressures.
- The policymakers should advise the central bank to maintain the monetary policy in a balanced approach. Central banks should give serious thought to how changes in interest rates affect the volatility of inflation. Low interest rates should be regulated to prevent excessive inflation even though they can help economic growth.
- Policymakers and governments should strive for a balance between economic stability and democratic procedures. While democracy is necessary for good government, it can also result in political pressures that compromise the independence of central banks.
- Government and policymakers prioritize raising general economic well-being. Increased income levels frequently make households less susceptible to shocks from inflation.
- Policymakers should make a policy that stabilizes the exchange rate because inflationary pressures can be lessened, and uncertainty can be reduced in an environment with stable exchange rates.

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