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Impact of Financial Inclusion on Monetary Policy Effectiveness: Evidence from Pakistan

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Abstract
Effective monetary policy controls inflation, reduces unemployment, strengthens economic growth, and brings economic stability. To examine whether this channel works in the case of Pakistan, we have designed this study to investigate the impact on the monetary policy effectiveness of financial inclusion (FI). The inflation rate is used as a proxy for the monetary policy's effectiveness. The FI index is constructed, through principal component analysis, by utilizing the demand and supply sides indicators of FI proposed by the International Monetary Fund. The augmented ARDL bounds test results confirmed the co-integration relationship among the variables. The ARDL model results indicate, both in the long run and short run, that FI has a negative and significant effect on the inflation rate. It means that FI contributes to the improvement in the monetary transmission mechanism, which in turn makes the monetary policy more effective. Exchange rate has a positive and significant impact on the inflation rate, both in the short run and the long run. The lending rate, GDP growth, and broad money supply have no significant impact on the effectiveness of monetary policy. The long-run Granger causality test indicated that causality runs from FI to the effectiveness of monetary policy. In short, we concluded that FI contributes significantly to the improvement of monetary policy effectiveness. This study recommends that policymakers should encourage the access of poor and marginalized adults to financial services and products to improve the monetary policy's effectiveness and bring stability to the price level and the economy. The study also extended and applied the Phillips (2016) framework for the selection of the ARDL bounds model to the selection of the augmented ARDL bounds model.

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Introduction

Since the last decade, most of the central banks and governments in developing economies have become interested in providing their people with easy and affordable access to financial services and products to make effective monetary policy and to get macroeconomic stability. Monetary policy effectiveness depends on the well-furnished monetary transmission mechanism, which is strongly associated with financial inclusion (FI). Improvement in monetary transmission mechanisms can be achieved by formalization and documentation of the informal and undocumented economy through FI. FI means making reasonable financial products and services for the poor and marginalized groups (Kelkar, 2010). It helps to increase the level of saving and credit availability, eliminate the leakages problem from subsidies and welfare distribution, and break the vicious cycle of poverty (Ellis et al., 2010). FI also helps in improving the money circulation in an economy, increasing the investment rate and purchasing power parity, and reducing the inflation rate (Lenka & Bairwa, 2016). FI can increase the scope of consumption, saving, and investment decisions between the masses and thus can ensure monetary stability. Widening FI brings down cash management costs and keeps local currency stable (Mbutor & Uba, 2013). It can help to increase economic growth and promote economic stability.

The primary objectives of the monetary policy design by the central bank are economic growth, reduction of the unemployment rate, and controlling the general price level. The monetary authorities can achieve these goals by managing the money supply and/or policy rate in the economy. An effective monetary policy, a monetary policy in which the policy actions are effectively transferred into the economy, can help to achieve these goals. Various transmission mechanisms are available that transfer the policy actions into the economy. The monetary transmission mechanisms connect the monetary policy to the financial system (Mishkin, 1995). A higher level of FI makes more effective monetary policy by increasing transmission in the financial system. FI extends the monetary policy to the financially marginalized people and thus helps policymakers to better forecast inflation.

The majority of the 1.4 billion individuals worldwide who do not already have an account at a financial institution are in emerging nations, according to the 2021 Global Findex survey. More than half of the globally unbanked adults, about 54%, live in China, India, Pakistan, Indonesia, Bangladesh, Egypt, and Nigeria. According to the Global Findex report of 2021, Pakistan, as a developing country, has the largest segment of the adult population, around 115 million, unbanked. Account ownership grew by 11 percentage points over the past decade, from 10% in 2011 to 21% in 2021, which is very low. The State Bank of Pakistan, with the support of the United Kingdom Department for International Development (DFID), initiated an FI program to improve inclusive economic growth and to improve income and livelihood opportunities for poor and financially excluded people in Pakistan.

The nature of the Pakistan economy is largely informal and undocumented due to the sheer size of involuntary financial exclusion. So, monetary policy actions

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are unable to affect the financial decisions taken by individuals and firms in informal sectors and thus hamper the monetary policy transmission. Boosting FI in Pakistan is not just only helpful for marginalized and poor people but also for the monetary policy's effectiveness and financial stability.

Pakistan, as a developing country, has a lot of macroeconomic problems, such as a high level of inflation, unemployment, budget deficit, external and internal debts, and economic and political instability, etc. To pay debt back and to balance the budget, Pakistan always prefers to go to the IMF, which provides loans at lower cost. One of the IMF's conditions for providing loans to Pakistan is to increase the tax base and tax income, which is not possible without FI. In the last two decades, the State Bank of Pakistan has made a lot of efforts and started a number of programs to boost FI and to get the desired output of economic growth, stability, and stable general price level. Unfortunately, the State Bank of Pakistan achieved no significant success and merely increased the financially included adults from 11% to 21% over the period 2011 and 2021.

Numerous scholars have examined the relationship between monetary policy efficacy and FI for both people and groups of nations. For instance, Oanh et al. (2023) investigated the relationship between FI and monetary policy for financially developed and underdeveloped countries. Evans (2016) examined this relationship for African countries, Lenka and Bairwa (2016) for SAARC countries, Lapukeni (2015) for Malawi, and Arshad et al. (2021) for developed and underdeveloped countries, etc. To the best of our knowledge, no one has investigated this relationship, especially for Pakistan. This study tries to find out how Pakistan's level of FI affects the diffusion and effectiveness of monetary policy interventions. This study aims to provide useful insights for policymakers, the State Bank of Pakistan, and financial institutions by understanding the impact of FI on the effectiveness of monetary policy. It will help them create and implement more informed and effective monetary policies that can boost inclusive economic growth.

Review of Literature

Monetary policy effectiveness depends on improved monetary transmission mechanisms, which in turn depend on boosted levels of FI. This section examines the body of research on the effects of FI on the efficacy of monetary policy globally, for a panel of some specified countries and economies, and for some individuals' countries. Monetary authorities play a pivotal role in regulating the money supply to attain price stability and targeted inflation. They utilized various monetary policy tools to achieve their policy objectives. It is evident that the efficacy of these monetary policy tools is closely tied to the extent to which economic agents engage with formal financial services and products. A robust banking sector facilitates the aggregation and redistribution of dispersed savings within an economy, thus contributing to overall monetary policy effectiveness (Ratti, 2012). Monetary authorities adopt either expansionary or contractionary monetary policy stances to align with their policy goals. Controlling the money supply is of paramount importance because an excessive money supply can trigger inflation, eroding the purchasing power of economic agents. Conversely, an inadequate money supply can lead to economic downturns, resulting in decreased prosperity for the population. Importantly, individuals who are financially excluded, often characterized by their limited engagement with formal

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financial services such as savings and investments, are less affected by changes in interest rates. They typically rely on informal financial channels or consume their entire income. This group's financial choices are less responsive to traditional monetary policy measures (Mehrotra & Yetman, 2014). Therefore, the effectiveness of monetary policy can be significantly enhanced by bringing financially excluded individuals into the formal financial system (Mehrotra & Yetman, 2015). This demonstrates the crucial relationship between monetary policy and financial inclusion (FI), emphasizing the value of increasing access to formal financial services as a way to improve monetary policy's overall efficacy in fostering economic stability and equitable distribution of income.

Evans (2016) examined the impact of FI on the monetary policy effectiveness in Africa. The study used panel data over the years 2005-2014 for fifteen African countries. The panel Pedroni co-integration test, PVECM, impulse response function, and variance decomposition were used to investigate the co-integration, long and short run relationship, the response of variables to exogenous shock, and explaining variation in inflation by the selected variables, respectively. The study found a long-run association between the two. The study also showed that the reaction of policy to positive FI shock is statistically insignificant, and causality runs from monetary policy effectiveness to FI. A similar study was done by Mbutor and Ubar (2013) for Nigeria. The study used commercial bank loans and deposits (% of GDP and the number of bank branches as determinants for FI and CPI inflation rates as proxies for the monetary policy's effectiveness. The study used a simple VAR model and Johansen co-integration test. They concluded based on the estimated results that boosting FI would improve monetary policy effectiveness. Lapukeni (2015) studied the impact of FI on monetary policy effectiveness in Malawi. The study used quarterly data over the period 2001 to 2013. The commercial bank loan and deposit as a percentage of GDP were used as the determinants for FI. The results suggested that FI has some causal effect on monetary policy effectiveness. In 2023, Mabuza examined the impact of FI, measured by the deposit and loan with a commercial bank as a % of GDP, on monetary policy. The Granger causality test was estimated on the quarterly data over the period 2013 to 2022. The study found a unidirectional causality from the effectiveness of monetary policy to FI.

Lenka and Bairwa (2016) looked at how FI affected the efficacy of monetary policy for SAARC nations. Panel data from 2004 to 2013 were used in the study. They created an FI index based on demographic, regional, and bank usage penetrations and utilized inflation as a gauge of the monetary policy's efficacy. After estimating the fixed effect and random effect models, the study came to the conclusion that FI increases monetary policy's efficacy. If financial institutions focus more on the upgraded contemporary banking facilities, the FI can proceed more quickly (Kumar, 2013). Providing banking facilities to the marginalized poor and rural people will make them keep their money in the bank. Thus, there will be no idle money, and FI will make the monetary policy more effective (Mehrotra & Yetman, 2015). By controlling the rate of inflation, FI controls the general price level (Ray & Pravu, 2013).

Huong (2012) investigated the connection between FI and Vietnam's monetary policy's efficacy. An index was created for the FI, and the dependent variable, the inflation rate, serves as a stand-in for monetary policy. The measures for the FI index were the number of ATMs within a 1,000 km² region and the percentage of

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GDP that was allocated to outstanding loans and deposits. The work generated a basic OLS and GLS model using annual data from 2004 to 2015. The study discovered a negative correlation between the inflation rate and FI. A more stable and sustainable economy is facilitated by FI, which also translates into more effective monetary policy. In remote communities, having access to basic financial services will increase economic activity and job opportunities, leading to increased levels of savings and disposable income. According to Khan (2011), a high level of saving will boost bank and other financial institution deposits, which will strengthen the efficacy of monetary policy. According to Mehrotra and Nadhanael (2016), interest rates have a more significant role in the transmission of monetary policy since larger levels of FI show sensitivity to higher interest rates.

The relationship between FI and the efficacy of monetary policy in nine ASEAN nations between 2010 and 2019 was examined by Komala and Widodo (2022). They created the FI index using inflation as a stand-in for the efficacy of monetary policy. The influence on the efficacy of monetary policy of FI was examined using the VECM and the causality test. The study found that FI has a short- and long-term detrimental effect on inflation. According to the study, FI increases monetary policy's ability to effectively manage inflation. FI can alter the channels of monetary transmission by strengthening the importance of interest (Loukoianova & Yang, 2018).

According to Gali et al. (2004), monetary policy rules become unstable when FI is low. Ineffective monetary policy will result from the policy acts not having an immediate impact on those who are financially excluded. Anarfo et al. showed in 2019 that the FI determines how successful monetary policy is in an economy. Jungo et al. (2021) investigated how FI affected the efficacy of monetary policy in Sub-Saharan Africa. According to the study, expanding people's access to affordable financial services and products can lead to better monetary policy transmission. Using a panel VECM model, Brownbridge (2017) investigates the influence on the efficacy of FI's monetary policy. According to the study, economies with high levels of FI are better able to transmit monetary policy than those with low levels. Yetman (2018) examines three ways that monetary policy is impacted by the increased FI. First, the state bank may be obliged to prioritize core inflation above headline inflation because of the rising degree of FI. Second, when FI increases, the interest rate turns into a useful instrument for monetary policy. Investors can finance investments due to the high number of FI immunes, and borrowing demand rises as interest rates decline. Third, the central bank may choose to adjust interest rates in order to ensure optimality and determinacy. For 10 industrialized and 30 developing nations, Arshad et al. (2021) investigate the causal link between monetary policy efficacy and FI from 2004 to 2018. The effect of FI on monetary policy was examined using the structural VAR model. The analysis found no contemporaneous relationship between the efficacy of monetary policy and FI. For developed economies, Granger causality demonstrates that the two variables are causally inversely related. Inclusion is improved by monetary policy, which lowers inflation and increases monetary policy effectiveness. A one-way causal relationship between monetary policy efficacy and FI was noted for developing nations.

Jungo et al. (2022) investigated the relationship in sub-Saharan nations. They utilized the PCA to create a financial inclusion index and concluded that in order

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to maintain monetary policy stability, the government should strengthen financial services to stimulate financial investment in emerging nations. Ridwan's (2022) study looked at the influence of financial inclusion on monetary policy through the interest rate channel. He utilized PCA to create the financial inclusion index. Hussain (2023) investigates the influence of financial inclusion on Iraq's monetary policy.

In summary, there exists a vast amount of literature on how FI affects the efficacy of monetary policy. Numerous scholars have examined this influence for a group of nations, while others have used time series data to examine it for specific nations. To the best of our knowledge, no one has looked at how FI affects Pakistan's monetary policy's efficacy. This research will close this gap and add to the body of knowledge in a developing country like Pakistan, which suffers macroeconomic imbalances.

Material and Methods

This section discusses type and sources of data, empirical model, and econometric methodology.

Data and variable description

The analysis used secondary annual data from 2004 to 2023 for Pakistan. Table 1 lists the data sources and describes them. The ultimate aim of monetary policy is price stability; hence, the CPI inflation rate is frequently employed as a proxy for monetary policy efficiency. In most extant work, the inflation rate is employed as a proxy for monetary policy efficiency. The interest rate, money supply, growth rate, and exchange rate all have an impact on inflation; hence, these variables are utilized as control variables in the model to avoid omitted variable bias. The principal components analysis (PCA) approach is used to create the FI index using supply and demand-side information. The FI index is constructed using two demand-side metrics, namely outstanding deposits and loans as a proportion of GDP with commercial banks. In addition to these two metrics, four supply-side indicators are used: commercial bank branches per 1,000 square kilometers, bank branches per 100,000 adults, total ATMs per 1,000 square kilometers, and ATMs per 100,000 adults. The data for the FI indicators are derived from the IMF financial access survey, while the remaining variables are derived from the World Development Indicators database.

Table 1: Data sources and variables description

Variable	Description	Source
Inflation rate	Inflation, consumer prices (annual %)	WDI
Board money	Broad money (% of GDP)	WDI
Economic growth	GDP growth (annual %)	WDI
Interest rate	Lending interest rate (%)	WDI
Exchange rate	Official exchange rate (LCU per US$, period average)	WDI
FI index	Comprise six indicators	
DCB	Outstanding deposit with commercial banks (% of GDP)	FAS
LCB	Outstanding loans from commercial banks (% of	

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	GDP)
CBBPKM	Number of commercial bank branches per 1,000 km2
CBP	Number of commercial bank branches per 100,000 adults
ATMSKM	Number of ATMs per 1,000 km2
ATMSAD	Number of ATMs per 100,000 adults

Empirical model

This study seeks to explore the influence of FI on monetary policy efficacy. As a result, the inflation rate, which is a proxy for the efficiency of monetary policy, is employed as the model's dependent variable, with the FI index serving as the independent variable. The model's control variables include the exchange rate, wide money, interest rate, and economic growth. Equations (1) and (2) indicate the study's functional connection and empirical econometric model, respectively.

$$Inflation = f\begin{pmatrix} Financial\ Inclusion, \text{Exchange Rate}, Lending\ Rate, \\ \text{GDP Growth}, \text{Broad Money} \end{pmatrix} \quad \dots \quad (1)$$

$$Inflation_t = \beta_0 + \beta_1 \text{financialInclusion}_t + \beta_2 \text{ExchangeRate}_t + \beta_3\ \text{lendingRate}_t + \beta_4 \text{GDPgrowth}_t + \beta_5 \text{broadmoney}_t + \varepsilon_t \quad \dots \quad (2)$$

Econometric methods

Sam et al. (2019) established the augmented ARDL modeling technique of cointegration, which was employed in this work to examine the long-term relationship between variables. A modification of Pesaran et al. (2001)'s ARDL limits technique is the enhanced ARDL bounds approach. According to Sam et al. (2019), the augmented ARDL limits test performed well even when endogenous regressors were present and does not depend on the assumption of an I(I) response variable. Co-integration bounds testing is not appropriate for models containing explosive series or series with integration orders greater than one. The rationale is that if any of the variables discovered are integrated of order more than 1, the bound cointegration test's F-statistic begins to exhibit bias.

Augmented ARDL-bounds approach for Cointegration

The empirical model shall be represented as an unconstrained equilibrium correction model prior to formally testing for level correlations among variables using the enhanced ARDL limits technique (Philips, 2016).

$$\begin{aligned} \Delta Inflation_t = {} & \beta_0 + \theta_0 Inflation_{t-1} + \theta_1 \text{financialInclusion}_{t-1} + \theta_2 \text{ExchangeRate}_{t-1} \\ & + \theta_3 lendingRate_{t-1} + \theta_4 \text{GDPgrowth}_{t-1} + \theta_5 \text{broadmoney}_{t-1} \\ & + \sum_{i=0}^{q} \beta_{1i} \Delta \text{financialInclusion}_{t-p} + \sum_{i=0}^{q} \beta_{2i} \Delta \text{ExchangeRate}_t \\ & + \sum_{i=0}^{q} \beta_{3i}\ \Delta \text{lendingRate}_t + \sum_{i=0}^{q} \beta_{4i} \Delta \text{GDPgrowth}_t \\ & + \sum_{i=0}^{q} \beta_{5i} \Delta \text{broadmoney}_t + \sum_{i=1}^{p} \delta_i \Delta inflation_{t-i} \\ & + \varepsilon_t \quad \dots \quad (3) \end{aligned}$$

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In the augmented ARDL bounds approach, restrictions are imposed on lagged level regressors that enter into the ARDL bounds model in equation (3).

Error correction model (ECM)

The error correction model shows the long run and dynamic relationship between the variables. The ECM for our case is represented by equation (5).

$$\begin{aligned}\Delta Inflation_t = {} & \beta_0 + \theta_0 Inflation_{t-1} + \theta_1 \text{financialInclusion}_{t-1} + \theta_2 \text{ExchangeRate}_{t-1} \\ & + \theta_3 lendingRate_{t-1} + \theta_4 \text{GDPgrowth}_{t-1} + \theta_5 \text{broadmoney}_{t-1} \\ & + \sum_{i=0}^{q} \beta_{1i} \Delta \text{financialInclusion}_{t-p} + \sum_{i=0}^{q} \beta_{2i} \Delta \text{ExchangeRate}_t \\ & + \sum_{i=0}^{q} \beta_{3i} \Delta \text{lendingRate}_t + \sum_{i=0}^{q} \beta_{4i} \Delta \text{GDPgrowth}_t \\ & + \sum_{i=0}^{q} \beta_{5i} \Delta \text{broadmoney}_t + \sum_{i=1}^{p} \delta_i \Delta inflation_{t-i} \\ & + \varepsilon_t \qquad \ldots (4)\end{aligned}$$

The coefficients β_{ji} $(where\ j = 1, \ldots, 5)$ on variables with Δ sign show the short run dynamic relationship among the variables. The lag length can be selected based on optimal lags selection criteria. The coefficient θ_0 on lagged level dependent variable $(Inflation_{t-1})$ represent the value of adjustment into the long run equilibrium. The long run coefficient for any variable in the model can be extracted by the ratio of the coefficient of that variable to the coefficient of lagged level dependent variable $\pi_i = \frac{\theta_i}{\theta_0}, where\ [i = 1, \ldots 5]$. The standard errors of the long-run coefficients can be computed by utilizing the delta method. The relationship is implicitly included in the ECM term.

Long-run Granger causality

To test the long-run Granger causality between the FI and monetary policy effectiveness, we used the ECM representation, as suggested by Hendry et al. (1984) and Johansen (1988), for the co-integrating variables. The ECM representation shows two sources of causation for monetary policy effectiveness, either through the lagged co-integrating vector or through the lagged terms of first differenced FI.

In this case, we imposed zero restrictions on the coefficients of the ECM term and lagged values of the variable of interest in equation (5). Long-run causality exists when the coefficient of the co-integrating vector is statistically and economically significant. A brief discussion on long-run causality is found in Hall and Asteriou (2016, pp. 285).

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$$\Delta Inflation_t = \beta_0 + \sum_{i=0}^{p} \beta_{1i} \Delta \text{financialInclusion}_{t-p} + \sum_{i=0}^{p} \beta_{2i} \Delta \text{ExchangeRate}_t + \sum_{i=0}^{p} \beta_{3i} \Delta \text{lendingRate}_t + \sum_{i=0}^{p} \beta_{4i} \Delta \text{GDPgrowth}_t + \sum_{i=0}^{p} \beta_{5i} \Delta \text{broadmoney}_t + \sum_{i=0}^{p} \delta_i \Delta inflation_{t-i} + \theta ECM_{t-1} + \varepsilon_t \quad \ldots (5)$$

The null hypothesis: $\beta_{1i} = 0$ *and* $\theta = 0$. And the alternative hypothesis is: at least one of the coefficients is not equal to zero.

Results and Discussion

In this section, we have graphically checked the behavior of all included variables and econometrically examined the impact of FI on monetary policy effectiveness by utilizing the autoregressive distributed lags model (ARDL).

Graphical Analysis

Before estimating a formal regression model, it is customary to know the structure of the data by utilizing the visual inspection method. In this method, one can plot the series and visually inspect its behavior. It tells us about the possible outliers, missing values, trend, seasonal effects, and some kinds of structural breaks and level shifts. Therefore, owing to the above-mentioned benefits, we have plotted all the series in figure 1. According to the CPI time series graphic, the inflation rate series peaked in 2008 at 20%. This shows unequivocal proof of the worldwide financial crisis of 2008. The inflation rate subsequently steadily decreased until 2015 before rising once further to 30% in 2023. Political unrest and rising energy prices worldwide are to blame for this sharp increase in the inflation rate. The CPI graph shows no missing values and no other issues. The time series of exchange rates is steadily increasing throughout the analysis periods. It shows a clear upward trend. The lending rate smoothly increased until 2011 and then steadily declined until 2017. The highest lending rate is recorded in 2023. The GDP growth time series plot shows that the growth rate was high in 2004 and then declined very sharply until 2008. This sharp decline in GDP growth was the consequence of war and terror in Pakistan and global financial crises. The GDP growth rate reached the lowest of all time in 2020 because of the global health crisis, the COVID-19 pandemic. The broad money shows a stable pattern over the years, except in the year 2006. Figure 1 also plotted the index of FI. It shows trending behaviors, which means that FI in Pakistan is increasing over time.

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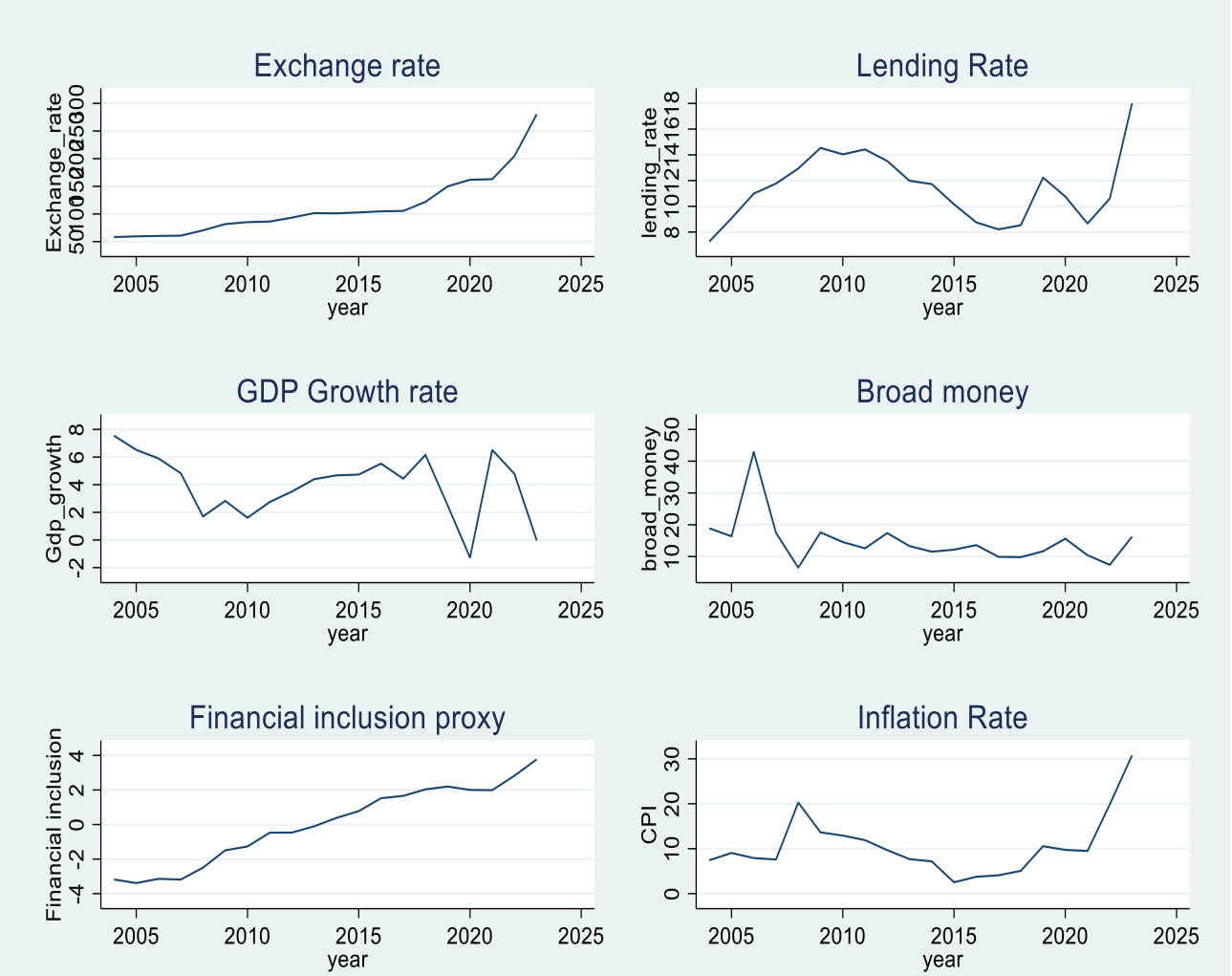
Figure 1: Visual inspection of the variables



Source: Authors' own calculation

Descriptive statistics

Table 2 displays the variables' summary statistics. From 2004 to 2023, Pakistan's CPI inflation rate averaged 10.5%, reaching a peak of 30.76%. The political unrest in the shape of a regime change operation is to blame for the highest inflation rate, which stands at 30.76%. From 2004 to 2023, the average exchange rate between Pakistani rupees and US dollars was 112.67. Over these time periods, the highest exchange rate ever noted is 280.35. During the 2004–2023 research period, the average loan rate was 11.4%, with a maximum of 18%. With a peak of 7.54%, the average GDP growth rate is 3.97%. With a maximum value of 42.9%, the average annual wide money growth rate is 14.80%.

Table 2: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
CPI	20	10.565	6.646	2.529	30.768
Exchange rate	20	112.669	55.867	58.258	280.356
lending rate	20	11.408	2.674	7.258	18.000

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Gdp growth	20	3.979	2.283	-1.274	7.547
broad money	20	14.806	7.470	6.525	42.909
FI	20	9.31E-09	2.261	-3.388	3.774

Source: Author

Unit root tests results

Based on visual examination, the ADF and Phillips-Perron unit root tests are computed for all variables using drift and no trend specification. The results of both tests are presented in Table 3. Both experiments found that the variables CPI, FI, loan rate, and exchange rate are stationary at first difference. It signifies that these variables are integrated with order one, I(1). The variables broad money and GDP growth are stationary at the level, thus they are integrated with order zero I(0).

Table 3: Unit Root tests results

Variables	ADF unit root Test (with drift, no trend)		Phillips-Perron (PP) test (with drift, no trend)	
	Level	1st Difference	Level	1st Difference
CPI inflation	-0.251	-3.398**	-0.388	-3.383**
Broad Money M2	-3.612***		-3.569***	
Financial inclusion	-2.699	-3.612**	-1.911	-3.645**
GDP growth	-3.277**		-3.137**	
Lending Rate	-2.095	-3.016**	-2.104	-2.783*
Exchange rate	0.222	-3.059**	2.180	-3.7602**

Source: Authors' own calculation

Augmented ARDL bounds tests for Cointegration

Unit root tests demonstrate that no variable is integrated with an order larger than one. As a result, the enhanced ARDL limits technique is used to examine the long-term relationship between variables. The lags length in the augmented ARDL model is chosen using the optimum BIC criteria. The BIC criteria assigned a maximum of one lag to each variable in the model. We estimated an ARDL (1,1,1,1,1,1) model in ECM form and looked for potential cointegration between variables. Table 4 summarizes the bound cointegration test findings.

At the five percent significance level, the total F-statistic for the entire model is in-between the two bounds at the ten percent significance level and extremely near to the lower bound critical value. At a significance level of 5%, the t-statistic likewise falls between the upper and lower bound critical values. When it comes to lagged independent variables, the F-statistic is below the crucial values at the 5% and 10% levels of significance. A degenerate lagged independent variables example yields inconclusive findings according to the test statistics for the entire model. In order to address the issue of ambiguous findings, we have embraced Phillips' (2016) paradigm.

We excluded the lagged level stationary variables "GDP growth" and "broad money supply" from our long-run cointegration equation. This is because level stationary independent variables do not co-integrate with the I(1) dependent variable. These factors were only considered in first difference form since they may have a short-run link with the inflation rate. The simplified model is calculated and retested for cointegration. The reduced enhanced ARDL limits

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model for cointegration yielded unsatisfactory results. Furthermore, we removed the I(1) independent variable "lending rate" from our model and examined the findings for a long-term connection. The final model's result shows that there is cointegration between the independent variables "financial inclusion" and "exchange rate" and the dependent variable "inflation rate." Since the augmented bounds test clearly shows that cointegration exists, we went on to estimate and interpret the equilibrium correction model. This time, the values of all three test statistics fall outside the 10% upper bounds critical values.

Table 4: Augmented ARDL bounds test results

	Test statistics for full model					
Test	Test-statistics	5% critical values		10 % critical Values		Decision
		I(0)	I(1)	I(0)	I(1)	
Overall F-test	3.120	3.125	4.608	2.578	3.858	Inconclusive
T-test	-3.900	-2.860	-4.190	-2.570	-3.860	
F-test on lagged independent variables	2.07	2.65	4.54	2.12	3.76	
Test statistics after excluding stationary regressors						
Overall F-statistic	2.770	2.450	3.630	2.010	3.100	Inconclusive
T-statistic	-3.020	-1.950	-3.330	-1.620	-3.000	
F-statistic on lagged independent variables	3.12	3.00	4.96	2.32	3.99	
Test statistics after excluding non-cointegrated regressor						
Overall F-statistic	3.490	2.720	3.830	2.170	3.190	Conclusive
T-statistic	-3.150	-1.950	-3.020	-1.620	-2.680	
F-statistic on lagged independent variables	4.56	3.40	5.60	3.53	4.42	

Source: Authors' own calculation

Long term estimates of the ARDL model

Adopting the Phillips (2016) approach, it remained only two regressors "financial inclusion" and "exchange rate" in our long-run cointegration equation. The long-run coefficients are estimated by applying $\pi_i = \frac{\theta_i}{\theta_0}, where\ [i = 1,2]$ recipe. The standard errors of the long-run coefficients are computed using the delta approach. Table 5 summarizes these findings. The results reveal that in the long term, the FI index has a negative and statistically significant influence on CPI

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inflation. It means that better FI decreases inflation in the economy and makes monetary policy more effective. This conclusion is consistent with those of Lenka and Bairwa (2016), Evans (2016), and Mbutor and Uba (2013). In contrast, the exchange rate has a positive and statistically significant effect on the CPI inflation rate. It indicates that the depreciation of Pakistani rupees results in higher CPI inflation in the long run.

Table 5: Long run estimates of ARDL model

Variable	**Coefficient**	**Standard error**	**t-statistic**
FI	-6.023	1.409	-4.27
Exchange rate	0. 101	0.022	4.48

Short run estimates

The results of different specifications of the error correction model are given in Table 6. The first column shows the results of the full model, which provide inconclusive results regarding cointegration. Therefore, the full model is not interpretable. The second column shows the results of the ARDL bounds model without including the stationary lagged level "GDP growth" and "broad money" regressors. This specification also provided inconclusive results for the level relationship between CPI inflation and the included regressors. The final column has showcased the results of the final model. The final model has excluded both stationary level regressors as well as the I(1) "lending rate" regressor. The final specification demonstrated a cointegration connection between variables, which should be viewed in terms of speed of adjustment and dynamic association. The speed of the adjustment term is substantial, with an expected negative sign. It shows that around 80% of the divergence in the short run will converge to equilibrium in the long run during the following decade. The findings also demonstrate that, in the near run, only the "exchange rate" and "financial inclusion" have statistically significant effects on the CPI inflation rate. The impact of "exchange rate" is favorable, but "financial inclusion" is negative. All remaining determinants are statistically negligible.

Table 6: Short run estimates of ARDL model and ECM term

VARIABLES	(1) Full Model	(2) Excluding $Gdp_{growth_{t-1}}$ $broad_{money_{t-1}}$	(3) Excluding $Gdp_{growth_{t-1}}$ $broad_{money_{t-1}}$ $lending_{rate_{t-1}}$
$\frac{ECM}{CPI_{t-1}}$	-1.772***	-0.978**	-0.801***
	(0.455)	(0.324)	(0.254)
$Exchange_{rate_{t-1}}$	0.208*	0.0502	0.0812**
	(0.0899)	(0.0449)	(0.0284)
$lending_{rate_{t-1}}$	-0.175	0.485	
	(0.974)	(0.542)	

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$lbroad_{money_{t-1}}$	-6.149		
	(4.038)		
$Financial_{inclusion_{t-1}}$	-12.98**	-3.643	-4.822**
	(4.564)	(2.405)	(1.994)
$Gdp_{growth_{t-1}}$	-1.767		
	(1.244)		
$\Delta Exchange_{rate_t}$	0.358**	0.334**	0.311**
	(0.148)	(0.134)	(0.130)
$\Delta lending_{rate_t}$	0.0514	0.0962	-0.236
	(0.926)	(0.862)	(0.771)
ΔGdp_{growth_t}	-0.852	-0.230	-0.317
	(0.522)	(0.373)	(0.357)
$\Delta broad_{money_t}$	-0.155	-0.0633	-0.0811
	(0.103)	(0.0806)	(0.0774)
ΔFinancial inclusion$_t$	-25.34*	-27.67**	-22.99*
	(13.02)	(11.79)	(10.47)
Constant	20.14		
	(15.06)		
Observations	19	19	19
R-squared	0.895	0.824	0.810

Source: Authors' own calculation
Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Long run Granger causality

To estimate the long run causality, after estimating the co-integration, is to make restrictions on the coefficient of ECM and coefficients of the variables of interest in short run dynamics. In this particular case, we have imposed restrictions on the coefficient of ECM and D. FI. The F-test statistic shows that the long run causality runs from FI to monetary policy effectiveness. The Wald F-test statistic results are given below.

F-statistic	**Ho:** $\beta_{1i} = 0 \ and \ \theta = 0$ **H1:**at least 1 coefficient is not zero **Ho:** $\theta = 0$ **H1:** $\theta \neq 0$	
	DF	P-value
5.52	(2,11)	0.0219
9.92	(1,11)	0.0092

Diagnostic checking

The validity of the model depends upon the model fit and model stability. Table 7 shows the diagnostic test results. The results indicate that our model has no autocorrelation and heteroskedasticity problems because the probability values are greater than the benchmark value of 0.05. The model also passed the misspecification test. It means that our model is not mis-specified and fulfills the basic assumptions of the regression model.

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Table 7: Diagnostic tests results

Test	Statistic	Probability value
Normality	0.537	0.4873
Serial correlation	1.468	0.2257
Heteroscedasticity	1.27	0.2601
Ramsey RESET	2.88	0.2038

Source: Authors' own calculation

Conclusion and Policy Implications

The study evaluated the effects of FI on the efficacy of monetary policy, as measured by the inflation rate. The study used the CPI inflation rate as a proxy for the efficacy of monetary policy. The FI index is calculated using supply and demand access indicators such as outstanding loans and deposits as a percentage of GDP with commercial banks, the number of bank branches in a 1,000-square-kilometer area, the number of bank branches per 100,000 adults' population, the total ATMs in a 1,000-square-kilometer area, and the number of ATMs per 100,000 adults.

To address model misspecification, control variables such as broad money M2, loan rate, exchange rate, and GDP growth are employed. The CPI inflation rate is employed as the dependent variable, while the FI index, the core variable, serves as the independent variable. The regression model is estimated using time series data collected between 2004 and 2023. Line graphs are used to visually evaluate the data. The data had no outliers, missing values, or other time series issues. The ADF and Phillips-Perron unit root tests are used to determine the stationarity of the variables. The wide money and GDP growth variables are stationary at the level, whereas the other variables are stationary at first difference.

All of the regressors have a mixed order of integration, and the dependent variable, the CPI inflation rate, is I(1). The co-integration connection is checked using Sam et al.'s (2019) enhanced ARDL bound technique due to the data's characteristics. The co-integration link between the variables was validated using the enhanced ARDL bound test. For investing in the long-term and short-term dynamic connection, the equilibrium correction mechanism and long-term equation are employed. The findings verified that the FI and the CPI inflation rate had an inverse connection over the long term. CPI inflation and the currency rate are positively correlated.

Additionally, a negative dynamic association between "CPI inflation" and "financial inclusion" was established by the data. Additionally, there is a positive dynamic correlation between the "exchange rate" and "financial inclusion." The broad money supply, lending rate, and GDP growth do not significantly correlate with "CPI inflation." Long-term Granger causality between "financial inclusion" and "CPI inflation" was also examined in the study. We discovered a long-term causal relationship between monetary policy efficacy and FI.

We can conclude from the results that FI improves monetary policy effectiveness in Pakistan over the long term and that the exchange rate hike has a positive impact on CPI both in the short and long term, which deteriorates the effectiveness of monetary policy. The study found that FI has a significant contribution to the effectiveness of monetary policy over the long term, which is consistent with the findings of other researchers from other countries. Granger

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causality in the long term runs from FI to the efficacy of monetary policy. Given that the study shows that FI has a short- and long-term detrimental influence on CPI inflation, policymakers are advised to promote poor and marginalized individuals' access to financial services and products in order to increase the efficacy of monetary policy. The study's conclusions suggest that policymakers should monitor the exchange rate in order to ensure price stability and the efficacy of monetary policy.

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