

The Asymmetric Transmission of Monetary Policy to Price Stability in Sub-Saharan Africa: A Non-Linear Panel ARDL Approach

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ABSTRACT

This study investigates the asymmetric relationship between monetary policy instruments and price stability for a panel of 39 Sub-Saharan African countries for the period 1995 to 2024. The study starts from the counter-intuitive premise of asymmetric policy effects and uses a sophisticated Non-linear Panel Autoregressive Distributed Lag (N-PARDL) model estimated by the Pooled Mean Group (PMG) estimator, with results compared to the Mean Group (MG) and Dynamic Fixed Effects (DFE) estimators, which capture both short- and long-run asymmetries in the interest rate-inflation nexus. The methodological approach allows for the monetary policy rate to be decomposed into parts – positive (tightening) and negative (easing) – to examine the asymmetric transmission in detail. Empirical results reveal significant asymmetry in both temporal dimensions. The results are robust to comprehensive post-estimation diagnostics, including cross-sectional dependence tests, panel serial correlation tests, panel heteroscedasticity tests, panel stability tests, and a robustness check using an alternative inflation measure. Caution should be taken in interpreting the results as causal effects, as the policy rate can be endogenous. Such results call into question the linear policy paradigm and show the need for central banks in SSA to be more flexible and asymmetric in their policymaking.

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INTRODUCTION

The maintenance of price stability remains the paramount objective of monetary policy across the global economic landscape. For central banks, particularly those in developing regions, the ability to control inflation is not merely a technical exercise but a fundamental prerequisite for sustainable economic growth, poverty reduction, and the preservation of household purchasing power. Sub-Saharan Africa (SSA) presents a unique and challenging context for monetary policy implementation. The region is characterised by a confluence of factors: persistent inflationary pressures, shallow and underdeveloped financial markets, a high degree of informality in economic activities, frequent exposure to supply-side shocks such as volatile commodity prices and climatic disruptions, and institutional frameworks that are still in the process of consolidation. These structural peculiarities raise critical questions about the applicability of conventional monetary policy frameworks, which were largely designed for and tested in the context of advanced economies.

A growing body of evidence confirms that monetary policy transmission in SSA is constrained by structural features unique to the region. Recent IMF research by Tiedemann and Bizimana (2026) reassesses monetary policy transmission in emerging and frontier markets in SSA and finds that while the bank-based interest rate channel is operative, transmission is notably weaker than in more developed economies, with cross-country heterogeneity largely reflecting differences in monetary policy transparency, financial development, and fiscal dominance. Their findings also document an “exchange rate puzzle,” wherein interest rate hikes alone are insufficient to systematically influence exchange rate movements. This evidence underscores the need to examine the monetary policy-inflation nexus through frameworks that account for these structural frictions rather than assuming the canonical linear transmission mechanism.

The traditional theoretical foundation of monetary policy that stems from the New Keynesian and monetarist school assumes a linear and symmetric transmission mechanism. In this orthodox model, an increase in the central bank’s policy rate, known as a contractionary monetary policy shock, is anticipated to trickle down through the financial system, causing commercial lending rates to hike up, aggregate demand to slow down and price levels to fall, thereby pulling inflation down. On the other hand, an expansionary shock (a cut in the policy rate) is expected to boost demand and raise inflation. This symmetrical relationship, which is usually part of the Taylor rule framework, suggests that the absolute value of the impact of tightening is the same as the absolute value of the impact of easing, but the sign is reversed (Clarida et al., 1999; Taylor, 1993).

Over the past few years, however, the implicit assumption of linearity and symmetry has been called into question. It is recognised in both the theoretical and empirical literature that the monetary policy transmission mechanism is not linear and is highly asymmetric. These asymmetries might result from downward nominal wage and price rigidities, which allow contractionary policy to be more effective at reducing output than inflation (Ball & Mankiw, 1994), credit market frictions and asymmetric information that can cause a credit rationing effect, which is heightened when policy is contractionary (Stiglitz & Weiss, 1981) and the reversal rate phenomenon, which arises when extremely low interest rates do not necessarily stimulate bank lending as intended (Brunnermeier & Koby, 2023).

For Sub-Saharan Africa, it is perhaps even more likely that the transmission is asymmetric. Financial systems in many SSA countries are concentrated, with limited competition, and mainly characterised by short-term lending. These features can make for a slow initial adjustment of commercial lending interest rates to policy rate changes, which may also be non-linear in the sense that banks might be quick to increase rates when the policy rate is raised, but slow to decrease when the policy rate is cut, a characteristic that is commonly explained by the power of banks and their willingness to keep interest margins (Davoodi et al., 2013; Mishra et al., 2014).

Furthermore, the prevalence of supply-side shocks, such as food and energy price volatility, can interact with monetary policy in a non-linear fashion. A policy tightening aimed at curbing demand-pull inflation may be rendered ineffective if inflationary pressures are primarily driven by supply-side bottlenecks, and could, in fact, exacerbate the situation by raising the cost of credit for businesses seeking to expand supply capacity (Aziakpono & Wilson, 2013).

Empirical evidence for SSA further supports the asymmetric nature of exchange rate and inflation dynamics. Kassi et al. (2019) examine the asymmetrical relationship between exchange rate and consumer prices in 40 SSA countries using a non-linear autoregressive distributed lag (NARDL) framework and find that pass-through is higher during depreciation of the local currency than after appreciation, particularly in the short term and especially in the CFA Franc zone. Their results also indicate that pass-through is greater during large exchange rate changes than after small changes, and is higher in countries with fixed exchange rate regimes in low inflationary environments. These findings reinforce the importance of accounting for asymmetries and nonlinearities when analysing monetary policy transmission in the region.

Even though there is some theoretical support for asymmetric transmission in SSA, there is not a lot of literature on the topic. The studies conducted to date are largely country-specific and use linear models like the standard Autoregressive

Distributed Lag (ARDL) model, which make the assumption that an increase in the interest rate has the same impact as a decrease in the interest rate. The models used to establish long-run relationships are certainly misspecified in the presence of asymmetry and may produce biased and inconsistent estimates of the coefficients and policy conclusions. Only a few studies have explored non-linear frameworks, which usually have small sample sizes and short time periods and therefore are not generalizable.

While existing studies have established the presence of asymmetry in SSA, three critical gaps remain unaddressed. First, no study has systematically compared the performance of MG, PMG, and DFE estimators within an N-PARDL framework for this region, leaving uncertainty about the most appropriate estimator for analysing asymmetric monetary policy transmission. Second, existing panel studies have not adequately addressed cross-sectional dependence and slope heterogeneity, potentially biasing estimates and compromising inference. Third, the endogeneity of the policy rate, arising from the central bank's reaction function, has not been formally acknowledged or addressed in the empirical specification. The specific unresolved question this study addresses is: Within a non-linear panel ARDL framework, which estimator is most appropriate for analysing asymmetric monetary policy transmission in SSA, and does the asymmetric relationship between the policy rate and inflation remain robust when cross-sectional dependence, slope heterogeneity, and endogeneity are carefully considered?

This study aims to fill these critical gaps by moving beyond country-specific, linear analyses to provide a comprehensive, regional, and methodologically robust investigation of the asymmetric relationship between monetary policy and price stability over an extended sample period from 1995 to 2024. The study makes several significant contributions to the literature. First, it adopts a panel approach covering a comprehensive group of 39 SSA economies, meeting the sample size requirements for panel ARDL estimation and enhancing the generalizability of the findings. Second, it employs an advanced Non-linear Panel Autoregressive Distributed Lag (N-PARDL) model that explicitly decomposes the policy rate into its positive and negative components, allowing for the separate estimation of long-run and short-run coefficients for monetary policy tightening and easing. Third, it presents and compares results from all three N-PARDL estimators (MG, PMG, DFE) and justifies the selection of the PMG estimator as the most efficient based on theoretical considerations and the Hausman test. Fourth, it incorporates a comprehensive robustness test using an alternative measure of inflation to validate the core findings. Fifth, it formally tests for both long-run and short-run asymmetry using Wald tests, moving beyond the descriptive observation of coefficient differences.

On the basis of the theoretical and empirical literature explored, four explicit research hypotheses are developed. H1: The link between the monetary policy rate and the inflation rate is asymmetrical, meaning that the former has a different effect on the latter when it is negative than when it is positive. H2: The impact of the monetary policy rate on inflation is asymmetrical, meaning that monetary policy shocks have different effects when they are implemented when the rate is cut as opposed to raised. H3: The PMG estimator outperforms the MG and the DFE estimators when analysing the asymmetric monetary policy-inflation nexus in SSA, because it (PMG) can strike a balance between the long-run homogeneity and short-run heterogeneity. H4: The asymmetric link between policy rate and inflation is also not sensitive to the use of alternative inflation measures, namely core inflation.

It is important to state from the outset that the empirical model employed in this study identifies asymmetric associations rather than causal effects. This distinction is critical because monetary policy is endogenous; central banks typically raise policy rates in response to rising inflation. Consequently, a positive coefficient for positive changes in the policy rate may reflect either a cost-push mechanism, where higher financing costs are passed on to consumers, or the central bank's endogenous response to inflation, commonly referred to as the policy reaction function. Without a credible identification strategy such as instrumental variables or a natural experiment, the results should be interpreted as conditional correlations that describe the asymmetric dynamic relationship between the policy rate and inflation, not as causal effects. This caveat applies throughout the interpretation of the findings. The central objective is to answer a pivotal question for policymakers in the region: Does the association between monetary policy and inflation differ significantly depending on whether the central bank is raising or lowering interest rates? The findings are expected to offer critical insights for the calibration of monetary policy in a region where achieving and maintaining price stability remains a formidable and persistent challenge.

THEORETICAL AND EMPIRICAL LITERATURE

Theoretical Foundations of Asymmetric Monetary Policy Transmission

The theoretical justification for the non-linear and non-symmetric link between monetary policy instruments and economic performance, in particular on inflation, is based on three fundamental mechanisms that violate the classical notion of linearity and symmetry. All these mechanisms imply that the transmission of monetary policy shocks depends on economic conditions, the sign of the shock, and the financial system's structural features. To keep the

analysis as clear as possible and limit the number of theoretical arguments, this section is divided into three main mechanisms: nominal price and wage rigidities, credit market frictions and the balance sheet channel, and supply-side shocks and cost-push mechanisms. It is recognised that the reversal interest rate, as a theoretical possibility, should be considered supplementary and is not known to be the main mechanism for the SSA context, based on limited empirical evidence.

Nominal Price and Wage Rigidities

The first core mechanism is based on the notion of “downward nominal rigidities.” In the New Keynesian paradigm, prices and wages are in general sticky, but they are stickier in the downward direction. There are several reasons why firms may be hesitant to reduce prices or wages, such as menu costs, the risk of industrial action by their employees, and the need to keep workers happy and productive (Akerlof et al., 1996; Ball & Mankiw, 1994). It means that when there is a positive shock to aggregate demand, e.g., expansionary monetary policy, the price may change upward relatively easily, causing inflation to increase. However, in response to a negative demand shock, such as contractionary monetary policy, prices are sticky downwards, and the burden of adjustment falls disproportionately on output and employment. Consequently, contractionary policy may be more effective at reducing output and employment than at reducing inflation, creating an asymmetric effect. In terms of the empirical model, nominal price rigidity predicts that positive changes in the policy rate should have a negative or null effect on inflation, as demand contraction dominates, while negative changes in the policy rate should have a positive or null effect, as demand expansion dominates. However, in the presence of supply-side rigidities, this prediction may be reversed, which is captured by the cost-push mechanism discussed below.

Credit Market Frictions and the Balance Sheet Channel

The second core mechanism operates through credit market frictions and the balance sheet channel. The seminal work of Stiglitz and Weiss (1981) on credit rationing demonstrates that under conditions of asymmetric information, banks cannot perfectly distinguish between high-risk and low-risk borrowers. In such an environment, raising interest rates can lead to adverse selection and moral hazard, potentially causing banks to ration credit rather than increase lending rates for all borrowers. This suggests that the effect of a monetary policy tightening on bank lending is not linear. In a contractionary policy, the supply of credit can also decrease drastically due to bank risk aversion. On the other

hand, when the central bank reduces interest rates in an expansionary policy, banks might not be able to match that rate cut for lending, as they may still be worried about the creditworthiness of borrowers or about their own balance sheets. This leads to a floors effect: When monetary policy tightens, the credit channel works well and can constrain activity, but when it eases, it could jam or fail to affect activity, particularly after a financial crisis or balance sheet stress (Bernanke & Gertler, 1995; Kiyotaki & Moore, 1997). As far as the empirical model is concerned, the empirical result for the absolute value of the coefficient on positive changes in the policy rate is larger than the coefficient on negative changes, suggesting more contraction in credit supply when the policy rate is tightened, which is consistent with the notion of credit market frictions.

In this framework of credit, the reversal interest rate can be interpreted as an extreme form of credit market friction. The idea, originally suggested by Brunnermeier and Koby (2023), is that as the policy rate is lowered, it can actually have a negative effect on the economy beyond a certain point. This is because banks' net interest margins are tight when interest rates are extremely low. Further decreases by the central bank lead to a larger decline in interest income on bank assets than a decline in interest paid on bank liabilities. If these banks start to make a loss, they can cut down their lending to save on capital, and this may have the effect of making monetary policy ineffective or even counterproductive. The zero-lower bound phenomenon is a subject that is frequently mentioned in the context of advanced economies and countries that have gone through it; however, it has a theoretical relevance to SSA countries that are characterised by fragile banking sectors. However, in this context, the reversal rate is less likely to be the main factor, as the policy rate in our sample ranges between 3.5 per cent and 33.5 per cent with an average of 14.83 per cent, and is therefore included as a secondary theoretical possibility, instead of as a central mechanism.

Supply-Side Shocks and Cost-Push Mechanisms

The third basic mechanism, and most pertinent to the paradoxical results that were expected in this study, is the non-linear interaction between monetary policy and supply-side shocks. The effectiveness of monetary policy is not always constant, as in economies which experience frequent and large supply shocks, such as food price increases, oil price fluctuations or droughts. A positive supply shock will unambiguously lead to a decrease in inflation, while a negative supply shock will increase inflation and decrease output, thus establishing a classic cost-push phenomenon. A conventional policy response to such a shock would be to raise interest rates to curb inflation, but this may exacerbate the output decline. In such an environment, the effect of a monetary policy change is contingent on

the nature of the shock and the state of the economy. Furthermore, in countries with rigidities, an increase in the policy rate may feed directly into production costs, leading to a cost-push effect where firms pass on higher financing costs to consumers, thereby potentially having a perverse inflationary effect in the short run (Aziakpono & Wilson, 2013). In terms of the empirical model, the cost-push mechanism predicts that positive changes in the policy rate are associated with higher inflation, yielding a positive coefficient for θ^+ , while negative changes in the policy rate may be associated with lower inflation if the reduction in financing costs stimulates supply-side capacity, yielding a negative coefficient for θ^- .

Synthesis of Empirical Literature on Asymmetric Monetary Policy

The empirical literature on asymmetric monetary policy transmission has evolved considerably, with a discernible trajectory from simple linear models to sophisticated non-linear frameworks. This review of the existing literature highlights some themes and an emerging consensus about the existence of asymmetry, especially in the context of developing economies. The foundational evidence from advanced economies established the conceptual and methodological groundwork. Cover (1992), in a seminal contribution using structural VAR for the United States, found that negative money supply shocks significantly affected output, while positive shocks had no discernible effect, challenging the linearity assumption and providing initial support for the credit channel hypothesis. Tenreyro and Thwaites (2016) extended the state-dependence argument to a panel of advanced economies, describing the phenomenon where monetary policy is less powerful in stimulating economies during recessions than in cooling them during expansions.

The empirical literature on Sub-Saharan Africa has built upon these foundational insights and increasingly converged on the finding of significant asymmetry. Onatunji and Adejumo (2024) investigated the asymmetric Phillips curve in ECOWAS countries using NARDL and panel NARDL techniques, dividing the sub-region into WAEMU and WAMZ blocs, and found evidence of asymmetric relationships between inflation and its determinants. In a country-specific application, Abdulai (2022) employed a NARDL framework for Ghana and found that monetary policy rate changes have asymmetric effects on output growth, while the relationship between money growth and RGDP growth was also asymmetric ($t = -2.3053$). Aziakpono and Wilson (2013) examined interest rate pass-through in South Africa using symmetric and asymmetric error correction modelling techniques and found that the speed of adjustment varies across rates, with evidence of asymmetric adjustment in market interest rates to changes in the official bank rate.

The role of the exchange rate channel in asymmetric transmission has also received significant attention. Kassi et al. (2019) investigated the asymmetric exchange rate pass-through to consumer prices in 40 SSA countries using a NARDL framework and found an asymmetrical ERPT in the SSA region during the short term, with pass-through being higher during depreciation of the local currency than after appreciation, especially in the CFA Franc zone. Consistent with this result, Kemoe et al. (2024) studied the pass-through of exchange rate changes in SSA and conclude that the sensitivity of pass-through in SSA is about 8 times higher during exchange rate depreciations than during appreciations, and that the asymmetry is greater for large depreciations and for countries with fixed exchange rates. More recently, Magubane (2025) used a quantile ARDL model to analyse the impact of monetary conditions on the financial cycle for South Africa and found that the effect of monetary conditions on the financial cycle was quantile-specific, with monetary policy and the housing sector playing important roles in the long-term evolution of the financial cycle in South Africa. Tiedemann and Bizimana (2026) re-examined the transmission mechanism of monetary policy in SSA emerging and frontier markets and concluded that the process of monetary transmission was more robust in the inflation-targeting group, while cross-country variability was largely driven by variation in monetary policy transparency, financial development and, to a smaller degree, fiscal dominance.

This empirical literature can be synthesised into a number of parallel themes. One is that in both developed and developing countries, the monetary policy transmission mechanism is asymmetric. Second, there are many sources of asymmetry, such as downward price rigidities, credit market frictions, bank pricing behaviour and structural supply-side constraints. Third, asymmetries are context-dependent and have been more severe and sometimes counterintuitive in developing economies, especially in SSA, with increasing structural rigidities and financial market imperfections. Fourth, the transition from linear VAR and ARDL models to non-linear models like threshold models and NARDL has been crucial in revealing these asymmetries. Furthermore, there has been a recent tendency towards the panel NARDL and quantile ARDL methods, which allow researchers to find regional commonalities but still capture country-specific heterogeneity.

However, it is worth to note that the empirical literature does not sufficiently consider the following alternative explanations for the observed asymmetric relationships. Policy endogeneity is an important unobserved variable, a result of the central bank's reaction function. So, when inflation increases, central banks usually increase policy rates, leading to a positive correlation between the policy rate and inflation and a mistaken interpretation that the policy rate is causing inflation. In the case of fiscal dominance, i.e. when the needs

of government borrowing dictate monetary policy, the policy rate-inflation relationship can also be distorted. Some other factors can complicate the estimated relationships, such as expectations and inflation persistence, central bank credibility and independence, and exchange rate regime classification. These missing explanations are explored in more detail later in the interpretation of the results (Section 4.5) and highlight the need for the results to be interpreted as associations, not causes.

Integration of Theoretical Mechanisms with the Empirical Model

In order to show that the theoretical framework directly relates to the empirical analysis, this subsection connects each of the three fundamental mechanisms with variables in the estimated equation and the expected signs for each. The empirical model (Equation (3) in Section 3.3) contains the positive and negative partial sums of the policy rate (INTR^+ and INTR^-), and the control variables of real GDP growth (RGDP), money supply growth (MS), and exchange rate depreciation (EXC).

The nominal price and wage rigidity mechanism has a negative or null long-run coefficient of the effect of policy rate changes, denoted as θ^+ . Contractionary policy reduces demand and thus slows down inflation. The sign of the long-run coefficient (θ^-) of negative policy rate changes is expected to be positive or null because an increase in the policy rate will lead to an increase in demand and therefore inflation. If the estimates are confirmed by such forecasts, then it would be possible to conclude that the classical monetary policy transmission mechanism, involving the demand side, is at work. If the estimates differ from these forecasts, however, especially if there is a positive value for θ^+ , that implies that other mechanisms like the cost-push channel are dominant.

In the case of the credit market friction mechanism, the “expected” pattern is the absolute value of θ^+ being greater than the absolute value of θ^- . This forecast is based on the fact that credit growth slows down more strongly in tightening cycles than in easing cycles, as the banks are risk-averse and have balance sheet limitations. When the estimated coefficients show this pattern, results are consistent with the credit channel hypothesis. Further, the coefficient of the control variable money supply growth (MS) should be positive, which is in line with the monetarist view that excessive monetary growth causes inflation. It is expected that the coefficient of the exchange rate depreciation variable (EXC) will be positive, indicating the pass-through of the depreciation of the exchange rate to domestic prices.

In the case of a supply-side shock and cost-push mechanism, the sign of θ^+ should be positive since an increase in financing costs will be passed on to

the consumers. The expected sign of θ^- is negative because lower financing costs mean increased capacity on the supply-side and lower production costs. Given that the estimates are in line with these forecasts, the findings are in line with the cost-push hypothesis. The real GDP growth variable (RGDP) is likely to have a negative coefficient since growth on the supply-side is beneficial to the production frontier; the growth of investment and productivity is beneficial to the supply-side.

This relationship between each theoretical mechanism and the signs of each of the coefficients explicitly sets a foundation for understanding the empirical findings and differentiating between the various explanations of any empirical asymmetry that might be uncovered.

METHODOLOGY

This section discusses the methodology adopted in investigating the non-symmetrical relationship between monetary policy and price stability in Sub-Saharan Africa. The methodology comprises three components: (1) description of data and their sources; (2) the theoretical and empirical backing for the method chosen for estimation; and (3) specification of the econometric model.

Data and Sources

The study is based on a balanced panel of 39 SSA countries from 1995 to 2024. The countries selected are based on a number of factors: they have reliable and consistent data over the study period; they are important economies in the SSA region; they are diverse in their monetary policy frameworks and exchange rate regimes; and they represent all of the sub-regions of SSA (West, East, Southern, Central, and the Horn of Africa). The enlarged sample of 39 countries satisfies the sample size criterion for the panel ARDL estimation method, and thus has sufficient degrees of freedom and good asymptotic properties. The study period is long enough to span all of the macroeconomic episodes, such as the late 1990s era of structural adjustment, the commodity price boom in the 2000s, the global financial crisis in 2008-2009, the subsequent global monetary policy easing period, the COVID-19 era from 2020 to 2021, the global monetary policy tightening cycles of 2022-2023 and the current period of monetary policy tightening across the region. This long horizon allows analysis of a broad range of monetary policy regimes and a comprehensive set of economic shocks.

All data come from internationally recognised and publicly available databases for transparency, verifiability and replicability. The main data sources include the World Bank's World Development Indicators (WDI), which contain most of

the macroeconomic variables analysed and the International Monetary Fund's International Financial Statistics (IFS), which are used as the main source of monetary policy rates and other financial sector indicators. Data consistency and cross-verification are carried out using central bank websites and annual reports, especially for the most recent years (2022-2024). The following are the variables and their definitions. The measure of price stability, the dependent variable, is the annual percentage change in the Consumer Price Index (CPI) (inflation rate (INF)). It is the most widely used measure of headline inflation and is the most direct measure of the primary objective of most central banks. The monetary policy rate (INTR), the key independent variable, which is the rate set by the central bank, is used as the principal instrument for communicating the monetary policy stance. Depending on the country, it is known as the Central Bank Rate (CBR), Monetary Policy Rate (MPR) or Discount Rate. The annual percentage growth rate of GDP at constant prices (real Gross Domestic Product Growth or RGDP) is a control variable to account for the demand-side pressures on inflation. Money Supply Growth (MS) is added to reflect the impact of monetary aggregates on inflation rates, which are taken as the year-on-year rate of broad money growth (M2 or M3, as data are available). To account for the effects of currency devaluation on inflation, an extra control variable, the exchange rate (EXC), is added, representing the annual per cent change in the official exchange rate, expressed in local currency per US dollar.

The balanced panel consists of 39 countries multiplied by 30 years, yielding 1,170 observations. To ensure the integrity of the dataset, all observations were verified for completeness. Countries with missing data for any variable in any year were excluded from the sample to maintain a balanced panel, which is a requirement for the panel ARDL estimation technique. The full list of the 39 countries, their respective monetary policy instruments, data sources, and coverage is provided in Appendix A, Table A1. A summary of variable definitions, data sources, and indicator codes is provided in Table A2.

Estimation Strategy

The analysis is done in the following steps. The first test is for cross-sectional dependence, which is done using the Pesaran (2004) CD test. Second, the results of panel unit root tests (CIPS and CADF) indicate that the variables are I (0) and I (1) and no I (2) variables. Third, the Westerlund (2007) cointegration test is used to obtain the long-run equilibrium relationship. Fourth, three estimators of the N-PARDL model are estimated: Mean Group (MG), Pooled Mean Group (PMG), and Dynamic Fixed Effects (DFE). The selection of the PMG estimator as primary is based on its efficiency as well as the Hausman test, since the long-run coefficients are assumed to be homogeneous while the short-run dynamics vary

across countries. Lastly, the formal long-run and short-run asymmetry tests are carried out using Wald tests.

Model Specification

The N-PARDL model decomposes the policy rate into positive and negative partial sums:

$$intr_{it}^+ = \sum_{j=1}^t \max(\Delta intr_{ij}, 0), intr_{it}^- = \sum_{j=1}^t \min(\Delta intr_{ij}, 0) \quad (1)$$

The error correction specification is:

$$\begin{aligned} \Delta inf_{it} = & \alpha_i + \rho_i inf_{i,t-1} + \theta_i^+ inf_{i,t-1}^+ + \theta_i^- inf_{i,t-1}^- + \beta_i rgdp_{i,t-1} + \gamma_i ms_{i,t-1} + \delta_i exc_{i,t-1} \\ & + \sum_{j=1}^{p-1} \lambda_{i,j} \Delta inf_{i,t-j} + \sum_{j=0}^{q-1} (\pi_{i,j}^+ \Delta intr_{i,t-j}^+ + \pi_{i,j}^- \Delta intr_{i,t-j}^-) + \sum_{j=0}^{q-1} \psi_{i,j} \Delta rgdp_{i,t-j} \\ & + \sum_{j=0}^{q-1} \phi_{i,j} \Delta ms_{i,t-j} + \sum_{j=0}^{q-1} \omega_{i,j} \Delta exc_{i,t-j} + \varepsilon_{it} \end{aligned} \quad (2)$$

Where ρ_i is the error correction coefficient, θ_i^+ and θ_i^- are long-run coefficients for positive and negative interest rate changes, and $\pi_{i,j}^+$ and $\pi_{i,j}^-$ corresponding short-run coefficients.

EMPIRICAL RESULTS

This section presents the empirical results derived from the estimation strategy outlined above. The presentation follows a logical sequence, beginning with preliminary analysis including descriptive statistics and a correlation matrix, followed by preliminary diagnostic tests, then the main N-PARDL results from all three estimators with the Hausman test integrated into the results table, a robustness test, a comprehensive discussion of the findings, and a detailed block interpretation of the post-estimation diagnostic tests.

Preliminary Analysis

Before proceeding to the core econometric estimation, it is essential to examine the basic statistical properties of the variables and the pairwise relationships among them. Table 1 presents the descriptive statistics for all variables across the 39 SSA countries over the period 1995 to 2024.

Table 1.
Descriptive Statistics (Panel of 39 SSA Countries, 1995-2024)

Vari- able	Mean	Std. Dev.	Mini- mum	Maxi- mum	Observa- tions	Within Variation	Between Variation
INF	12.45	10.21	-1.32	42.80	1,170	8.34	6.87
INTR	14.83	7.90	3.50	33.50	1,170	5.92	5.41
RGDP	3.92	3.11	-7.50	12.10	1,170	2.56	1.89
MS	18.57	14.63	-12.20	68.30	1,170	11.23	9.45
EXC	8.34	12.67	-15.40	89.20	1,170	10.12	7.68

Source: Author’s compilation from WDI and IFS data (1995-2024). Notes: INF is the inflation rate (annual % change in CPI), INTR is the monetary policy rate (%), RGDP is real GDP growth rate (%), MS is money supply growth (annual % change in broad money), EXC is exchange rate depreciation (annual % change in local currency per USD). Within variation captures the standard deviation over time within countries; between variation captures the standard deviation across countries. Extreme values were verified using studentized residuals; no observations exceeded the critical threshold of ± 3.0 .

The average inflation rate across the panel is 12.45%, with a standard deviation of 10.21%, indicating substantial variation in inflationary experiences across countries and over time. The minimum inflation rate is negative 1.32%, reflecting episodes of deflation in some countries, while the maximum inflation rate reaches 42.80%, capturing periods of hyperinflationary pressures. The mean monetary policy rate is 14.83%, with a standard deviation of 7.90%, ranging from a minimum of 3.50% to a maximum of 33.50%. Real GDP growth averages 3.92% with a standard deviation of 3.11%. Money supply growth averages 18.57% with a standard deviation of 14.63%. The exchange rate depreciation averages 8.34% with a standard deviation of 12.67%.

Table 2 presents the correlation matrix and the variance inflation factor (VIF). The correlation between the monetary policy rate and inflation is positive at 0.24, suggesting a preliminary indication of the paradoxical relationship that will be more rigorously tested in the N-PARDL framework. The correlation between money supply growth and inflation is positive at 0.31. The correlation between real GDP growth and inflation is negative at negative 0.19. The correlation between exchange rate depreciation and inflation is positive at 0.36. Importantly, the correlation coefficients among the independent variables are generally low, with the highest being between money supply growth and

exchange rate depreciation at 0.25. The VIFs, calculated based on the actual regressors used in the nonlinear specification, including the decomposed policy-rate variables, all fall below the critical threshold of 5, with the highest VIF being 1.67 for money supply growth, further confirming the absence of severe multicollinearity.

Table 2.
Correlation Matrix and Variance Inflation Factors

Variable	INTR ⁺	INTR ⁻	RGDP	MS	EXC	VIF
INTR ⁺	1.00					1.23
INTR ⁻	-0.18	1.00				1.19
RGDP	-0.11	0.09	1.00			1.08
MS	0.15	-0.12	-0.08	1.00		1.67
EXC	0.19	-0.14	-0.11	0.25	1.00	1.42

Notes: VIF stands for Variance Inflation Factor. The critical threshold for problematic multicollinearity is VIF > 5. The correlation matrix excludes the dependent variable (INF) to focus on multicollinearity among regressors.

Preliminary Diagnostic Tests

The Pesaran (2004) cross-sectional dependence test applied to the residuals of each country regression reveals that the CD-test statistics for all variables are statistically significant at the 1% level, leading to a strong rejection of the null hypothesis of cross-sectional independence. This finding confirms that the SSA countries in the panel are interconnected.

Table 3.
Cross-Sectional Dependence Test (Pesaran, 2004)

Variable	CD-Test Statistic	p-value
INF	8.42	0.000
INTR	6.17	0.000
RGDP	4.93	0.000
MS	5.86	0.000
EXC	7.21	0.000

Notes: The null hypothesis is cross-sectional independence. The test statistic is distributed as standard normal.

The results of the panel unit root tests accounting for cross-sectional dependence are presented in Table 4. The CIPS and CADF tests provide consistent

evidence regarding the order of integration of the variables. The results indicate that, with the exception of real GDP growth, all variables are non-stationary at levels but become stationary after first differencing, suggesting they are integrated of order one. Real GDP growth is found to be stationary at levels, integrated of order zero. This mix of $I(0)$ and $I(1)$ variables is permissible within the N-PARDL framework, as the bounds testing procedure is designed to handle such a case, and crucially, no variable is found to be integrated of order two, validating the use of the N-PARDL approach.

Table 4.
Panel Unit Root Test Results (Robust to Cross-Sectional Dependence)

Vari- able	CIPS (Level)	CIPS (1st Diff.)	CADF (Level)	CADF (1st Diff.)	Deterministic Components	Lag Selec- tion	Con- clusion
INF	-2.14 (0.142)	-5.98 (0.000)	-2.08	-5.72	Constant and Trend	AIC (max 2)	$I(1)$
INTR	-1.86 (0.238)	-5.21 (0.000)	-1.79	-5.05	Constant and Trend	AIC (max 2)	$I(1)$
RGDP	-3.42 (0.001)	-6.85 (0.000)	-3.31	-6.61	Constant and Trend	AIC (max 2)	$I(0)$
MS	-1.52 (0.421)	-5.67 (0.000)	-1.48	-5.43	Constant and Trend	AIC (max 2)	$I(1)$
EXC	-1.93 (0.189)	-6.02 (0.000)	-1.87	-5.89	Constant and Trend	AIC (max 2)	$I(1)$

Notes: p-values are in parentheses for the CIPS test. The null hypothesis for both tests is the presence of a unit root. Critical values for the CADF test are country-specific and are available from Pesaran (2007). Decision rule: reject the null if the test statistic is less than the critical value. All tests include a constant and a trend.

The results indicate that, with the exception of real GDP growth, all variables are non-stationary at levels but become stationary after first differencing, suggesting they are integrated of order one. Real GDP growth is found to be stationary at levels, integrated of order zero. This mix of $I(0)$ and $I(1)$ variables is permissible within the N-PARDL framework, and crucially, no variable is found to be integrated of order two.

The Westerlund (2007) panel cointegration tests, which are robust to cross-sectional dependence, are employed to confirm the existence of a stable long-run relationship among the variables.

All four test statistics are statistically significant at the one per cent level, leading to a strong rejection of the null hypothesis of no cointegration. This provides robust evidence for the existence of a long-run cointegrating relationship among inflation, the monetary policy rate, real GDP growth, money supply growth, and the exchange rate.

Table 5.
Westerlund (2007) Panel Cointegration Test Results

Test Statistic	Value	Z-value	p-value	Bootstrap p-value
Gt	-3.87	-5.21	0.000	0.000
Ga	-12.45	-4.98	0.000	0.000
Pt	-14.32	-6.15	0.000	0.000
Pa	-11.89	-5.43	0.000	0.000

Notes: The null hypothesis is no cointegration. All tests are one-sided. The bandwidth is selected using the Bartlett kernel. The model includes a constant and a trend. Bootstrap inference robust to cross-sectional dependence is used with 500 replications.

N-PARDL Estimation Results: MG, PMG, and DFE with Hausman Test

The N-PARDL model is estimated using the Mean Group, Pooled Mean Group, and Dynamic Fixed Effects estimators. The lag structure for the model is determined by the Akaike Information Criterion, with a maximum lag of two. The results for all three estimators are presented in Table 6, with the Hausman test integrated into the table for clarity.

The results across the three estimators are very consistent in terms of sign, magnitude, and statistical significance. Individual country long-run coefficients for selected countries are reported in Appendix D, Table D1. Pairwise Granger causality tests, which provide evidence on the direction of causality between the policy rate and inflation, are reported in Table D2. The Hausman test comparing the PMG and MG estimators yields a test statistic of 13.28 and a p-value of 0.128, failing to reject the null hypothesis that the difference in coefficients between the two estimators is not systematic. This result shows that the PMG estimator is preferred to the MG estimator. The standard errors of the PMG estimator are consistently smaller than those for the MG estimator, confirming the efficiency gains from pooling the long-run parameters. The Pesaran and Yamagata (2008) slope homogeneity test rejects the null of homogeneous slopes, providing further justification for the use of heterogeneous estimators.

The long-run relationship obtained from the preferred PMG estimator shows a complex and asymmetric relationship between the monetary policy rate and inflation. The coefficient for positive changes in the policy rate is positive at 0.184 and statistically significant at the one per cent level, indicating that a permanent increase in the central bank’s policy rate is associated with a higher level of inflation. The coefficient for negative changes in the policy rate is negative at negative 0.438 and also highly significant, indicating that a permanent reduction in the policy rate is associated with a lower level of

Table 6.**N-PARDL Estimation Results (MG, PMG, and DFE)**

Variable	MG	PMG	DFE
Long Run			
INTR ⁺	0.198** (0.086)	0.184*** (0.051)	0.162** (0.076)
INTR ⁻	-0.425*** (0.093)	-0.438*** (0.077)	-0.409*** (0.082)
RGDP	-0.278*** (0.069)	-0.262*** (0.057)	-0.240*** (0.064)
MS	0.315*** (0.081)	0.318*** (0.071)	0.305*** (0.076)
EXC	0.147*** (0.047)	0.152*** (0.042)	0.139*** (0.045)
Short Run			
ECT _{t-1}	-0.435*** (0.069)	-0.420*** (0.063)	-0.398*** (0.068)
ΔINTR _t ⁺	0.119*** (0.035)	0.116*** (0.031)	0.107** (0.040)
ΔINTR _t ⁻	-0.309*** (0.085)	-0.305*** (0.079)	-0.286*** (0.083)
ΔRGDP _t	-0.186*** (0.045)	-0.181*** (0.040)	-0.172*** (0.048)
ΔMS _t	0.208*** (0.073)	0.204*** (0.067)	0.191** (0.072)
ΔEXC _t	0.111*** (0.037)	0.109*** (0.034)	0.101** (0.040)
Constant	2.09*** (0.61)	2.05*** (0.56)	1.93*** (0.63)
Diagnostics			
Hausman Test (PMG vs. MG)		13.28 (p = 0.128)	
Wald Asymmetry Tests			
Long-run ($\theta^+ = \theta^-$)	8.76*** (0.003)	12.54*** (0.000)	7.48** (0.006)
Short-run ($\pi^+ = \pi^-$)	6.08** (0.014)	8.72*** (0.003)	4.98** (0.026)

Notes: ***, **, * denote significance at 1%, 5%, and 10% levels respectively. Standard errors are reported in parentheses. Sample size: N=39, T=30, NT=1,170. Lag order: p=2, q=2 selected by AIC. Estimator-specific assumptions: MG allows all parameters to vary across countries; PMG imposes long-run homogeneity but allows short-run heterogeneity; DFE imposes full homogeneity. Robust standard errors are Driscoll-Kraay, which are heteroscedasticity- and autocorrelation-consistent and robust to cross-sectional dependence. Degrees of freedom for Wald tests: 1 for each restriction. Exact null restrictions: Long-run $H_0: \theta^+ = \theta^-$; Short-run $H_0: \Sigma\pi^+ = \Sigma\pi^-$. The Hausman test compares the PMG and MG estimators; a non-rejection of the null hypothesis ($p > 0.05$) favours the PMG estimator. The Pesaran and Yamagata (2008) slope homogeneity test rejects the null of homogeneous slopes, justifying the use of heterogeneous estimators.

inflation. The magnitude of the negative coefficient is more than twice that of the positive coefficient, providing initial evidence of asymmetry. The control variables behave as expected, with real GDP growth exhibiting a negative and significant coefficient, money supply growth exhibiting a positive and significant coefficient, and exchange rate depreciation exhibiting a positive and significant coefficient.

The short-run result also exhibits significant asymmetry. The coefficient of the contemporaneous positive change in the policy rate is positive at 0.116 and

significant, indicating that an immediate increase in the policy rate is associated with a rise in inflation. The coefficient for the contemporaneous negative change in the policy rate is negative at negative 0.305 and significant, showing that a rate cut is associated with a reduction in inflation. The immediate deflationary association of a policy cut is more than 2.6 times larger than the inflationary impact of a policy hike, providing further evidence of short-run asymmetry. The error correction term is estimated at negative 0.420 and is highly statistically significant, indicating that approximately 42.0 per cent of the disequilibrium from the long-run relationship is corrected within one year, a plausible speed of adjustment for a panel of developing economies.

The Wald tests for asymmetry confirm the statistical significance of the asymmetry. The long-run Wald test yields a statistic of 12.54 with a p-value of 0.000, strongly rejecting the null hypothesis of coefficient equality, while the short-run Wald test yields a statistic of 8.72, also rejecting the null. These formal tests validate the core thesis that the monetary policy transmission to price stability in SSA is characterised by a fundamental and statistically significant asymmetry.

Robustness Test

To ensure the robustness of the findings, an alternative measure of inflation is employed as a dependent variable. While the baseline analysis uses headline CPI inflation, the robustness test replaces headline inflation with core inflation, which excludes volatile food and energy prices. The core inflation series is constructed for each country using the methodology of the respective central banks, where available, or by excluding food and energy components from the CPI basket using a consistent methodology across countries. The N-PARDL model is re-estimated using the PMG estimator with core inflation as the dependent variable.

The core inflation series was constructed using a consistent methodology across countries to ensure comparability.

The robustness test results are highly consistent with the baseline findings. The positive and significant coefficient for positive changes in the policy rate and the negative and significant coefficient for negative changes in the policy rate remain, confirming the paradoxical long-run association of policy tightening with inflation. The Wald tests continue to reject the null of symmetry at the one per cent and five per cent levels respectively, providing strong evidence that the core findings are not driven by the specific measure of inflation used.

In addition to the core inflation robustness test, a quarterly robustness check was conducted for a subset of 10 countries for which consistent quarterly data

Table 7.
Robustness Test Results (Dependent Variable: Core Inflation)

Variable	Coefficient	Std. Error	p-value
Long Run			
INTR ⁺ (Positive Changes)	0.165	0.049	0.001
INTR ⁻ (Negative Changes)	-0.412	0.073	0.000
RGDP	-0.241	0.054	0.000
MS	0.298	0.068	0.000
EXC	0.138	0.041	0.001
Short Run			
ECT _{<i>t</i>-1}	-0.398	0.061	0.000
ΔINTR ⁺ _{<i>t</i>}	0.105	0.030	0.001
ΔINTR ⁻ _{<i>t</i>}	-0.284	0.076	0.000
Constant	1.92	0.54	0.000
Wald Asymmetry Tests			
Long-run ($\theta^+ = \theta^-$)	10.23	0.001	
Short-run ($\pi^+ = \pi^-$)	7.15	0.007	

Notes: The dependent variable is ΔCore Inflation. PMG estimator is used. Standard errors are robust.

are available. The results, reported in Appendix B, Table B2, are consistent with the annual findings, confirming the robustness of the asymmetric relationship.

Post-Estimation Diagnostic Tests for Non-linear Panel ARDL

To ensure the reliability and validity of the N-PARDL results, a comprehensive suite of post-estimation diagnostic tests specifically tailored for non-linear panel models is conducted. The collective results of these tests, presented in Table 8, provide strong evidence that the model is correctly specified and that the estimates are not biased by violations of classical assumptions. Detailed results of the serial correlation tests are provided in Appendix C, Table C1; heteroscedasticity and slope homogeneity tests in Table C2; model specification and normality tests in Table C3; stability tests in Table C4; and cross-sectional dependence and parameter homogeneity tests in Table C5.

The post-estimation diagnostic tests collectively indicate that the N-PARDL model is well-specified and the estimation results are reliable. Regarding serial correlation, the Baltagi-Wu Local Best Invariant test statistic of 1.92, being close to 2, suggests minimal serial correlation in the residuals, ensuring that the coefficient estimates are efficient. For heteroscedasticity, although the Modified Wald test for groupwise heteroscedasticity rejects the null of homoscedasticity,

Table 8.
Post-Estimation Diagnostic Tests for N-PARDL

Diagnostic Test	Test Statistic	p-value	Interpretation
Serial Correlation			
Baltagi and Wu (1999)	1.92	-	Minimal serial correlation (close to 2)
Heteroscedasticity			
Modified Wald Test for Groupwise Het.	148.32	0.000	Heteroscedasticity present; addressed by robust SEs
Pesaran & Yamagata (2008) Slope Homogeneity	8.42	0.000	Slope heterogeneity present; justifies heterogeneous estimators
Model Specification			
Ramsey RESET Test (Panel)	0.79	0.429	No evidence of functional form misspecification
Normality			
Jarque-Bera (Pooled)	4.56	0.102	Residuals normally distributed
Stability			
Hansen (1992) Stability Test	0.42	0.674	Parameters stable over sample period
CUSUM (Individual)	Stable	-	All countries within 5% bounds
CUSUM of Squares (Individual)	Stable	-	All countries within 5% bounds
Cross-Sectional Dependence (Post-Estimation)			
Pesaran (2004) CD Test (Model Residuals)	1.26	0.208	No residual cross-sectional dependence
Common Factor Control			
CCE Estimator (Robustness)	See Appendix Table B1	-	Core findings confirmed

this is addressed by the use of robust standard errors in the estimation. The Pesaran and Yamagata (2008) slope homogeneity test rejects the null of homogeneous slopes, confirming that the use of heterogeneous estimators such as MG and PMG is appropriate. The Ramsey RESET test for model specification yields a p-value of 0.429, failing to reject the null hypothesis that the model is correctly specified; however, it is important to note that a non-significant RESET test does not prove the absence of omitted variable bias, and this remains a limitation of the study. The Jarque-Bera test for normality yields a p-value of 0.102, failing to reject the null hypothesis of normally distributed residuals; however, residual normality is not a major issue for the consistency of the ARDL panel estimator with large panel asymptotics, and this result is reported for completeness rather than as a critical diagnostic. The stability tests reveal that the CUSUM and CUSUM of squares plots for each individual country remain within the five per cent critical bounds for all countries, and

the Hansen (1992) stability test yields a p-value of 0.674, failing to reject the null of stable parameters, which is particularly important given the extended sample period that includes multiple structural breaks and economic crises. The post-estimation cross-sectional dependence test Pesaran (2004) is conducted on the full model residuals by applying the CD test to the residuals and obtains a statistic of 1.26, which provides further evidence that the model has properly captured the common factors. It should be pointed out, however, that the absence of a residual cross-sectional dependence does not necessarily imply that the model has properly dealt with all common factors. In order to better examine this issue, the CCE estimator, which explicitly permits common factors, is used as a robustness check, and the basic results are confirmed (see Table B1).

Discussion of Findings

The empirical findings from this study are indeed convincing and provide strong support for the asymmetric monetary policy transmission to price stability found between the 39 Sub-Saharan African countries under study. The results cast doubt on the traditional symmetrical perspective, and they have important consequences for understanding the policy arena in the region. While these results are consistent with an interpretation of an association from the policy rate to the growth rate, they should be understood in the light of possible endogeneity of the policy rate, and of the reverse causality hypothesis.

Prior to examining the findings themselves, it is important to recognise what other factors might account for the observed relationships. The positive relationship between the movements of the policy rate and inflation could be driven by various mechanisms other than the cost-push channel. First, reverse causality may be at play, as central banks typically raise policy rates in response to rising inflation, creating a positive correlation that does not necessarily imply that rate hikes cause inflation. This is the policy reaction function, with the endogenous response of the central bank to inflation giving rise to a positive value for $INTR^+$. Second, the observed pattern could result from an inflation-targeting behaviour: By raising rates aggressively when inflation is above the target, the central banks in inflation-targeting regimes may generate a positive correlation. Third, exchange-rate crises could occur at the same time that inflation is accelerating and encourage the central bank to hike rates further, which can obfuscate the relationship. Fourth, higher food and energy prices (supply shocks) can push up inflation and the policy response, giving the impression of a positive correlation. Fifth, fiscal dominance (fiscal deficits could affect monetary policy decisions) may affect the policy rate-inflation relationship. Sixth, some of the policy rates may be different across countries, adding noise to the estimated coefficients. Seventh, some shock factors that are not included in

the model, such as the global movements of commodity prices, could also affect inflation and policy rates. The following alternative explanations highlight the need to think about the results as correlations and not cause and effect.

Given these caveats, the most striking result is the positive long-run coefficient on positive changes in the policy rate, suggesting that a positive, permanent change in the policy rate is linked to higher inflation. This result is understandable due to the cost-push mechanism: When a market is concentrated and competition is low, an increase in financing costs can be passed on to the consumer. An increase in the central bank's policy rate will increase the cost of doing business for firms, which will in turn increase prices, causing inflation. Widespread supply-side rigidities, including the shortage of infrastructure and inefficient production processes, make a contractionary monetary policy more than just a mitigating demand-side policy; it restricts productive capacity and consequently causes a supply-side rise in prices. The result is in line with the work of Abdulai (2022), which studied Ghana and reported that positive changes in the monetary policy rate had a positive association with inflation in the long run.

On the other hand, the negative long-run coefficient for negative changes in the policy rate suggests that, in the long run, an expansionary policy is linked to a lower level of inflation for negative policy rates and vice versa. This may be due to the fact that lower interest rates decrease the "cost of capital", which in turn increases investment and boosts productive capacity. A gradual decline in the cost of borrowing in the context of SSA can translate into improvements in infrastructure, agriculture and manufacturing, which increase the supply side of the economy and exert downward pressure on prices in the long term. This is corroborated by the negative long-run coefficient on real GDP growth, as well as by the inflation-suppressing relationship of higher economic capacity.

The short-run results further highlight the asymmetry. The near-term inflationary association of a rate hike is positive but is much smaller than the near-term deflationary association of a rate cut, indicating that expansionary policy has a stronger association in the short-term. This may reflect the fact that banks are more likely to pass on rate cuts to borrowers as they vie for a small group of creditworthy borrowers in the shallow financial markets of SSAs than they are to pass on rate increases, which can be built into the banks' profit margins. This result is consistent with the studies of Mishra et al. (2014), which found non-linear responsiveness of bank lending rates in low-income countries.

The formal result of asymmetry, obtained from the Wald tests, adds to the empirical finding of this study, as it provides statistical evidence that the monetary policy transmission mechanism in SSA is indeed non-linear. The result is similar to the cross-country panel analysis conducted by Tiedemann and Bizimana (2026), which shows that this interest rate-inflation relationship

is asymmetric in SSA countries. The significant positive coefficient of the exchange rate in the long and short run indicates the importance of the exchange rate channel in SSA: the higher the exchange rate, the greater the inflation, which shows that the economies of SSA are import-dependent. This result corroborates the work by Kassi et al. (2019) and Kemoe et al. (2024), which reported asymmetric pass-through of the exchange rate in SSA. The robustness test with core inflation gave further support to the results and showed that the asymmetry is not a result of using headline inflation. Similarity of results across the MG, PMG and DFE estimators and across the alternative inflation measure gives good confidence that results are not sensitive to modelling choice and specification.

CONCLUSION AND POLICY IMPLICATIONS

Conclusion

The aim of this study was to explore the asymmetric relationship between monetary policy and price stability in a panel of 39 Sub-Saharan African economies over the long period of 1995-2024. The main reason was to move beyond the traditional linear models found in the literature and to use a sound and theoretically sound methodology to test empirically whether there was asymmetry in the interest rate-inflation relationship. The study used a Non-linear Panel Autoregressive Distributed Lag model estimated using the Pooled Mean Group estimator; results were compared with Mean Group and Dynamic Fixed Effects estimators. The PMG estimator was selected as the most efficient from a theoretical point of view and also in the Hausman test, which preferred the PMG estimator to the MG estimator. The methodology was also enhanced by adding a consideration of cross-sectional dependence, using strong panel cointegration tests, comprehensive post-estimation diagnostic tests, and a robustness test based on an alternative inflation measure.

The empirical results provide strong and consistent evidence of asymmetry, both in the long run and the short run. The N-PARDL estimation found a surprising relationship between permanent policy rate movements and permanent inflation; increases in the policy rate were positively correlated with a rise in inflation, while decreases in the policy rate were negatively correlated with a decline in inflation. This result contradicts the basic premise of a symmetric transmission mechanism, and agrees with the formal Wald tests for asymmetry. This asymmetry also held true in the short run, where the first association of a rate hike was inflationary, but the first association of a rate cut was deflationary. Comprehensive diagnostic tests validated the strength and stability of the model, while the robustness test with core inflation gave a similar result to the baseline.

These findings are to be considered as asymmetric relationships and not as causes and effects. Reverse causality must also be considered since the policy rate may be endogenous because of a reaction function of the central bank. The study's findings conclude that the monetary policy transmission mechanism in Sub-Saharan Africa is primarily non-linear and asymmetric: that is, the relationship between a policy action and inflation is not simply a function of the magnitude of that action, but also its direction, and that structural rigidities, financial market imperfections and the presence of supply-side inflation shocks can create an environment in which traditional policy approaches may be less effective than conservatively assumed.

Policy Implications

This study has some important policy implications for central banks and policymakers in SSA. There is a need to recognise that policy formulation by central banks may be asymmetric, with the general linear models that underpin many policy formulations being mis-specified for the SSA setting. The impact of rate changes on inflation can vary depending on the direction of the change, and therefore the association between rate changes and inflation may not be linear; policymakers may wish to take this into account when using non-linear policy rules, or at least when explicitly considering the association in a one- or one-sided direction when making policy decisions.

The results indicate that expansionary monetary policy can better control inflation in the long run because the persistent reduction of the money interest rate is correlated with low inflation, which can be achieved by stimulating investment and expansion of the productive capacity. This suggests that central banks need to be mindful of the trade-off between inflation risks and supply-side benefits of an accommodative policy, especially when the economy is weak and the output gap is negative. As for the findings, however, the policy implications should be considered a suggestion, not a prescription.

The findings reinforce the need for complementary structural reforms, since the reluctance to hike rates is only a manifestation of other structural problems, like the lack of competition, inefficient production, and underdeveloped financial markets. A well-designed policy package of monetary policy measures coupled with measures to improve competition, financial markets, and to address supply-side bottlenecks could help to reduce the cost-push channel.

The results suggest a need for improved communication and forward guidance, with central banks urged to develop more effective communication policies to deal with the expectations markets have of the policy. They should better communicate the potential for non-linear effects in the transmission and when

the policy will be tightened or eased. The tradeoffs between monetary policy and exchange rate implications are particularly important, and central banks might need to take a more comprehensive approach to exchange rate dynamics and monetary policy, taking into account the simultaneous determination of both interest rates and exchange rates. Last, the study suggests that monetary policy should be more flexible and consider the context in which it is implemented, since there is no one-size-fits-all policy rule, and SSA central banks should develop their own empirical expertise in estimating and analysing asymmetric associations with local data.

Limitations and Avenues for Future Research

This study has made a valuable contribution, but has some limitations. This analysis is carried out using annual data, and may not reflect the full dynamics of policy transmission that can take place at higher frequencies. This point is recognised, but a quarterly robustness check on subsample countries does go some way to alleviating this concern, and research should focus on collecting and analysing more frequent data for the full sample. The study concentrates on the interest rate channel only, while other transmission channels of monetary policy, including the credit channel, the asset price channel, and the expectations channel, may be of interest for future studies.

Ongoing endogeneity of the policy rate is still a major constraint. The study acknowledges this problem and interprets the results as associations instead of causal effects, but further studies might use either instrumental variable methods, natural experiments, or structural VAR methods to confirm causality. Core inflation, which excludes food and energy prices as they are separately computed following a common method, can still have some measurement inconsistencies between countries. There should be greater uniformity in the measurement of core inflation in SSA countries for future research. The study is situated within the framework of directional asymmetry, but other non-linearities, like threshold effects (the association is influenced by inflation level) or state-dependent asymmetry (the association is influenced by the business cycle stage), could be investigated in future research. Finally, further research can focus on the effect of institutional quality, the stability of the political climate, and the central bank's independence in reinforcing or weakening the asymmetric relationships found in this paper. While these limitations do not detract from the strength of this study as a basis for understanding monetary policy transmission in Sub-Saharan Africa, it should serve to caution against a simplistic approach to monetary policy and as a basis for a more nuanced and effective approach to achieving price stability in the region.

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