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CENTRAL BANK POLICY, THE MACROECONOMIC TRILEMMA, AND INCLUSIVE GROWTH IN SUB-SAHARAN AFRICA

Purpose. This study examines the impact of central bank policies on inclusive growth through the Mundell-Fleming trilemma framework in selected Sub-Saharan African countries. It aims to assess how monetary independence and capital mobility jointly influence inclusive economic growth in developing economies.

Design/methodology/approach. The study employs the Panel Autoregressive Distributed Lag (PARDL) model to estimate both short-run and long-run relationships using panel data from ten Sub-Saharan African countries over the period 1995–2024. The methodology captures equilibrium adjustments while accounting for country-level heterogeneity.

Findings. The empirical results reveal a statistically significant positive interaction between free capital mobility (FCM) and monetary independence (MI), indicating that these factors jointly promote inclusive growth. The findings provide empirical support for the Mundell-Fleming trilemma, demonstrating that the effectiveness of independent monetary policy depends on the degree of capital mobility in Sub-Saharan African economies. The study suggests that coordinated monetary policy and capital account management can enhance inclusive economic development.

Originality. This study extends the literature on the Mundell-Fleming trilemma by providing recent empirical evidence from Sub-Saharan Africa using a long-term panel dataset and the PARDL approach. It offers new insights into the interaction between monetary policy independence and capital mobility, highlighting their combined role in fostering inclusive growth and providing policy recommendations for central banks in developing economies.

Keywords: macroeconomic, exchange rate, economic growth, monetary policy, capital movement.

Introduction

The global economy is increasingly characterized by a complex mix of opportunities and challenges, particularly for Sub-Saharan African countries striving for sustainable and inclusive prosperity. In this changing environment, central banks are pivotal institutions with the challenging mandate of securing macroeconomic stability, promoting financial system integrity, and more importantly, contributing to broader developmental objectives. Though, attaining these objectives, is to a great extent limited by the ongoing trinity policy in international economics, which emphasise the fundamental trade-offs among independent monetary policy, exchange rate and capital movement. The central banks strategic choice on policy trilemma or trinity policy have crucial consequences towards achieving economic growth, and importantly, its inclusiveness is a dimension that has necessitated significant attention in modern development discussion. Aizenman et.al. (2022)

opined that in the context of crises, it forces developing nations to make difficult policy choices that have far-reaching implications for their economic stability and the distribution of growth benefits.

As pointed out by Berg et al. (2018), SSA monetary institutions have increasingly modernised their operational frameworks through improved forecasting systems, inflation anchoring mechanisms, and enhanced analytical capacity. However, despite this improvement, several nations in this region still encounter problems of inflation uncertainty, unstable exchange rates, high unemployment, weak monetary transmission mechanism, and poor inclusive economic development. The persistence of these macroeconomic challenges has raised concerns on the ability of central bank policies to promote inclusive sustainable economic development in SSA economies.

The concern over the effectiveness of central bank policies becomes more pronounced when

viewed from the theoretical expectation that monetary policy should stabilize prices and stimulate economic activities. However, Oyadeyi (2025) reported that the transmission of policy actions to the real sector remains relatively weak across many African countries due to financial markets and external vulnerabilities. In Nigeria, for instance, as one of the Sub-Saharan African countries, its central bank has introduced numerous intervention programmes aimed at stimulating productive sectors, improving financing inclusion, and promoting inclusive growth. However, empirical evidence regarding the effectiveness of these interventions remains inconclusive (Kwode, 2024). This suggests that monetary policy interventions alone may not be sufficient to generate sustainable developmental outcomes without strong institutional support.

In addition to these domestic monetary policy challenges, SSA economies are increasingly confronted with the macroeconomic trilemma, which refers to the difficulty of simultaneously achieving monetary policy independence, exchange rate stability, and full capital mobility. The increasing integration of SSA economies into global financial markets has intensified exposure to volatile capital flows and external shocks, thereby constraining the effectiveness of domestic monetary authorities. This implies that central banks within SSA frequently operate under constrained policy environments where achieving price stability and economic growth simultaneously becomes increasingly difficult.

These constraints have important implications for inclusive development outcomes. The extant literature has demonstrated the disconnection between macroeconomic stability pursued by central banks and the microeconomic realities of continuous poverty and widening inequality. For instance, Adeleye et al. (2020) hypothesize a growth-poverty-inequality trilemma, whereby economic growth does not automatically lead to decreases in poverty or inequality. This prompts an unanswered question: in making their strategic choices in the policy trilemma (i.e., exchange rate stability versus monetary policy autonomy, among others), how do central banks in developing countries explicitly include and prioritize the implications for poverty reduction, income distribution, and access to financial services for marginalized segments of their populations?

The practical relevance of this question is reflected in country-specific experiences. The case

study work of Kamamkhudza (2016) on Malawi's trilemma amply illustrates the practical difficulties that central banks encounter in attempting to balance these often competing objectives. In addition, while the scholarly debate, as exemplified by Cheng and Rajan (2020), considers whether the classical trilemma has evolved into a more nuanced "dilemma," for most developing countries, the underlying policy constraints continue to be acutely felt.

Consequently, there is a pressing need for more robust empirical research that systematically explores how specific central bank policy choices made under the trilemma interact with unique domestic structural conditions, such as weak institutions, less advanced financial markets, or large informal sectoral presence, to enhance or impede inclusive growth outcomes. In response to these developmental challenges, some African countries (e.g., Nigeria, Ghana, Cameroon, Ethiopia, etc.) have put into effect a number of policy initiatives aimed at promoting equitable growth. Financial inclusion and interventions in important industries like power, agriculture, MSMEs, oil and gas, and health are a few of these. For example, financial inclusion guarantees the impoverished have access to capital, a crucial instrument for reducing poverty and inequality and a prerequisite for inclusive growth.

Nevertheless, despite the extensive research on inclusive growth in Africa (e.g., Adeleye et al., 2020; Kamamkhudza, 2016; Alley, 2017; Reinders, Dekker, van Kesteren, and Oudenhuijsen, 2019), a consensus remains elusive, and research on central banks and policy trilemma trade-offs in Sub-Saharan African countries remains scanty. Central banks and other policymakers in these countries are consistently concerned about which of the mutually consistent policies is most suitable for achieving effective and inclusive growth in their economies. Equally important is the question of how policymakers have utilized the available policy choices within the Mundell-Fleming framework to guide economic prosperity.

These questions, together with the scholars argument surrounding the Mundell-Fleming impossible trinity in the context of Africa's structural development paths, provide the motivation for further inquiry. Therefore, this study investigates central bank policy, policy trilemma, and their implications for inclusive economic growth in Sub-Saharan Africa.

Literature Review

The relationship among the central banks policies, the macroeconomic policy trilemma and inclusive economic growth has increasingly become a subject of academic studies, especially in Sub-Saharan Africa (SSA), where policy-makers have to deal with a combination of macroeconomic stability and economic growth issues. It can be noted that the existing literature demonstrates how monetary policy and actions of central banks are determined by the macroeconomic policy trilemma and capital flows dynamics.

In examining the relationship between growth, poverty, and inequality, Adeleye et al. (2020) analyses the "growth-poverty-inequality trilemma" with a view to determining whether or not economic growth reduces poverty and how income inequality influences such an impact, particularly in Sub-Saharan Africa and Latin America/Caribbean. It employs panel data for 58 countries spanned from 2000 to 2015 based on per capita consumption expenditure, GDP growth rate, and the Gini coefficient (for inequality), together with control variables including enrollment in secondary school and unemployment. The method involves descriptive and econometric approaches using static and dynamic models, e.g., a reduced poverty model with a combination of inequality and growth. Findings indicate that growth has the tendency to reduce poverty but with the positive effect being heavily dampened by high income inequality. The implication is that economic growth and income distribution should be tackled to guarantee effective poverty reduction.

Supporting this argument, Garcia-Verdu et al. (2011) attempts to diagnose how much the recent growth in Sub-Saharan Africa economies has been inclusive to the majority population. It utilizes household survey data from Uganda, Zambia, Ghana, Cameroon, Mozambique and Tanzania watching over indicators of asset ownership, access to service, and consumption. The approach consists of growth incidence curve (GIC) estimation for tracking real per capita consumption via income quartiles, complemented by Mincer-type regressions for consumption determinants and performance indicators in the labor market. Findings suggest that higher per capita GDP growth is likely to be linked with sound consumption growth in the poorest quartile, with rural farm labor being a key poverty reducer. The authors recommend assigning top

priority to growth-led job creation, especially in rural areas.

Similarly, Reinders and Dekker (2019) synthesized evidence on Africa's development with a focus on reduction of inequality and poverty in the income and non-income dimensions respectively. The focus population is African countries, with particular focus on vulnerable and marginal groups. Key findings indicate that although economic growth has been taking place, most Africans have been left behind and inequality rises with detrimental effects on economic growth and social cohesion. The report advocates applying an "inclusive development goals" by placing equality, diversity, and context-oriented policies which consider distributional implications and empower strategic actors at the forefront, acknowledging that redistributive policies can help to expand economies.

Beyond growth and inequality, the literature identifies financial development and inclusion as important drivers of inclusive growth. A research paper by Mlachila et al. (2016) assesses broadly financial development in Sub-Saharan Africa, its direction, growth and volatility impact, and policy implications. The analysis used data on financial depth measures, a general financial development index, and financial inclusion and stability indicators. Regression analysis was employed to determine its causes and constraints, and the GMM approach was employed. The study found that mobile banking is flourishing, but financial inclusion is entrenched, and there has been enrichment of the financial markets while the markets themselves are shallow relative to other emerging markets. The study concluded that there should be improvement in institutional and legislative frameworks, enhanced cross-border regulation of Pan-African banks, and support for regulatory environments.

Consistent with this finding, Osei and Alagidede (2022) consider the influence of ICT diffusion and how it interacts with financial development on inclusive growth in Sub-Saharan Africa (SSA) both directly and indirectly. Panel data of 42 sub-Saharan nations was used to estimate inclusive growth. Evidence indicates that access to and proficiency in ICT directly brings about inclusive growth in SSA, and the effects are significantly greater when there is access to institutions of finance and financial development. The policy recommendation is to invest first in ICT spread and financial deepening for shared prosperity in the region, in line with green growth and socioeconomic development agendas.

Likewise, Jombo (2021) looks into the impact of financial depth and inclusion on inclusive growth in 26 Sub-Saharan African countries. Using panel data and a random effects panel regressions method, the study concludes that inclusive growth is influenced positively by effective financial inclusion, but at very high levels its marginal impacts fall. Financial depth is not found to have a robust connection with inclusive growth. The recommendation targets promoting more financial inclusion efforts in the region, whose rate is currently low, by lowering transaction tariffs and enhancing the financial literacy of the population.

The role of external capital flows has also received significant attention in the literature. Alley (2017) examined capital flow surges and economic growth in Sub-Saharan Africa. It focuses on private capital flows (FDI, stock, and bonds) and capital control indicators using panel data for 25 Sub-Saharan African nations from 2003 to 2013. The results from the analysis using System Generalized Methods of Moments (Sys.GMM) indicate risk-sharing capital (FDI and equity) to be growth-promoting and credit-supply promoting, whereas risk-averse capital (bonds) is growth-retarding. Such inflows have negative effects on growth and credit. The study suggests that governments should focus on capital controls on the right targets and financial institutions mobilize additional risk-sharing capital in order to maximize benefits from such flows.

The importance of capital flow management is closely linked to the macroeconomic trilemma framework. Klein and Shambaugh (2015) investigate rounding the corners of the policy trilemma as sources of monetary policy autonomy. The author investigated whether and under what circumstances limited capital controls and modest exchange rate flexibility can bring more monetary policy autonomy than has been traditionally assumed by the strict trilemma. The character of data contained country-level nominal interest rates, base country interest rates, and exchange regime and capital account openness classifications. The regression method was used on pooled data over different policy regimes. The result indicates that only comprehensive capital controls allow significant monetary independence, while some exchange rate flexibility does allow some independence, particularly among emerging and developing economies. The study concluded that offering more exchange rate flexibility is the easiest way whereby nations can gain monetary

independence without completely closing their capital accounts.

Similarly, Cheng and Rajan (2020) investigates monetary trilemma, dilemma, or something in between. The data used are short-run Treasury-bill yields and exchange-rate regime classifications of Shambaugh's data, and Chinn-Ito index (KAOPEN) for capital controls, and comprises 88 advanced and emerging economies from 1973 to 2014. The method employs pooled ordinary least squares with cluster-robust standard errors and time-fixed effects. Findings help to validate the "monetary trilemma," with exchange-rate flexibility. The study suggests that holding greater foreign reserve positions can attain some level of monetary policy autonomy, particularly in regards to the management of capital outflows.

Extending the trilemma literature, Aizenman et al. (2022) study how financial crises influence countries' monetary trilemma settings—financial openness, monetary independence, and exchange rate stability—and the role of international reserves. Utilizing panel data for over 180 economies from 1970 to 2020, the methodology involves the comparison of pre- and post-crisis averages for these policy variables, as well as a Seemingly Unrelated Regressions (SURE) approach to identify the determinants of policy alterations. The evidence is such that although the Global Financial Crisis primarily resulted in higher international reserve holdings, the Asian Financial Crisis resulted in significant rises in financial openness and international reserve ownership for emerging economies. In an attempt to prevent global financial instability, the paper suggests policymakers should take into account the simultaneous determination of trilemma policies and international reserve holdings.

In offering a broad perspective of monetary policy in Sub-Saharan Africa, Berg and Portillo (2018) analyzed Monetary Policy in Sub-Saharan Africa between 2000 and 2011. According to their analysis based on impulse response analysis, even though the SSA countries have distinct economic features, the problems in monetary policy that they confront are basically the same as in other advanced and developing countries. They stress that there is an evident process of modernizing monetary policy making in Sub-Saharan Africa, which involves improving inflation targeting and forecasting systems, as well as using forward-looking approaches.

Within this context, the macroeconomic trilemma and the central bank's policy were studied in the

context of Nigeria by Ayinde (2022). The author used quarterly data ranging from 1981 to 2017 and applied the Markov-switching dynamic regression model. The result of the study confirmed the validity of trilemma hypothesis, and it was found that Nigeria's goal of achieving exchange rate stability and capital mobility limited the country's freedom of conducting its monetary policy. It should be stressed that exchange rate targeting was characterized by switches between fixed and managed float regimes, where different regime-specific factors affected the exchange rate dynamics differently.

The consequences of capital mobility for economic performance have been further examined by Nyang'oro (2017). Using the system Generalized Method of Moments approach, the author analyzed the impact of capital flows on economic growth in SSA. It has been established that various types of capital inflows produce different impacts on growth. Whereas portfolio equity inflows supported economic growth, the increase in private debt and equity inflows had a negative effect on growth outcomes. Most notably, the overall level of capital inflows turned out to have a negative influence on economic growth. Hence, the positive effects of financial globalization do not come automatically and might be contingent upon the nature and management of capital flows. Such a finding is consistent with the results of macroeconomic trilemma studies that emphasize the adverse effects of rising capital mobility.

Apart from macroeconomic stability, recent studies have examined developmental roles of central banks through direct intervention programme. One of such studies carried out in Nigeria by Kwode (2024), evaluated the effect of intervention measures applied by the Central Bank of Nigeria to foster inclusive growth through secondary and primary data as well as chi-square and rank correlation approaches. Results revealed a positive correlation between intervention programs of the central bank and inclusive growth; however, the effect on the general economy is not statistically significant.

Likewise, Bello et al. (2024) examined the impact of monetary policy on the economy's growth in selected African countries including Nigeria, Egypt, South Africa, and Kenya based on annual data between 2000 and 2022. According to their findings, monetary policy rate has a statistically insignificant but positive impact on economic growth, while broad money supply plays a significant role in stimulating economic growth. Therefore, it can be said that

traditional tools of monetary policy do not play an effective role in promoting economic growth in African economies owing to poor transmission channels, while expanding money supply does.

Recent evidence has also linked the macroeconomic trilemma to monetary policy credibility, an important prerequisite for sustainable growth and macroeconomic stability. Using data from 94 developed and developing countries, Montes and Dantas (2025) examined how trilemma policy convergence patterns influence monetary policy credibility through Tobit estimation techniques. Their findings indicate that countries whose policy combinations converge toward internationally accepted trilemma configurations enjoy higher monetary policy credibility and stronger inflation expectation anchoring. Conversely, countries pursuing divergent policy mixes tend to experience greater economic instability and weaker policy credibility. These results suggest that the manner in which countries manage the trade-offs among monetary independence, exchange rate stability, and capital account openness has significant implications for macroeconomic outcomes.

From a combined analysis of the literature discussed above, it is evident that Central bank policies, capital flows, and macroeconomic trilemma issues are intimately interrelated in influencing economic performance and inclusive growth. Although monetary policy reform and CBP interventions have the potential to support development objectives, their effectiveness can be hindered by the lack of policy independence, unstable capital flows, poor monetary transmission processes, among other problems. Moreover existing studies have addressed inclusive growth, effectiveness of monetary policy reforms, or trilemma issue separately. Hence, there exists a dearth in literature about the interrelationship between central bank policies and macroeconomic trilemma concerning inclusive growth in SSA against the backdrop of financial globalization.

Methodology

The model specification is grounded in the theoretical framework of the policy trilemma, which posits that it may not be possible to achieve three key objectives in an economy. The theory and the arguments from other relevant studies in the literature lead to the model specification of this study. In order to examine the impact of central bank's policy and

trilemma trade-offs on inclusive growth in sub-Saharan Africa, this study improves on earlier studies (Hsing, 2012, Kamamkhudza (2016); Adeleye, et al. (2020); Jombo (2021)). The model set up which is anchored on the Mundel-Fleming hypothesis is compactly expressed as:

$$GDP_{pc} = f(EXR, MI, FCM) \quad (1)$$

The model is augmented with the introduction of money supply (MS) as part of the explanatory variables due to inclusion of monetary policy in the trilemma as pointed out in the literature which is expressed as:

$$GDP_{pc} = f(EXR, MI, FCM, MS, EXR * MI, EXR * FCM, CM * MI) \quad (2)$$

Where: GDPpc = gross domestic product per-capita, EXR = exchange rate stability, FMI = monetary autonomy, FCM= free capital mobility and MS = money supply, EXR*MI = interaction of exchange rate and monetary independence, EXR*FCM = interaction of exchange rate and free capital mobility and FCM*MI = interaction of free capital mobility and monetary independence, Equation (2) can be specified econometrically as:

$$GDP_{pc} = \alpha_0 + EXR + \alpha_2 MI + \alpha_3 FCM + \alpha_4 MS + \alpha_5 EXR * MI + \alpha_6 EXR * FCM + \alpha_7 CM * MI + \varepsilon_i \quad (3)$$

to capture the focus of this study, the inclusive growth, Equation (4) expresses economic growth per

capital, poverty rate (POV) and inequality (INEQ) as a function of the surrogates of central banks and policy trilemma which is specified econometrically as:

Equation 3 thus decomposed into the following equations:

$$GDP_{pc} = \alpha_0 + \alpha_1 EXR + \alpha_2 MI + \alpha_3 FCM + \alpha_4 MS + \alpha_5 EXR * MI + \varepsilon_i \quad (4)$$

$$POVT = \alpha_0 + \alpha_1 EXR + \alpha_2 MI + \alpha_3 FCM + \alpha_4 MS + \alpha_5 EXR * FCM + \varepsilon_i \quad (5)$$

$$INEQ = \alpha_0 + \alpha_1 EXR + \alpha_2 MI + \alpha_3 FCM + \alpha_4 MS + \alpha_5 EXR * FCM + \varepsilon_i \quad (6)$$

α_0 to α_6 are coefficients estimated to show the impact of central banks of subsaharan countries policy trilemma on inclusive growth ε_i means stochastic element that is randomly and normally distributed which other variables that are not specified in the model are embedded in it. Pesaran and Shin (1998) and Pesaran *et al* (2001) (as cited in Ajogbeje, Adeniyi & Egwaikhide, (2019), to deal with peculiar outcome a mixture of both $I(0)$ and $I(1)$ variables in a model, autoregressive distributed lag (ARDL) model is appropriate. The PARDL is appropriate in situations where data availability is a problem, especially in developing nations where short time spans for variables are common and frequently insufficient for time series regression fitting.

Model 1

$$GDP_{pct} = \delta_0 + \sum_{j=i}^k \phi_j GDP_{pct} \binom{n}{k} x^k a^{n-k} \quad (7)$$

$$GDP_{pct} = \delta_0 + \sum_{j=0}^k \phi_j GDP_{pct-j} + \sum_{j=0}^{p1} \psi_{1j} EXR_{t-j} + \sum_{j=0}^{p2} \psi_{2j} MI_{t-j} + \sum_{j=0}^{p3} \psi_{3j} FCM_{t-j} + \sum_{j=0}^{p4} \psi_{4j} MS_{t-j} + \sum_{j=0}^5 \psi_{5j} (EXR - MI)_{t-j} + \mu_t \quad (8)$$

Where:

k, p^1 to p^5 are the optimal lag orders for GDPpc_t, EXR_t, MI_t, FCM_t, MS_t, and EXR_MI_t respectively, determined through model selection procedures.

The reparameterized ARDL model, or ECM form, is derived by taking first differences of the variables and incorporating the error correction term. This form highlights the speed of adjustment to long-run equilibrium.

$$\begin{aligned}\Delta GDP_{pct} = & \delta_0 + \sum_{j=0}^k \phi_j \Delta GDP_{pct-j} + \sum_{j=0}^{p1} \psi_{1j} \Delta EXR_{t-j} + \sum_{j=0}^{p2} \psi_{2j} \Delta MI_{i-j} + \sum_{j=0}^{p3} \psi_{3j} \Delta FCM_{i-j} + \sum_{j=0}^{p4} \psi_{4j} \Delta MS_{i-j} \\ & + \sum_{j=0}^5 \psi_{5j} \Delta (EXR - MI)_{i-j} + ECT_{t-1} + v_t.\end{aligned}\quad (9)$$

Model 11

$$\begin{aligned}POV_{pct} = & \delta_0 + \sum_{j=0}^k \phi_j POV_{pct-j} + \sum_{j=0}^{p1} \psi_{1j} EXR_{t-j} + \sum_{j=0}^{p2} \psi_{2j} MI_{i-j} + \sum_{j=0}^{p3} \psi_{3j} FCM_{i-j} + \sum_{j=0}^{p4} \psi_{4j} MS_{i-j} \\ & + \sum_{j=0}^5 \psi_{5j} (EXR - MI)_{i-j} + \mu_1.\end{aligned}\quad (10)$$

The reparameterized ARDL model, or ECM form;

$$\begin{aligned}\Delta POV_{pct} = & \lambda_0 + \sum_{j=0}^k \phi_j \Delta POV_{pct-j} + \sum_{j=0}^{p1} \psi_{1j} \Delta EXR_{t-j} + \sum_{j=0}^{p2} \psi_{2j} \Delta MI_{i-j} + \sum_{j=0}^{p3} \psi_{3j} \Delta FCM_{i-j} + \sum_{j=0}^{p4} \psi_{4j} \Delta MS_{i-j} \\ & + \sum_{j=0}^5 \psi_{5j} \Delta (EXR - MI)_{i-j} + v_t\end{aligned}\quad (11)$$

$$\begin{aligned}INEQ_{pct} = & \delta_0 + \sum_{j=0}^k \phi_j INEQ_{pct-j} + \sum_{j=0}^{p1} \psi_{1j} EXR_{t-j} + \sum_{j=0}^{p2} \psi_{2j} MI_{i-j} + \sum_{j=0}^{p3} \psi_{3j} FCM_{i-j} + \sum_{j=0}^{p4} \psi_{4j} MS_{i-j} \\ & + \sum_{j=0}^5 \psi_{5j} (EXR - MI)_{i-j} + \mu_t.\end{aligned}\quad (12)$$

The reparameterized ARDL model, or ECM form;

$$\begin{aligned}\Delta INEQ_{pct} = & \lambda_0 + \sum_{j=0}^{k-1} \phi_j \Delta POV_{pct-j} + \sum_{j=0}^{p1-1} \psi_{1j} \Delta EXR_{t-j} + \sum_{j=0}^{p2-1} \psi_{2j} \Delta MI_{i-j} + \sum_{j=0}^{p3-1} \psi_{3j} \Delta FCM_{i-j} + \sum_{j=0}^{p4-1} \psi_{4j} \Delta MS_{i-j} \\ & + \sum_{j=0}^{p5-1} \psi_{5j} \Delta (EXR - MI)_{i-j} + v_t.\end{aligned}\quad (13)$$

Where:

Δ the first difference operator (e.g., $\Delta POV_t = POV_t - POV_{t-1}$).

$\gamma_{j,i}$ = the short-run coefficients for the differenced variables.

ECT_{t-1} this refers to Error Correction Term (ECT) with one lagged period, which captures the long-run equilibrium relationship.

κ is the coefficient of the ECT, representing the Speed of Adjustment (SOA).

v_t = white-noise error term.

Results and Discussion

Descriptive Statistics Analysis

As depicted in table 1: GDPpc Mean is around 6.34, median 3.34, which suggests central tendency. It is slightly right-skewed. Meaning there are some higher GDP per capita values that pull the average up with a moderate dispersion (std. dev. 0.42) and is normally distributed. The minimum and maximum (Max and Min) values range between 2.33 to 11.66. EXR Mean is 1.92 but median slightly higher at 1.98,

which suggests strong left skewness. std. dev. (0.99) indicates moderate variability in the exchange rate. MI mean of 1.77 and median of 1.80 are close, suggesting a reasonably symmetric distribution. It has a wide spread (std. dev. 0.94) and is likely to be normally distributed. Values stretch from -0.08 to 4.19. FCM mean of (8.55) and median of 8.65 are very close, suggesting a symmetric distribution. It has a smaller spread (std. dev. 0.87) than the others and is normally distributed. Max and Min values

ranges between 8.55 and 8.65. Mean of Money Supply (1.77) is higher than the Median (1.50), indicating a right-skewed distribution. Range & Dispersion: Ranges from 0.72 to 7.90. The standard deviation (1.23) Skewness & Kurtosis: Displays very high positive skewness (3.80) and is extremely leptokurtic (Kurtosis 17.46). **Normality:** The Jarque-Bera Probability (0.000000) is highly significant, rejecting the null hypothesis of normality. MS is extremely far from normally distributed.

Table 1
Descriptive Statistics of the Variable

	GDPPC	FCM	MI	EXR	MS
Mean	6.335482	8.550656	9.388829	1.922585	1.773700
Median	3.343331	8.654525	10.11813	1.975097	1.503431
Maximum	11.66105	10.60915	35.76000	3.064868	7.896698
Minimum	2.334642	6.176091	-31.45257	-2.560631	0.716843
Std. Dev.	3.652185	0.866016	10.48491	0.772800	1.225176
Skewness	0.265973	-0.493800	-0.588574	-1.237747	3.798263
Kurtosis	1.161372	2.865816	4.346725	6.978820	17.46348
Jarque-Bera	39.53550	10.72000	34.52628	236.9751	2880.291
Probability	0.200000	0.004701	0.140000	0.000000	0.020010
Sum	1640.890	2214.620	2431.707	497.9495	459.3884
Sum Sq. Dev.	3441.322	193.4958	28362.82	154.0827	387.2726
Observations	259	259	259	259	259

The Unit Root (Stationarity) Results

The need to determine whether each variable exhibits mean reversion using Levin, Lin & Chu t statistic Unit tests became paramount. This was conducted using drift only and drifts with trend specifications of unit roots at levels and first differences of the series. It was found that most of

the variables were non-stationary at levels but became stationary at first differencing I(1) except for MI that was stationary at level I(0). Having established that all variables were integrated at an order one and zero, we applied PARDL the bounds test for cointegration analysis in the model.

Table 2
Levin, Lin & Chu t statistic Unit Root Test Result

	Levin, Lin & Chu t statistic critical value	Prob.	Level of integration
RGDPpc	3.6614	0.0001	I(1)
POVrate	2.5231	0.0058	I(1)
INEQ	6.8627	0.0000	I(1)
EXR	6.2160	0.0000	I(1)
MI	4.5955	0.0000	I(0)
FCM	4.7862	0.0000	I(1)
MS	2.0335	0.0210	I(1)

Source: Author's Computation

Long-run Dynamic Analysis**MODEL I:**

The Exchange Rate Coeff (0.0003) with Prob: 0.5387 is statistically not significant. The positive coefficient (0.0003) suggest that a one-unit rise in the exchange rate causes a 0.0003 increase in GDP per capita. By implication, this result suggests that, within the context of this model, changes in the exchange rate do not have a longrun statistically reliable or measurable impact on GDP per capita in the selected sub-saharan countries

Monetary Independence coeff (-0.0877) with prob (0.001) has a longrun statistically significant. A one-unit rise in monetary independence is associated with a statistically significant (-0.0877 decrease in GDP per capita. This suggests that greater monetary independence will lead to lower longrun effect on economic output per person in sub-saharan countries This result suggests that the benefits of policy coordination or credible commitment mechanisms may outweigh the costs of reduced policy autonomy in the selected sub-saharan countries

The FCM coeff (0.3120) with prob (0.001) shows that there is longrun linear relationship between free capital mobility and GDP per capita, and it statistically significant. This suggests that economies benefit significantly from international capital flows, likely through improved resource allocation, technology transfer, and access to foreign investment in sub-saharan countries under consideration

Money Supply (MS) has a substantial positive long-run effect, with a 1% increase associated with about 0.51% higher GDP per-capita in sub-Saharan countries under consideration. This indicates that expansionary monetary policy can stimulate economic growth, consistent with Keynesian theory about money's role in economic activity

The $exr*mi$ Coeff (-5.74E-06) is insignificant (0.8600). This implies that the effect of exchange rate on GDP per-capita does not significantly depend on the level of monetary independence, and vice versa. In other words, there is no long-run statistically significant effect on "joint effect" or moderation between exchange rate and monetary independence on GDP per capita in the selected sub-Saharan countries. This could indicate that these countries have found ways to manage this trade-off without major growth penalties

MODEL II:

A rise in the exchange rate causes -0.0317 unit decrease in poverty in the long run ($p < 0.001$),

implying increase in the value of the domestic currency (if the exchange rate is defined as local per foreign currency) tends to reduce in sub-Saharan countries under consideration. The Coefficient of FCM (-2.6568) and the p-value (0.0000) less than 0.05 means that a 1% decrease in capital mobility leads to a -2.6568% long-run decrease in poverty. Foreign investment creates employment opportunities Technology transfer and it also bring productivity-enhancing technologies in the long-run in the selected sub-Saharan countries

Monetary Independence (MI) and Money Supply (MS) are not statistically significant, suggesting these variables do not have robust long-run effects on poverty in this specification. The insignificant MI coefficient suggests that the degree of monetary independence does not significantly affect long-run poverty outcomes. This could indicate that global monetary conditions are sufficiently synchronized

With coefficient of -0.001094 a p-value of 0.022, this interaction term ($exr*fc$) is statistically significant. The finding of the interaction is statistically significant, implies that the trade-offs highlighted by the trilemma regarding exchange rate policy and capital mobility have long-run direct impact on poverty reduction in the selected sub-Saharan countries

Model III

EXR Coefficient of -0.0345, the probability (0.0018) is lesser than 0.05. The statistically significant negative coefficient suggests that a reduction in the value of the domestic currency associated with a reduction in income inequality in the longrun. Therefore, from a policy perspective, this result suggests that exchange rate depreciation could be a tool to address income inequality in the long-run among the selected sub-Saharan countries

Monetary Independent coefficient of -0.3790 and P-value (0.0065) means the negative coefficient suggests that, in the long run, a unit rise Monetary Independent variable is causes a decrease of 0.3790 units in inequality. This implies that, in the long run, a more restrictive or tighter monetary policy (if your independent variable represents such a stance, e.g., money supply growth is retarded by higher interest rates) causes a reduction in income inequality

MS Coefficient (-35.05) with the p-value (0.0001) is lesser than 0.05. Money Supply (MS) has a negative coefficient, indicating that monetary expansion reduces inequality. This suggests that negative coefficient indicates the long run, for every

a unit rise in the money supply; inequality is expected to decrease by -35.05434 units.

The FCM coefficient (3.975478) and Prob (0.2262) shows that financial capital mobility (fcm) alone is not significant, but this changes when we consider the interaction effect.

The highly significant positive interaction term $mi*fcm$ (-0.1759, $p = 0.0004$) is crucial for under-

standing trilemma dynamics. This indicates that the combination of monetary independence and capital mobility creates particularly strong long-run inequality effects. This suggests a **compounding effect** where countries trying to maintain both monetary independence and capital mobility face the classic trilemma tension, leading to policy volatility that benefits those who can adjust quickly (the wealthy)

Table 3

Long-run Dynamic Results for model I, II and III

Variab	Model I			Model II			Model III		
	Coef	t-stat	Prob	Coef	t-stat	Prob	Coeff	t-stat	Prob
EXR	0.0003	0.6158	0.5387	-0.0317	3.3342	-0.0010	-0.0345	3.16372	-0.0018
MI	-0.0877	-4.1890	0.0000	0.0171	0.4814	0.6307	-0.3790	-2.75064	0.0065
LFCM	0.3120	4.1961	0.000	-2.6568	5.4667	0.0000	3.9754	1.21436	0.2262
MS	0.5059	2.8175	0.0053	0.2324	1.2183	0.2247	-35.054	-4.15178	0.0001
EXR*MI	-5.74E-06	-0.1766	0.8600						
EXR*FCM				-0.00109	-1.2247	0.2222			
MI*IFCM							0.1759	3.5899	0.0004

Source: Author's Computation: Notes: denotes statistical significance at 1% level.

Short-Run Dynamic Analysis

Model I:

A negative coefficient -0.020549 ($p=0.05$) suggests that about 2.05% of the disequilibrium from the past period long-run equilibrium is corrected in the current period. The result support the presence of a long-run association between the variables. The change in the exchange rate has a negative coefficient, but it is **insignificant** ($p\text{-value} > 0.05$). It means that, in the short run, fluctuation in exchange rate which is statistically significant does not affect GDP per-capita. The change in monetary independence also have a negative coefficient but is **insignificant** ($p\text{-value} > 0.05$). This suggests that short-run changes in the degree of monetary independence do not significantly influence GDP per-capita. The change in free capital movement has a negative significant coefficient (p is less than 0.05). This indicates that a 1% increase in free capital movement (in log terms) causes a 0.011302 unit reduction in GDP per-capita in the short-run, holding other factors constant. The change in money supply has a negative coefficient and is statistically significant ($p\text{-value}$ is less than 0.05, often considered significant at a 10% level). This suggests that a 1% increase in money supply causes

approximately a 0.22 unit decrease in GDP per-capita in the short run, though this effect is less robust than that of free capital movement. The combination of exchange rate and monetary independence has a very small positive coefficient but is not statistically significant. This implies that, in the short run, the combined effect of changes in exchange rate and monetary independence does not significantly impact GDP per-capita..

Model II:

The COINTEQ01 term is negative and significant ($p\text{-value} < 0.01$). The 23.46% shows that disequilibrium in the previous period's poverty level from its long-run path is corrected in the current period, suggesting a relatively fast adjustment process towards the long-run equilibrium level of poverty. The change in the exchange rate has a positive coefficient but is statistically insignificant (p is greater than 0.05). This implies that, in the short run, immediate changes in the exchange rate do not have a statistically significant impact on poverty levels. The change in monetary independence has a negative and statistically significant coefficient (p is lesser than 0.05). This indicates that a one-unit increase in monetary independence causes a 0.050584 unit

decrease in poverty in the short run, holding other factors constant. The change in free capital movement has a positive coefficient but is statistically insignificant (p-value > 0.05). This suggests that, in the short run, changes in the degree of free capital movement do not have a statistically significant immediate impact on poverty levels. The result of coefficient of money supply is statistically significant (p-value < 0.05). This is a very large coefficient. It indicates that a 1% increase in money supply (in log terms) causes 11.10 unit *increase* in poverty in the short run. The interaction term between exchange rate and free capital movement has a very small positive coefficient but is statistically insignificant. This implies that the combined effect of changes in exchange rate and free capital movement does not significantly impact poverty in the short run.

Model III:

D(EXR) 0.280805 with the p-value (0.2641) indicates that this variable is not statistically

significant. Short-run changes in the exchange rate do not have a discernible immediate impact on inequality. D(MI) Coefficient: 0.014850. p-value (0.7538) shows this variable is not statistically significant. Short-run changes in monetary independence do not have a statistically significant effect on inequality. D(LFCM) Coefficient: -0.188987 with P-value: 0.7431 confirms this variable is not statistically significant. Short-run changes in free capital movement do not have a statistically significant impact on inequality. D(LMS) (-1.897346) with the P-value: 0.7083 means this variable is not statistically significant. Short-run changes in the money supply do not have a statistically significant impact on inequality. D(MI_IFCM) Coefficient: -0.001137 with p-value (0.8765) confirms this interaction term is not statistically significant. The combined effect of changes in monetary independence and free capital movement does not significantly impact inequality in the short run.

Table 4
Short-run Dynamic Results for model I, II and III

Variab	Model I			Model II			Model III		
	Coeff	t-stat	Prob	Coeff	t-stat	Prob	Coeff	t-stat	Prob
COINTEQ01	-0.0205	-2.4703	0.0143	-0.23458	0.0838	-2.7973	-0.0558	-1.1635	0.2461
D(EXR(-1))	-0.00282	-0.5551	0.5794	0.36584	-2.7973	0.0057	-0.2808	-1.1201	0.2641
D(MI(-1))	-0.00150	-1.1990	0.2319	-0.05058	0.9505	0.3431	0.0148	0.3140	0.7538
D(IFCM(-1))	-0.0113	-2.1787	0.0305	0.56492	-2.2128	0.0281	-0.1889	-0.3282	0.7431
D(MS(-1))	-0.21999	-1.8032	0.0728	11.0995	1.1758	0.2412	-1.8973	-0.3747	0.7083
D(EXR*MI)	6.33E-05	0.3001	0.7644						
D(EXR*IFCM)				0.00060	2.5287	0.0123			
D(MI*IFCM)							-0.0011	-0.1555	0.8765

Post Estimation Tests and Results

Table 5 showed the diagnostic and stability post estimation test of the results and findings of this study. Its essence and need is the confirmation of the robustness and reliability of the results, observations and findings derived in the estimation technique and test conducted earlier on in the study. Thus, based on the probability values of the F-statistic and its values which are greater than 5% (0.05) threshold as seen in

all the post estimation tests results in Table 5, we can conclude emphatically that the model specified for this study and its entire results, observations and findings are reliable and do not suffer auto-correlation, mis-specification and heteroskedasticity problems that are usually associated with time series data, implying that the model was correctly specified and stabled as confirmed by the Ramsey Reset and other stability/diagnostic tests adopted in this study

Table 5
SUMMARY OF POST-DIAGNOSTIC TEST

	Model I		Model II		Model III	
	f-stat	Prob	f-stat	prob	f-stat	prob
Breush-Godfrey LM Test For Serial Correlation	0.322304	0.2267	1.46822	0.5126	1.3041	0.7612
Heteroskedasticity Test: Breush-Godfrey	1.6818	0.1648	1.9411	0.1486	1.218	0.1126
Jarque-Bera Normality Test	0.6066	0.064	0.4016	0.0722	0.1411	0.7432

Conclusion

The long-run results offer very significant evidence regarding the interconnectedness of the key macroeconomic variables. One such important result is the statistically significant positive interaction effect of free capital movement (FCM) and monetary independence (MI) in Model III (Coef=0.1759, $p=0.0004$), confirming the empirical support to the Mundell-Fleming trilemma in some selected sub-saharan countries which identifies how effective monetary policy by a central bank is highly dependent on the capital mobility level. Besides, the significant and strong impact of Money Supply (MS) across a variety of different models (e.g., Coef=-35.054, $p=0.0001$ in Model III) is reflective of the central bank's leading role in bringing about long-run macroeconomic stability through money supply control. These findings overall emphasize the significance for central banks, in formulating and implementing monetary policy, to adopt an integrated approach which has as an explicit consideration and unifies the dynamics of international capital flows and their integration with domestic monetary instruments. Such an integrated framework is required for achieving desired long-run economic outcomes and navigating the complexities of a more globalized financial system. Therefore, achieving sustainable inclusive growth and considerable poverty and inequality reduction in Sub-Saharan Africa needs an integrated, coherent policy agenda that judiciously balances macroeconomic stability with structural changes, human development, and social protection.

Policy Implications

Strategic Coordination of Monetary Policy with Capital Account Management: The high degree of

interaction of monetary instruments and free capital movement (MI*IFCM) implies that SSA central banks cannot pursue independent monetary policy independent of its interaction with capital flows.

Prioritizing Exchange Rate Stability for Trade and Investment: The pivotal role of the exchange rate (EXR) indicates its importance to SSA economies, which are extremely trade-dependent and foreign-investment-dependent. Policy should aim at reducing excessive exchange rate volatility through proper macroeconomic management

Leveraging Money Supply for Stability and Financial Inclusion: The significant impact of Money Supply (MS) in the long run suggests its strong influence on the macroeconomic environment. Central banks can leverage money supply management to maintain price stability, which is vital for the poor as inflation erodes real incomes and savings.

Author Contributions

Conceptualization, B.S.O. and B.E.A.; Methodology, B.S.O. and B.E.A.; Software, R.O. and B.S.O.; Validation, B.E.A. and B.S.O.; Formal Analysis, R.O. and B.S.O.; Investigation, R.O. and B.E.A.; Resources, R.O. and B.E.A.; Data Curation, B.S.O. and R.O.; Writing – Original Draft Preparation, B.S.O.; Writing – Review & Editing, B.E.A. and R.O.; Visualization, B.E.A. and R.O.; Supervision, B.E.A. and R.O.; Project Administration, B.S.O.

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References

- Adeleye, B. N., Gershon, O., Ogundipe, A., Owolabi, O., Ogunrinola, I., & Adediran, O. (2020). Comparative investigation of the growth–poverty–inequality trilemma in Sub-Saharan Africa and Latin American and Caribbean countries. *Heliyon*, 6(12), e05631. <https://doi.org/10.1016/j.heliyon.2020.e05631>
- Aizenman, J., & Ito, H. (2012). Trilemma policy convergence patterns and output volatility (NBER Working Paper No. 17806). National Bureau of Economic Research. https://web.pdx.edu/~ito/NBER_WP_w17806.pdf
- Aizenman, J., Chinn, M. D., & Ito, H. (2022). The impacts of crises on the trilemma configurations (NBER Working Paper No. 30406). National Bureau of Economic Research. <https://www.nber.org/papers/w30406>
- Alley, I. (2017). Capital flow surges and economic growth in Sub-Saharan Africa: Any role for capital controls? (Working Paper Series No. 252). African Development Bank. <https://www.afdb.org/en/documents/capital-flow-surges-and-economic-growth-sub-saharan-africa-any-role-capital-controls>
- Ayinde, T. O. (2022). Modelling macroeconomic trilemma and central bank behaviour in Nigeria: A Markov-switching approach. *Economic Change and Restructuring*, 55(3), 1303–1325. <https://doi.org/10.1007/s10644-021-09346-4>
- Berg, A., & Portillo, R. A. (2018). *Monetary policy in Sub-Saharan Africa*. Oxford University Press. <https://doi.org/10.5089/9780198785811.071>
- Bello, A. I., Okaro, C. S., & Okonkwo, V. I. (2024). Monetary policy and economic growth of selected emerging African economies: 2000–2022. *African Banking and Finance Review Journal*, 9(9). <https://www.abfrjournal.com/index.php/abfr/article/view/154>
- Cheng, R., & Rajan, R. S. (2020). Monetary trilemma, dilemma, or something in between? *International Finance*, 23(2), 257–276. <https://doi.org/10.1111/inf.12363>
- Garcia-Verdu, R., Selassie, A. A., & Thomas, A. (2011). Inclusive growth in Sub-Saharan Africa: Evidence from six countries during the recent high-growth period. In *Regional economic outlook: Sub-Saharan Africa* (pp. 245–257). International Monetary Fund.
- Jombo, W. (2021). Inclusive growth in Sub-Saharan Africa: Do financial depth and inclusion matter? (Policy Brief No. 768). African Economic Research Consortium. <https://aercafrica.org/old-website/wp-content/uploads/2021/08/Research-paper-455.pdf>
- Kamamkhudza, C. (2017). *Malawi's trilemma: Monetary policy independence, exchange rate stability and financial integration* (Master's thesis, Rhodes University). <http://hdl.handle.net/10962/41634>
- Klein, M. W., & Shambaugh, J. C. (2015). Rounding the corners of the policy trilemma: Sources of monetary policy autonomy. *American Economic Journal: Macroeconomics*, 7(4), 33–66. <https://doi.org/10.1257/mac.20130237>
- Kwode, I. E. (2024). Central bank intervention schemes and inclusive growth in Sub-Saharan Africa: Empirical evidence from Nigeria. *Journal of Academic Research in Economics*, 16(3). https://www.jare-sh.com/downloads/nov_2024/kwode.pdf
- Mlachila, M., Cui, L., Jidoud, A., Newiak, M., Radzewicz-Bak, B., Takebe, M., Ye, Y., & Zhang, J. (2016). Financial development in Sub-Saharan Africa: Promoting inclusive and sustainable growth. International Monetary Fund. <https://www.imf.org/external/pubs/ft/dp/2016/afr1605.pdf>
- Montes, G. C., & Dantas, J. (2025). Effects of trilemma policies patterns on monetary policy credibility. *Economic Systems*, 49(2), Article 101271. <https://doi.org/10.1016/j.ecosys.2024.101271>
- Nyang'oro, O. (2017). Capital inflows and economic growth in Sub-Saharan African countries (Working Paper Series No. 285). African Development Bank. <https://www.afdb.org/en/documents/publications/working-paper-series/>
- Obstfeld, M., Ostry, J. D., & Qureshi, M. S. (2017). A tie that binds: Revisiting the trilemma in emerging market economies (IMF Working Paper No. 17/130). International Monetary Fund. <https://doi.org/10.5089/9781484302620.001>
- Ofori, I. K., Osei, D. B., & Alagidede, I. P. (2022). Inclusive growth in Sub-Saharan Africa: Exploring the interaction between ICT diffusion and financial development. *Telecommunications Policy*, 46(7), Article 102315. <https://doi.org/10.1016/j.telpol.2022.102315>
- Oyadeyi, O. O. (2025). Financial development, financial inclusion and the effectiveness of monetary policy transmission mechanism in Africa. *Borsa Istanbul Review*, Advance online publication. <https://doi.org/10.1016/j.bir.2025.10.016>
- Reinders, S., Dekker, M., Van Kesteren, F., & Oudenhuijsen, L. (2019). Inclusive development in Africa: Synthesis report series. INCLUDE. <https://includeplatform.net/wp-content/uploads/2019/07/ID-synthesis-INCLUDE-Final.pdf>
- Zhang, J. (2016). Research on marketing management of small and medium-sized enterprises in my country: Based on the perspective of e-commerce development. *Modern Marketing (Late Journal)*, 8, 24.

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