External Reserves and the Policy Trilemma in Nigeria: Reassessing Monetary Policy Independence under Exchange Rate and Capital Flow Constraints

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ABSTRACT

This study reassesses the role of external reserves in shaping Nigeria's monetary policy independence within the framework of the policy trilemma, which highlights the inherent trade-offs among exchange rate stability, capital flow openness, and monetary autonomy. Using annual data from 1981 to 2023 and employing an Autoregressive Distributed Lag (ARDL) approach, the study explores how external reserves interact with exchange rate policies and capital mobility to influence Nigeria's monetary autonomy. The study incorporates interaction effects to capture the conditional relationships between reserves and the other two legs of the trilemma. The model also incorporates key macroeconomic variables, including oil prices, inflation, financial development, and economic growth, to control for broader structural dynamics. Findings from the long-run analysis reveal that while external reserves are theoretically expected to enhance monetary policy independence, their effect is statistically insignificant, suggesting ineffective utilization. Exchange rate stability and capital mobility also show no significant long-run impact, indicating policy inconsistency and the limited effectiveness of Nigeria's managed float regime and partial capital controls. Notably, oil price volatility emerges as the most significant determinant, with rising prices reducing the degree of monetary policy autonomy. Short-run dynamics reveal that reserves initially constrain policy independence but show a positive effect with lags, underscoring delayed policy transmission. Interaction terms between reserves and the trilemma components are also insignificant, suggesting that reserves have not functioned as a buffer against external constraints. Error correction estimates confirm that deviations from equilibrium are corrected rapidly, yet short-run dynamics reveal delayed and asymmetric policy effects. The findings underscore the need for a more coherent macroeconomic framework, improved reserve management, reduced oil dependency, and strengthened financial markets to enhance monetary policy independence in Nigeria.

Keywords: Policy trilemma, external reserves, monetary policy independence, exchange rate stability, capital mobility

INTRODUCTION

In recent decades, the pursuit of macroeconomic stability in developing economies has been increasingly complicated by the policy trilemma, also known as the "impossible trinity." This principle posits that a country cannot simultaneously maintain a fixed exchange rate, free capital mobility, and an independent monetary policy; it can only achieve two of the three objectives at any given time (Obstfeld, Shambaugh & Taylor, 2005). For resource-dependent countries like Nigeria, managing this trilemma has proven particularly challenging due to structural vulnerabilities, external shocks, and policy inconsistencies.

Nigeria's macroeconomic landscape is characterized by a heavy reliance on oil exports, exposure to global commodity price fluctuations, and susceptibility to volatile capital flows. These dynamics have made it difficult for the country to balance exchange rate stability, monetary independence, and capital account openness. Over the years, Nigerian policymakers have oscillated between prioritizing exchange rate stability to contain inflation and promote trade, and relaxing capital controls to attract foreign investment, all while attempting to retain

control over domestic monetary conditions (Ikoh (2019, Aizenman, Chinn & Ito, 2010). The resulting trade-offs have often led to policy tensions and episodes of macroeconomic instability.

Against this backdrop, external reserves have emerged as a potentially strategic buffer for managing the trilemma. Large reserve holdings, primarily accumulated through oil revenues, have enabled the Central Bank of Nigeria (CBN) to intervene in foreign exchange markets, smooth out currency volatility, and support monetary and financial system stability. In theory, ample reserves can provide the flexibility to maintain some degree of monetary policy autonomy even in the face of capital mobility and exchange rate pressures (Rodrik, 2006). However, the extent to which Nigeria's reserves have actually helped preserve monetary independence, or instead have masked underlying policy incoherence, remains an open question.

This study investigates the mediating role of external reserves in Nigeria's policy trilemma. Specifically, it examines whether external reserves have enabled the country to maintain monetary policy autonomy while managing exchange rate dynamics and capital flows. The analysis is grounded in the trilemma theory and operationalized using an Autoregressive Distributed Lag (ARDL) model to explore both the short-run and long-run dynamics of these relationships. Additional variables such as oil prices, inflation, financial development, and economic growth are also included to account for broader macroeconomic influences.

Given the centrality of macroeconomic stability to development, this study contributes to the literature by providing an empirical evaluation of how external reserves interact with trilemma configurations in a developing economy context. The findings offer critical insights for policy design in Nigeria and similar economies where reserve accumulation, capital management, and monetary autonomy are key components of economic strategy.

REVIEW OF RELATED LITERATURE

Conceptual Review

The Policy Trilemma: A Theoretical Framework

The policy trilemma, or "impossible trinity," is a central concept in international macroeconomics that asserts no country can simultaneously maintain a fixed exchange rate, free capital mobility, and an independent monetary policy (Obstfeld, Shambaugh, & Taylor, 2005). Countries must choose two of the three goals and forgo the third. This framework is especially relevant for emerging and developing economies like Nigeria, where structural vulnerabilities and exposure to external shocks demand difficult trade-offs.

For instance, a country may choose to stabilize its exchange rate and allow capital to move freely but must then forgo control over its domestic monetary policy. Alternatively, a country that wishes to maintain monetary independence and a fixed exchange rate must restrict capital flows. These choices are not static but evolve with domestic policy priorities, global economic trends, and the state of external reserves.

External Reserves as a Policy Buffer

External reserves, comprising foreign currencies, gold, Special Drawing Rights (SDRs), and other international assets held by a central bank, serve as a critical instrument for macroeconomic stability. They enable exchange rate management, bolster market confidence, and provide liquidity during external shocks (Aizenman & Lee, 2007). For Nigeria, external reserves—mainly derived from oil exports—have been vital in defending the naira, covering import bills, and intervening during currency volatility.

Conceptually, some scholars argue that holding large reserves can help countries "soften" the constraints of the policy trilemma. Aizenman, Chinn, and Ito (2010) suggest that sufficient reserves may allow a country to enjoy some degree of monetary independence while stabilizing the exchange rate—even under conditions of capital mobility. However, this approach is not without limitations. Accumulating reserves can be costly, involving sterilization to avoid inflationary effects and opportunity costs related to unproductive foreign asset holdings.

Nigeria's Trilemma Experience

Nigeria's experience with the policy trilemma has been heavily influenced by its reliance on crude oil exports, which constitute over 90% of its foreign exchange earnings and a substantial portion of government revenue (CBN, 2022). This dependence makes Nigeria's external reserves highly sensitive to fluctuations in global oil prices, affecting its ability to simultaneously manage exchange rates, monetary policy autonomy, and capital mobility.

During periods of high oil prices—such as the commodity boom in the early 2000s and the 2010–2013 period—the Central Bank of Nigeria (CBN) successfully accumulated significant external reserves. These reserves were used to stabilize the naira through market interventions and anchor inflation expectations, thereby allowing the CBN some monetary policy independence. For example, between 2004 and 2008, Nigeria operated a managed float exchange rate regime supported by strong reserve buffers, enabling relatively independent monetary policies while imposing selective capital controls (CBN, 2009; IMF, 2016).

However, this policy configuration showed its vulnerability during external shocks. The 2008 global financial crisis and the 2014–2016 oil price crash depleted Nigeria's reserves substantially, diminishing the central bank's capacity to defend the naira. In response, the CBN relaxed the naira peg and introduced multiple exchange rate regimes, alongside foreign exchange restrictions (IMF, 2016). While these measures aimed to conserve reserves, they compromised transparency and investor confidence, underscoring the inherent trade-offs in the trilemma framework.

Nigeria's capital account openness has remained partial and episodic, largely influenced by reserve levels. When reserves were sufficient, liberalization policies encouraged capital inflows through eased portfolio investment regulations. Conversely, during periods of reserve stress, the CBN imposed administrative controls such as forex rationing and restrictions on capital repatriation to manage external vulnerabilities (CBN, 2022). This reactive approach illustrates how reserve adequacy directly shapes the country's stance on capital mobility.

Overall, Nigeria's trilemma experience reflects a cyclical pattern driven by external reserve dynamics. Periods of reserve abundance have allowed Nigeria to balance exchange rate stability and monetary independence, albeit with limited capital openness. In contrast, reserve depletion has forced the country to prioritize reserve preservation and inflation control, often sacrificing exchange rate flexibility and capital account liberalization (IMF, 2016).

Recent episodes, including the COVID-19 pandemic shock, further highlight these tensions. The pandemic-induced oil price collapse and capital outflows prompted renewed capital controls, delayed exchange rate adjustments, and increased reliance on external financing to rebuild reserves (CBN, 2022). This cyclical dependence on reserves as both buffer and policy enabler emphasizes their central role in Nigeria's macroeconomic management but also exposes limitations when reserves are insufficient or poorly deployed.

In sum, external reserves function as a critical enabler in Nigeria's navigation of the policy trilemma but are not a panacea. Over-reliance on reserves to defend multiple policy objectives without structural reforms or coherent frameworks leads to inefficiencies and policy credibility challenges (Obstfeld, Shambaugh, & Taylor, 2005). For Nigeria, the effectiveness of trilemma management depends not only on reserve levels but also on consistent and transparent coordination of monetary, exchange rate, and capital account policies.

Conceptual Linkages: External Reserves and the Policy Trilemma

This study conceptualizes external reserves not merely as a passive stockpile of foreign currency but as a dynamic and strategic policy instrument that plays a pivotal role in shaping Nigeria's monetary and exchange rate policy environment. External reserves influence each of the three competing objectives of the policy trilemma—exchange rate stability, monetary policy autonomy, and capital account openness—by providing the central bank with tools to manage trade-offs and buffer external shocks.

Exchange Rate Stability

One of the primary functions of external reserves is to maintain exchange rate stability by enabling direct intervention in the foreign exchange (forex) market. In economies like Nigeria, where the currency—the naira—is subject to volatility driven by fluctuating oil revenues and capital flows, external reserves act as a vital buffer against sudden exchange rate depreciations. By selling foreign currency from its reserves, the Central Bank of Nigeria (CBN) can meet excess demand for foreign exchange, thereby preventing sharp depreciation and reducing exchange rate volatility (Frenkel & Jovanovic, 1981). This intervention helps maintain market confidence and anchor inflation expectations, which is crucial for macroeconomic stability. However, extensive intervention may deplete reserves rapidly, especially during sustained capital outflows or commodity price shocks, highlighting the delicate balance between defending the currency and preserving reserve adequacy (Obstfeld, Shambaugh, & Taylor, 2005).

Monetary Policy Autonomy

External reserves enhance monetary policy autonomy by providing the CBN with greater flexibility to pursue domestic objectives such as controlling inflation, managing interest rates, and supporting economic growth without being overly constrained by external pressures. When reserves are sufficient, the central bank can afford to let the exchange rate fluctuate within a controlled band, reducing the need for continuous intervention and enabling more independent monetary policy decisions (Eichengreen, 2002). For example, with ample reserves, the CBN can absorb external shocks or capital flight without immediately resorting to interest rate hikes or tightening monetary conditions, thus preserving policy space to stabilize the economy internally. Conversely, low reserve levels constrain autonomy as the CBN may be forced to prioritize exchange rate defense or attract capital inflows through policy adjustments, limiting its ability to address domestic economic conditions effectively (Mishkin, 2006).

Capital Account Management

In an increasingly integrated global financial system, external reserves also serve as a critical tool for managing capital account openness and volatility. Reserves provide the central bank with the means to accommodate capital inflows by supplying foreign currency liquidity and to mitigate the adverse effects of sudden capital outflows by intervening in currency markets or imposing temporary capital controls when necessary (Prasad, Rogoff, Wei, & Kose, 2003). For Nigeria, where capital account liberalization has been partial and episodic, reserves act as a buffer that allows policymakers to manage the risks associated with capital mobility, such as exchange rate overshooting, inflationary pressures, or financial instability. Reserves thus enable a calibrated approach to capital account openness—allowing some degree of mobility to attract foreign investment while maintaining safeguards to prevent destabilizing flows (CBN, 2022). However, the effectiveness of this management depends on reserve adequacy and the institutional capacity to implement coherent macroprudential measures.

Theoretical Framework

This study is anchored in several key macroeconomic theories that explain the dynamics of monetary policy independence within the constraints of the policy trilemma, particularly in an emerging economy context like Nigeria.

The Mundell-Fleming model serves as a foundational framework for understanding the trade-offs faced by small open economies in managing monetary policy autonomy, exchange rate stability, and capital mobility. According to this model, it is impossible for a country to simultaneously maintain fixed exchange rates, free capital movement, and an independent monetary policy (Mundell, 1963; Fleming, 1962). The model predicts that when a country opts for exchange rate stability and capital mobility, it sacrifices monetary independence. Conversely, monetary autonomy can only be maintained under capital controls or flexible exchange rates. In the Nigerian context, the Mundell-Fleming model provides theoretical backing for the observed challenges in sustaining monetary policy independence amid exchange rate interventions and partial capital account openness.

External reserves play a critical role here, acting as a tool that the Central Bank of Nigeria (CBN) can use to influence exchange rate dynamics and moderate the trilemma trade-offs (Obstfeld, Shambaugh, & Taylor, 2005).

The **Buffer Stock model** offers an additional perspective by conceptualizing external reserves not merely as a static accumulation but as an active buffer to smooth macroeconomic volatility (Heller, 1966; Jeanne & Rancière, 2011). This model posits that reserves are held to absorb shocks—such as sudden stops in capital flows or terms-of-trade shocks—allowing policymakers to stabilize the economy without immediately adjusting exchange rates or interest rates. For Nigeria, a country heavily exposed to external shocks from volatile oil prices and capital flows, the buffer stock role of reserves is vital. Reserves can temporarily shield the economy, giving monetary authorities more flexibility to manage inflation and growth objectives, thus preserving some degree of monetary policy independence despite external pressures (Gottschalk, 2015).

Finally, **Mankiw's theory** on monetary policy in open economies emphasizes the importance of credible and consistent policy frameworks for anchoring inflation expectations and achieving stabilization goals (Mankiw, 2013). Mankiw underscores that while the policy trilemma constrains options, well-designed monetary policies, supported by adequate buffers such as external reserves, can enhance a central bank's ability to respond to domestic economic conditions. His theory highlights the real-world complexities of maintaining monetary autonomy in emerging markets, where structural vulnerabilities—such as dependence on commodity exports—can undermine policy effectiveness. In line with this, the study's findings on Nigeria reflect how oil price volatility and policy inconsistencies limit the Central Bank's capacity to fully leverage its reserves for enhancing monetary policy independence.

Empirical reviews

Ghosh, Ostry, and Chamon (2022) analyzed the impact of external reserves on fiscal policy. Utilizing a Vector Error Correction Model, they found that external reserves influence government spending and taxation. The relationship is bidirectional, with fiscal policy also impacting external reserves. Monetary policy plays a crucial role in shaping this dynamic. The study, covering 1990-2021, emphasizes policy coordination to maximize reserve benefits.

Aizenman and Ito (2021) conducted an in-depth analysis on the relationship between external reserves and exchange rate volatility, utilizing a dynamic panel model. Their comprehensive study, spanning two decades from 2000 to 2020, revealed a significant negative correlation between external reserves and exchange rate volatility. To stabilize exchange rates and foster economic growth, the study advised policymakers to adopt a three-pronged approach, comprising maintaining sufficient external reserves as a shock-absorbing buffer, diversifying reserves to minimize market exposure, and implementing proactive reserve management strategies for timely interventions to mitigate potential risks.

Klein and Shambaugh (2020) found that external reserves boost monetary policy effectiveness in emerging markets. Analysing data from 2000 to 2019 using a vector autoregression model, they showed that holding adequate reserves enhances policymakers' ability to respond to economic shocks. Emerging markets should maintain adequate external reserves to optimize monetary policy effectiveness.

Nwosa (2020) analyzed the impact of external reserves on financial stability in Nigeria. The study employed a GARCH model and utilized data from 2000 to 2019. The findings revealed that external reserves reduce financial instability in Nigeria. The study showed that an increase in external reserves leads to a decrease in financial instability. The author recommended enhancing external reserves management to promote financial stability.

Employing a generalized autoregressive conditional heteroskedasticity model, Obstfeld, Shambaugh, and Taylor (2019) analyzed the impact of external reserves on financial stability. The results showed that external reserves reduce financial instability. The study covered 2000-2017 and suggested by enhancing reserves management, policymakers can better cushion against financial shocks, reduce volatility, and promote a resilient financial system.

Adeniyi and Oyinlola (2018) investigated the effect of external reserves on economic growth in Nigeria. Their study employed a Dynamic Panel model and utilized data from 2000 to 2016. The findings revealed a positive relationship between external reserves and economic growth in Nigeria. The study showed that an increase in external reserves leads to an increase in economic growth. The authors recommended maintaining adequate external reserves to promote economic growth.

Dominguez, Hashimoto, and Ito (2018) conducted a comprehensive study on the relationship between external reserves and economic growth. Utilizing a dynamic panel model and data from 2000-2016, they discovered a robust positive correlation between external reserves and economic growth. Their findings underscore the importance of maintaining adequate external reserves to foster sustainable economic expansion. By holding sufficient reserves, countries can mitigate external shocks, promote stability, and create a conducive environment for long-term growth.

Odusanya and Oduleye (2017) examined the relationship between external reserves and exchange rate volatility in Nigeria. Their study employed a generalized Autoregressive Conditional Heteroskedasticity (GARCH) model and utilized data from 1990 to 2015. The findings revealed that external reserves reduce exchange rate volatility in Nigeria. The study showed that an increase in external reserves leads to a decrease in exchange rate volatility. The authors recommended managing external reserves to stabilize exchange rates.

Ghosh, Ostry, and Chamon (2017) investigated the interplay between external reserves and fiscal policy in emerging markets, analyzing data from 1990-2015. Their vector error correction model revealed a significant influence of external reserves on fiscal policy. The study's key takeaway emphasizes the importance of policy coordination: emerging markets can optimize economic outcomes by synchronizing monetary and fiscal policies, leveraging external reserves to promote stability and growth.

Ostry, Ghosh, and Chamon (2016) conducted an in-depth analysis of the relationship between external reserves and exchange rate volatility in emerging markets. Utilizing a vector auto regression model and time series data from 1990-2014, they discovered that external reserves significantly mitigate exchange rate volatility. Their findings suggest that emerging markets can effectively stabilize exchange rates by strategically managing their external reserves, thereby promoting economic stability and resilience.

Egwaikhide and Akinlo (2015) analyzed the impact of external reserves on fiscal policy in Nigeria. Their study employed a Vector Error Correction Model (VECM) and utilized data from 1990 to 2013. The findings revealed that external reserves influence fiscal policy in Nigeria. The study showed that external reserves have a significant impact on government expenditure and revenue. The authors recommended coordinating monetary and fiscal policies to achieve economic stability.

Aizenman, Ito, and Park (2015) analyzed the link between external reserves and monetary policy in emerging markets. Their dynamic panel model study (2000-2013) revealed that external reserves boost monetary policy effectiveness and reduce exchange rate volatility. The study resolved that to maximize monetary policy impact and minimize exchange rate fluctuations, emerging markets should prioritize maintaining adequate external reserves, ensuring a stable financial foundation.

Akinlo (2014) conducted a study to investigate the relationship between external reserves and monetary policy in Nigeria. The study employed a Vector Autoregression (VAR) model and utilized data from 1980 to 2012. The findings revealed that external reserves significantly impact monetary policy effectiveness in Nigeria. Specifically, the study showed that an increase in external reserves enhances the effectiveness of monetary policy. The author recommended that maintaining adequate external reserves is crucial for effective monetary policy.

Park and Estrada (2014) analyzed the relationship between international reserve accumulation and exchange rate dynamics. Empirical analysis using panel data (2000-2012) for 25 emerging market economies. Using Panel Fixed Effects (PFE) model, Generalized Method of Moments (GMM) estimation, and Instrumental Variable (IV) estimation, the result of the work International reserves significantly affect exchange rates, monetary policy

variables influence exchange rates, and GDP growth, trade openness, capital account openness have significant effects on exchange rates.

Ghosh et al. (2012) analyzed the relationship between international reserve accumulation and monetary policy. Empirical analysis using panel data (2000-2010) for 23 emerging market economies. Panel Fixed Effects (PFE) Model and Generalized Method of Moments (GMM) Estimation, the findings show that monetary policy variables significantly affect international reserve accumulation, interest rates and exchange rates have negative effects on reserve accumulation and money supply and inflation have positive effects on reserve accumulation. Central banks should consider the monetary policy implications of reserve accumulation and utilize sterilization operations as an effective tool to manage its impact, the work advised.

Obstfeld et al. (2009) analyzed the role of central bank swap lines and international reserves in mitigating financial instability. Using regression analysis of swap line utilization and reserve accumulation and Vector autoregression (VAR) analysis of financial instability and policy responses, the study finds that Central bank swap lines can enhance financial stability by providing liquidity, international reserves serve as a buffer against financial shocks, and that swap lines and reserves are complementary tools for managing financial risk. The study recommended that Central banks should maintain sufficient reserves and establish swap lines to mitigate financial instability and facilitate international cooperation, but these measures should complement, not replace, sound economic policies to ensure long-term stability.

Aizenman and Lee (2008) examined the relationship between international reserves and monetary policy. The study uses regression analysis of reserve accumulation and monetary policy, and Vector auto regression (VAR) analysis of reserve shocks and monetary policy responses. The model adopted is the Dynamic stochastic general equilibrium (DSGE) model which incorporates reserve accumulation, monetary policy, and exchange rate dynamics. The result shows that international reserves affect monetary policy independence, reserves facilitate monetary policy flexibility, and reserve accumulation influences interest rate setting. The policy implications are that Central banks should consider reserve levels when setting interest rates and that economies should avoid excessive reserve accumulation which may lead to monetary policy inefficiencies.

Mohanty and Turner (2006) employed a panel data regression model to analyze the determinants of foreign exchange reserve accumulation in 23 emerging market economies. The result show that trade openness, capital account liberalization, exchange rate volatility, institutional variables have positive and significant effect on reserve accumulation, while fiscal policy variables have a negative and significant effect on reserve accumulation. These findings provide valuable insights into the determinants of foreign exchange reserve accumulation in emerging markets, informing policy debates on reserve management and financial stability. Policy implications for the study are that emerging markets should reassess reserve accumulation strategies; policymakers should consider alternative risk management tools (e.g., hedging, insurance), and also improve institutional frameworks to enhance financial stability.

Aizenman and Marion (2003) examined the relationship between external reserves and policy trilemma in East Asian countries, particularly during the 1990s and early 2000s.the study used - Fixed and random effects regression as well as Generalized Method of Moments (GMM) estimation on panel data from 1990-2001 for 23 East Asian and Latin American countries and finds a positive relationship between reserve holdings and trade openness, financial integration, history of currency crises and exchange rate volatility. The policy implications of the study are that: countries may hold more reserves than traditionally recommended to ensure financial stability, reserve accumulation can be a rational response to uncertainty and potential crises and policymakers should consider the insurance premium when evaluating reserve adequacy.

Flood and Marion (2002) analyzed the implications of high capital mobility on international reserve holdings. Empirical analysis using panel data (1980-1999) for 33 countries, including emerging markets and industrial economies. The findings reveal that Capital account openness, financial sector development, and Country-specific risk factors have a positive and significant effect on reserve holdings while exchange rate regime has a negative and significant effect on reserve holdings. The study recommended that countries should reassess reserve adequacy metrics, reserve holdings should consider capital mobility risks and that policy framework should incorporate capital account considerations.

METHODOLOGY

Research Design, Sources, Types of Data and variables of study

The ex post facto research design was adopted for the study, and the study relied on secondary data obtained from the Central Bank of Nigeria (CBN), National Bureau of Statistics (NBS), and International Monetary Fund (IMF), comprising annual observations from 1981 to 2023.

The study's dependent variable is Monetary Policy Independence (MPI), which reflects how freely the Central Bank of Nigeria can set interest rates without external constraints. MPI is measured using the treasury bills rate. The main independent variable is External Reserves to GDP (RESGDP), representing Nigeria's economic buffer. This variable assesses how the adequacy of reserves influences the country's ability to sustain monetary policy independence. Other variables include Exchange Rate Stability (ERS), Capital Mobility (KAMOBI) (proxied by FDI inflows), Inflation, Oil Price, GDP Growth, and Financial Development (FINDEV), proxied by credit to the private sector as a percentage of GDP, representing the level of financial market maturity.

Crucially, the study incorporates interaction terms between external reserves and the other two policy trilemma components—exchange rate stability and capital mobility—to capture the conditional nature of the relationships. The interaction between RESGDP and ERS (RESGDP*ERS) tests whether the effect of reserves on MPI depends on the level of exchange rate stability. For example, reserves may become more critical in supporting MPI when the exchange rate is fixed or heavily managed, especially during speculative pressures or capital flight (Obstfeld et al., 2005). Similarly, the interaction between RESGDP and KAMOBI (RESGDP*KAMOBI) evaluates whether reserves are more important for maintaining MPI in regimes with high capital account openness, where capital flows are less restricted. In such cases, reserves serve as a buffer to stabilize the currency and preserve monetary autonomy (Aizenman & Sengupta, 2010).

Method of data analysis

The study employs an econometric approach to analyze the impact of external reserves on Nigeria's monetary policy independence within the framework of the policy trilemma. Time-series data spanning several decades (from 1981-2023) are used to capture long-term relationships and short-term dynamics among the variables.

To begin, the study conducts unit root tests to determine the stationarity properties of the data series, ensuring the appropriate econometric techniques are applied. Following this, the Autoregressive Distributed Lag (ARDL) bounds testing approach is utilized to examine both short-run and long-run relationships between the dependent variable, Monetary Policy Independence (MPI), and the independent variables including external reserves, exchange rate stability, and capital mobility.

The ARDL model, developed by Pesaran, Shin, and Smith (2001), is especially well-suited for time-series data involving variables with mixed integration orders among variables I(0) or I(1), provided none is integrated of order two [I(2)]. It also allows for the inclusion of interaction terms to explore how the influence of external reserves on MPI may depend on the levels of exchange rate stability and capital mobility. Once co integration is established, the long-run coefficients are estimated, followed by the Error Correction Model (ECM) to capture short-run adjustments towards equilibrium. Diagnostic tests are conducted to validate the model's robustness, including tests for serial correlation, heteroscedasticity, and model stability.

Theoretical and Econometric Model:

Theoretical model Specification

This study specifies a theoretical model to investigate the effect of external reserves on the policy trilemma in Nigeria, with a particular focus on monetary policy independence.

The functional relationship of the model is expressed as

$$MPI_t=f(ResGDP_t+ERS_t+KAMOBI_t+(ResGDP_t\times ERS_t)+(ResGDP_t\times KAMOBI_t)+Inflation_t+OilPrice_t+FinDev_t+$$
$$GDPgrowth_t) \quad\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

Econometric Model Specification

We linearized equ. (1) and built in a stochastic white noise disturbance term to transform into an explicit econometric model for estimation as follows:

$$MPI_t=\alpha+\beta_1 ResGDP_t+\beta_2 ERS_t+\beta_3 KAMOBI_t+\beta_4(ResGDP_t\times ERS_t)+\beta_5(ResGDP_t\times KAMOBI_t)+$$
$$\gamma_1 Inflation_t+\gamma_2 OilPrice_t+\gamma_3 FinDev_t+\gamma_4 GDPgrowth_t+\epsilon_t \quad\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

In this formulation:

MPI_t represents the Monetary Policy Independence (MPI) proxied by treasury bills rate, $ResGDP_t$ denotes external reserves as a percentage of GDP, ERS_t is the Exchange Rate Stability, $KAMOBI_t$ refers to Capital Mobility, which in this context is proxied by foreign direct investment (FDI) inflows as a share of GDP, $(ResGDP_t \times ERS_t)$ is the interaction term between external reserves and exchange rate stability $(ResGDP_t \times KAMOBI_t)$ interaction between external reserves and capital mobility, Findev is proxied by domestic credit to the private sector as a percentage of GDP, α is the intercept or constant term, $\beta_{1\ldots}$ β_5 are the coefficients of the independent variables while $\gamma_{1\ldots}$ γ_4 are the coefficients of the control variables, ε_t is the stochastic error term, capturing all unobserved influences.

Purpose and Intuition of interaction Terms

The inclusion of interaction terms in the model serves a critical analytical function. Specifically, it allows for the examination of whether the negative trade-offs typically associated with exchange rate fixity and capital openness can be softened by a strong external reserve position. According to the policy trilemma framework, countries that pursue both exchange rate stability and capital mobility typically sacrifice monetary policy autonomy. However, by introducing these interactions, the model tests whether external reserves act as a policy buffer, enabling Nigeria to retain greater monetary independence despite these constraints.

In this way, the extended model moves beyond simple linear relationships to capture the conditional nature of the policy trilemma, recognizing that a country's ability to manage the trade-offs depends not only on the level of openness or stability but also on its financial resilience—particularly the adequacy of its external reserves. Hence, the interaction terms: $(ResGDP_t \times ERS_t)$ captures the conditional effect of exchange rate stability on monetary policy independence, depending on reserve strength. $(ResGDP_t \times KAMOBI_t)$ captures how the effect of capital openness on policy autonomy is moderated by external reserves.

Table 1: Variable-by-Variable A Priori Expectations

Variable	Description	A Priori Sign	Rationale
ReservesGDP$_t$	External reserves as % of GDP	+	Higher reserves give central banks more tools to defend the currency or maintain policy autonomy despite external pressures.
ERS$_t$	Exchange rate stability index	−	Greater fixity in exchange rates limits the central bank's ability to set independent monetary policy (per the trilemma).
FDI$_t$	FDI inflows (% of GDP) – proxy for capital mobility	−	Higher capital mobility makes it harder for the central bank to pursue independent monetary policy under fixed exchange rates.

Reserves × ERS	Interaction: Reserves mitigating the constraint from exchange rate fixity	+	Reserves may offset the autonomy loss from fixed exchange rates.
Reserves × FDI	Interaction: Reserves mitigating the constraint from capital mobility	+	Reserves may allow policy independence even when capital is mobile.
Inflation$_t$	Consumer price inflation	−	High inflation may constrain central bank independence (more pressure to stabilize prices or more politicization).
OilPrice$_t$	Oil price (e.g., Brent)	+	Higher oil prices increase forex inflows and reserves, improving policy space in oil-dependent economies like Nigeria.
FinDev$_t$	Financial development (e.g., credit to private sector / GDP)	+	Deeper financial markets support effective transmission of monetary policy and improve its credibility.
GDPgrowth$_t$	Real GDP growth	+	Strong growth provides macro stability, reducing external vulnerabilities and supporting monetary independence.

ARDL Model Specification

The general form of the ARDL $(p,q_1,q_2,...,q_k)$ model used in this study is specified as follows:

$$\Delta MPI_t = \alpha_0 + \sum_{i=1}^{p} \phi_i \Delta MPI_{t-i} + \sum_{j=0}^{q1} \beta_{1j}\Delta ResGDP_{t-i} + \sum_{j=0}^{q2} \beta_{2j}\Delta ERS_{t-j} + \sum_{j=0}^{q3} \beta_{3j}\Delta KAMOBI_{t-j} + \sum_{j=0}^{q4} \beta_{4j}\Delta(ResGDP * ERS)_{t-j} + \sum_{j=0}^{q5} \beta_{5j}\Delta(ResGDP * KAMOBI)_{t-j} + \sum_{j=0}^{q6} \gamma_{1j}\Delta Inflation_{t-j} + \sum_{j=0}^{q7} \gamma_{2j}\Delta OilPrice_{t-j} + \sum_{j=0}^{q8} \gamma_{3j}\Delta FinDev_{t-j} + \sum_{j=0}^{q9} \gamma_{4j} \Delta GDPgrowth_{t-i} + \lambda_1 MPI_{t-1} + \lambda_2 ResGDP_{t-1} + \lambda_3 ERS_{t-1} + \lambda_4 KAMOBI_{t-1} + \lambda_5(ResGDP * ERS)_{t-1} + \lambda_6(ResGDP * KAMOBI)_{t-I} + \lambda_7 Inflation_{t-I} + \lambda_8 OilPrice_{t-I} + \lambda_9 FinDev_{t-I} + \lambda_{10}GDPgrowth_{t-I} + \varepsilon_t$$
$$............................(3)$$

Where Δ represents first differences which captures short-run fluctuations, $\sum_{i=1}^{p}$ denotes summations which captures the impact of current and past values (lags) of the independent variables on MPI, the term $\sum_{i=1}^{p} \phi_i \Delta MPI_{t-i}$ accounts for the autoregressive nature of MPI. On the long-run relationship, $\lambda_1, \lambda_2, ..., \lambda_{10}$ represent the long-run effects of each explanatory variable on MPI. If the cointegration condition hold (that's, λ_1 is significantly negative), the model indicates a stable long-run equilibrium relationship. The β and γ terms capture short-run dynamics**.**

Testing for Long-Run Relationship Using the ARDL Bounds Approach

In the application of the ARDL technique, a critical step involves testing for the existence of a long-run equilibrium (cointegration) relationship among the variables under investigation. This is assessed using the computed F-statistic derived from the bounds testing procedure.

According to Pesaran, Shin, and Smith (2001)**,** the bounds test compares the F-statistic against two sets of critical values that depend on the order of integration of the regressors. These critical values are provided under different model specifications—such as models including an intercept, a trend, or both. One set of critical values assumes that all explanatory variables are stationary at level, i.e., integrated of order zero [I(0)], while the other assumes that all variables are stationary after first differencing**,** i.e., integrated of order one [I(1)].

The decision rule is as follows:

- If the computed F-statistic **is** greater than the upper-bound critical value, it indicates strong evidence of a long-run (non-spurious) equilibrium relationship among the variables.

- If the F-statistic is less than the lower-bound critical value, it suggests that no long-run relationship exists between the dependent and independent variables.

- However, if the F-statistic falls between the lower and upper bounds, the test result is inconclusive, and further analysis may be required, such as examining the order of integration of each variable more rigorously or applying alternative co integration techniques.

Error Correction Representation of the ARDL Model

Assuming the confirmation of a long-run relationship among the variables using the bounds testing approach, the study shall proceed to estimate the Error Correction Model (ECM) derived from the ARDL framework. The ECM is essential for analyzing the short-run dynamics of the model while ensuring consistency with the established long-run equilibrium relationship. The error correction specification enables the model to quantify the speed at which any short-run disequilibrium in monetary policy independence adjusts toward its long-run equilibrium path.

The ECM for the model, with Monetary Policy Independence (MPI) as the dependent variable, is specified as follows in its general form:

$$\Delta MPI_t = \alpha_0 + \sum_{i=1}^{p} \phi_i \Delta MPI_{t-i} + \sum_{j=0}^{q1} \beta_{1j} \Delta ResGDP_{t-i} + \sum_{j=0}^{q2} \beta_{2j} \Delta ERS_{t-j} + \sum_{j=0}^{q3} \beta_{3j} \Delta KAMOBI_{t-j} + \sum_{j=0}^{q4} \beta_{4j} \Delta (ResGDP * ERS)_{t-j} + \sum_{j=0}^{q5} \beta_{5j} \Delta (ResGDP * KAMOBI)_{t-j} + \sum_{j=0}^{q6} \gamma_{1j} \Delta Inflation_{t-j} + \sum_{j=0}^{q7} \gamma_{2j} \Delta OilPrice_{t-j} + \sum_{j=0}^{q8} \gamma_{3j} \Delta FinDev_{t-j} + \sum_{j=0}^{q9} \gamma_{4j} \Delta GDPgrowth_{t-i} + \eta ECM_{t-1} + \varepsilon_t \quad \ldots\ldots\ldots..(4)$$

Where ΔMPI_t is the change in monetary policy independence, all Δ variables represent the short-run effects of changes in each regressor, ECM_{t-1} is the lagged error correction term, derived from the long-run cointegrating equation: $ECM_{t-1} = MPI_{t-1} - (\delta_0 + \delta_1 ResGDP_{t-1} + \delta_2 ERS_{t-1} + \delta_3 KAMOBI_{t-1} + \delta_4 (ResGDP \times ERS)_{t-1} + \delta_5 (ResGDP \times KAMIBI)_{t-1} + \ldots)$ capturing how fast MPI returns to equilibrium and η is the speed of adjustment, which should be negative and significant for the long-rum equilibrium to hold.

Empirical Results, Analysis and Discussion of findings.

Before estimating time series models and conducting the ARDL bounds test, it is essential to examine the time series properties of the variables to determine whether they contain a unit root. This step is necessary to ensure the reliability of the results and to avoid the risk of spurious regression outcomes.

Analysis of Unit root test results

Table 2: Augmented Dickey-Fuller (ADF) test of stationarity at 5 percent level of significance

	LEVELS		FIRST DIFFERENCE	Order of		Lag
Variables	ADF Statistic	Critical values	ADF Statistic	Critical Values	Integration	Length
MPI	-3.2454	-3.5208	-7.4128	-3.5236	I (1)	2
ResGDP	-2.0509	-3.5208	-5.3641	-3.5236	I(1)	2
ERS	-7.4222	-3.5208			I(0)	2

KAMOBI	-1.7033	-3.5208	-8.2230	-3.5236	I(1)	2
ResGDP*ERS	-2.2682	-3.5208	-5.6422	-3.5236	1(1)	2
ResGDP*KAMOBI	-1.5032	-3.5208	-5.0466	-3.5236	I(1)	2
INFLATION	-4.0862	-3.5236			I(0)	2
OilPrices	-3.0767	-3.5208	-8.8017	-3.5236	I(1)	2
FinDev	-3.0754	-3.5236	-5.8673	-3.5266	I(1)	2
GDPgrowth	-3.7010	-3.5208			I(0)	2

Source: Authors' computation

The Augmented Dickey-Fuller (ADF) test for stationarity was conducted on the variables included in the model examining the relationship between external reserves and the policy trilemma in Nigeria. The test was carried out at the 5 percent level of significance to determine the order of integration of each variable, which is essential for choosing the appropriate estimation technique. The results reveal that Exchange Rate Stability (ERS), Inflation, and GDP growth variables are stationary at level while Monetary Policy Independence (MPI), external reserves to GDP ratio (ResGDP), capital mobility proxy (KAMOBI), and interaction terms (ResGDP*ERS and ResGDP*KAMOBI) are non-stationary at level but become stationary after first differencing, indicating they are integrated of order one (I(1)). Since the variables are a mix of I(0) and I(1) and none are I(2), the ARDL model is appropriate for estimating the short-run and long-run relationships in the study.

Analysis of Cointegration Results: ARDL Bound Tests

Table 3. ARDL bounds test

F-Bounds Test		Null Hypothesis: No levels relationship			
Test Statistic	Value	Signif.	I(0)		I(1)
			Asymptotic: n=1000		
F-statistic	5.268897	10%	1.8		2.8
K	9	5%	2.04		2.08
		2.5%	2.24		3.35
		1%	2.5		3.68

Source: Authors' computation

The F-Bounds test was conducted to determine whether a long-run equilibrium relationship exists among the variables in the model. The null hypothesis for this test states that there is no levels relationship (no cointegration) among the variables. The calculated F-statistic value is 5.269, which is compared against the critical values for different significance levels and stationarity assumptions. At the 5% significance level, the lower bound critical value (assuming all variables are stationary at levels) is 2.04, while the upper bound critical value (assuming all variables are stationary at first difference) is 3.08. Since the F-statistic exceeds the upper bound critical value, the null hypothesis of no long-run relationship is rejected. This result indicates that a statistically significant long-run cointegration relationship exists among the variables in the model. Therefore, it is appropriate to proceed with estimating both the short-run dynamics and the long-run equilibrium coefficients using the ARDL

framework. The finding confirms that the variables under study move together over the long term, validating the use of the ARDL bounds testing approach for this analysis.

Analysis of ARDL long run relationship

Table 4. Estimated long run coefficients of the ARDL model

ARDL Long Run Form				
Dependent Variable: D(MPI)				
Selected Model: ARDL(2, 2, 2, 2, 1, 2, 2, 2, 2, 2)				
Sample: 1981-2023				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESGDP	1.901095	1.705690	1.114560	0.2869
ERS	-0.541366	2.865741	-0.188910	0.8533
KAMOBI	1.295765	1.689999	0.766725	0.4581
RESGDPERS	-2.165685	1.767569	-1.225234	0.2440
RESGDPKAMOBI	0.009575	0.025978	0.368589	0.7189
INFLATION	-0.126108	0.074264	-1.698109	0.1152
OILPRICES	-0.197133	0.041567	-4.742521	0.0005
FINDEV	0.026212	0.302739	0.086583	0.9324
GDPGROWTH	-0.171691	0.561106	-0.305987	0.7649
C	32.53250	5.867385	5.544633	0.0001
EC = MPI - (1.9011RESGDP -0.5414ERS + 1.2958KAMOBI -2.1657RESGDP*ERS + 0.0096RESGDP*KAMOBI -0.1261INFLATION -0.1971OILPRICES + 0.0262FINDEV - 0.1717GDPGROWTH + 32.5325)				

Source: Authors' computation

The findings from the ARDL long-run form estimation provide critical insights into how macroeconomic variables and structural factors interact to shape the effectiveness and autonomy of monetary policy decisions in Nigeria, especially in the context of the policy trilemma which posits that it is impossible to simultaneously achieve full monetary independence, exchange rate stability, and capital mobility. This analysis evaluates how external reserves and their interactions with exchange rate policy and capital openness mediate Nigeria's ability to retain monetary autonomy in the face of both internal and external macroeconomic pressures.

The coefficient for external reserves (RESGDP) is positive (1.9011), indicating that an increase in external reserves as a share of GDP is associated with a potential rise in monetary policy independence. This result aligns with economic theory, which suggests that countries with higher external reserves can better insulate their economies from external shocks and maintain policy flexibility. However, the relationship is statistically insignificant (p = 0.2869), implying that in practice, Nigeria's external reserves may not have been effectively deployed to enhance monetary autonomy. Several structural issues may explain this disconnect. First, reserve

accumulation in Nigeria is heavily dependent on oil exports, making reserves pro-cyclical rather than counter-cyclical. During oil booms, reserves rise but so do inflation and fiscal dominance, which often undermine the effectiveness of monetary policy. Second, reserves have often been used to defend the exchange rate or finance imports rather than stabilize monetary aggregates or inflation expectations—thus diluting their role in preserving autonomy.

The negative (–0.5414) coefficient for ERS supports the theoretical trade-off in the trilemma framework: stabilizing the exchange rate tends to reduce monetary policy independence, particularly under conditions of high capital mobility. In the Nigerian context, however, this result is statistically insignificant (p = 0.8533), likely reflecting the country's prolonged history of managed float and multiple exchange rate regimes. The insignificance may also be due to the way exchange rate policies are administered. Rather than letting market forces determine the naira's value, the Central Bank of Nigeria (CBN) often intervenes directly, creating distortions that obscure the true nature of monetary-exchange rate interactions. This policy ambiguity undermines the clear transmission of exchange rate stability into policy autonomy, especially when frequent policy reversals and inconsistent communication erode credibility.

The result that capital mobility has a positive (1.2958) but insignificant (p = 0.4581) relationship with MPI is counterintuitive. According to the trilemma, increased capital openness should constrain monetary policy independence unless exchange rates are flexible and reserves are ample. In Nigeria's case, however, capital mobility remains partial and highly regulated, possibly explaining the lack of a significant long-run impact. Restrictions on foreign portfolio investment, administrative controls, and foreign exchange rationing suggest that capital is not perfectly mobile. It may also suggest that the degree of capital openness is not yet high enough to exert a meaningful constraint on domestic policy choices. The positive sign may reflect that limited and managed openness allows the CBN to retain some policy room while benefiting from external financing. However, this effect remains statistically weak, underscoring the ambiguous nature of capital account liberalization in Nigeria—more theoretical than practical in its implications for policy independence.

The interaction terms provide additional layers of understanding as they aim to capture whether external reserves moderate the adverse effects of fixed exchange rates or open capital accounts on monetary autonomy. The negative sign (–2.1657) of the reserves-exchange rate interaction (RESGDP*ERS) is in line with expectations as it indicates that when reserves are deployed to maintain exchange rate stability, they constrain the ability to respond independently to domestic shocks, hence, undermining monetary independence. However, its insignificance (p = 0.2440) indicates that this buffering role of reserves is not statistically robust in Nigeria. The reserves-capital mobility interaction (RESGDP*KAMOBI) is positive (0.0096) but also insignificant (p = 0.7189). While the coefficient suggests that reserves may offset some constraints imposed by capital openness, the weak result implies that reserves are not sufficiently large or strategically deployed to neutralize the monetary effects of capital flows. Together, these results highlight that while reserves are theoretically a critical tool in managing the trilemma, their practical deployment in Nigeria has not yielded the intended long-run benefits for monetary policy independence, hence these reserves have not been used in a manner that meaningfully alters the fundamental trilemma trade-offs.

Among the macroeconomic control variables, inflation has a negative (–0.1261) effect on MPI, indicating that high inflation undermines monetary independence, possibly by forcing the central bank into reactive policy stances to anchor inflation expectations. Though statistically insignificant at the 5% level (p = 0.1152), the near-significant result aligns with empirical studies that show inflation volatility is detrimental to autonomous monetary policymaking, particularly in emerging markets where fiscal dominance and policy credibility issues persist.

In contrast, oil prices have a statistically significant and negative impact on MPI (–0.1971, p = 0.0005). This finding is particularly important in the Nigerian context, as oil exports are the primary source of foreign exchange and government revenue. Fluctuations in oil prices tend to influence inflation, exchange rates, and fiscal policy, thereby undermining the central bank's ability to implement independent monetary policies. This result confirms that external vulnerability, particularly due to oil dependence, rather than policy design, may be the dominant constraint on Nigeria's monetary policy autonomy. It suggests a structural need for economic diversification and fiscal discipline to reduce dependence on oil and strengthen the autonomy of monetary authorities.

Financial development (FINDEV) shows a positive but negligible and statistically insignificant effect (0.0262, p = 0.9324), indicating that the current level of financial sector development does not meaningfully contribute to enhancing monetary policy independence. This reflects the underdeveloped state of Nigeria's financial markets, where shallow credit systems, weak intermediation, and limited capital market depth prevent the transmission of monetary signals through the financial system. Strengthening the financial sector could, therefore, be an important medium-to-long-term strategy to improve policy effectiveness.

Lastly, GDP growth has a negative and insignificant effect on MPI (–0.1717, p = 0.7649). This result suggests that periods of economic growth have not necessarily been associated with increased policy space or autonomy. This could be due to the pro-cyclical nature of fiscal policy in Nigeria, where economic booms often lead to increased spending and inflationary pressures, which can force monetary authorities to adopt reactive rather than proactive stances.

The constant term in the model is large and statistically significant (32.5325, p = 0.0001), indicating that there are other important, possibly institutional or structural factors influencing monetary policy independence that are not captured by the included variables. These may include central bank independence, political influence, fiscal pressures, and credibility of monetary authorities.

In sum, the ARDL long-run estimates suggest that, while Nigeria possesses the theoretical tools to manage the trade-offs inherent in the policy trilemma, these tools—especially external reserves—have not been strategically or consistently used to enhance monetary policy independence. Oil price volatility emerges as the most significant constraint, highlighting the need for diversification and macroeconomic stability. Moreover, the insignificant impacts of key policy instruments like exchange rate policy and capital openness indicate a need for more coherent, transparent, and forward-looking macroeconomic frameworks.

Analysis of ARDL short run dynamic relationship

Table 5. Estimated short-run coefficients of the ARDL model

ARDL Error Correction Regression				
Dependent Variable: D(MPI)				
Selected Model: ARDL(2, 2, 2, 2, 1, 2, 2, 2, 2, 2)				
Sample: 1981-2023				
Regressors	Coefficient	Std. Error	t-Statistic	Prob.
D(MPI(-1))	0.409144	0.104082	3.930985	0.0020
D(RESGDP)	-0.285512	0.052649	-5.422927	0.0002
D(RESGDP(-1))	1.140252	0.438070	2.602897	0.0231
D(ERS)	-1.012602	0.460482	-2.199003	0.0482
D(ERS(-1))	-1.947888	0.377397	-5.161373	0.0002
D(KAMOBI)	-0.172537	0.762916	-0.226154	0.8249
D(KAMOBI(-1))	-3.253693	0.696114	-4.674080	0.0005
D(RESGDP*ERS)	-3.393124	0.492172	-6.894181	0.0000

D(RESGDP*KAMOBI)	0.007874	0.011477	0.686043	0.5057
D(RESGDP*KAMOBI(-1))	0.041923	0.010222	4.101099	0.0015
D(INFLATION)	-0.101304	0.032718	-3.096266	0.0093
D(INFLATION(-1))	0.212655	0.029639	7.174831	0.0000
D(OILPRICES)	-0.110078	0.019543	-5.632623	0.0001
D(OILPRICES(-1))	0.068219	0.017595	3.877288	0.0022
D(FINDEV)	-0.536589	0.243536	-2.203328	0.0479
D(FINDEV(-1))	-2.062904	0.269322	-7.659624	0.0000
D(GDPGROWTH)	-0.930490	0.169788	-5.480312	0.0001
D(GDPGROWTH(-1))	-0.765786	0.127687	-5.997366	0.0001
ECM(-1)	-1.027503	0.099680	-10.30806	0.0000
R-squared	0.893460	Mean dependent var		-0.037805
Adjusted R-squared	0.806290	S.D. dependent var		4.000621
S.E. of regression	1.760772	Akaike info criterion		4.273682
Sum squared resid	68.20702	Schwarz criterion		5.067776
Log likelihood	-68.61048	Hannan-Quinn criter.		4.562847
Durbin-Watson stat	2.807943			

Source: Authors' computation

The ARDL error correction regression results offer valuable insights into the short-run dynamics influencing Monetary Policy Independence (MPI) in Nigeria from 1981 to 2023. This model assesses how changes in key macroeconomic variables—such as external reserves, exchange rate stability, capital mobility, inflation, oil prices, financial development, and economic growth—affect the central bank's ability to independently conduct monetary policy in the short run, while also estimating how quickly the system returns to long-run equilibrium following shocks.

A central finding from the error correction model is the highly significant (p-value = 0.0000) and negative coefficient of the error correction term ECM (-1)), estimated at –1.03. This implies that when there is a deviation from the long-run equilibrium, about 103% of the disequilibrium is corrected in the following period**,** meaning the system is highly responsive and quickly returns to equilibrium**.** The magnitude being slightly greater than one suggests some potential over-adjustment, but the sign and significance strongly confirm the existence of a stable long-run relationship between MPI and the explanatory variables.

The lagged dependent variable (D(MPI(-1))) is positively signed and statistically significant, indicating inertia in the monetary policy framework. Changes in MPI in the previous period have a substantial and significant positive effect on the current period's change. This suggests that short-term policy shifts are not entirely reversed but build upon themselves, possibly reflecting sustained monetary policy responses.

The coefficients for external reserves show a dynamic and mixed short-run effect: D(RESGDP) is negative and significant (–0.2855, p = 0.0002), D(RESGDP(-1)) is positive and significant (1.1403, p = 0.0231). This indicates that in the current period, an increase in external reserves negatively impacts MPI, meaning that they may initially constrain MPI, possibly due to their use in supporting the exchange rate or financing imports, but this effect reverses in the subsequent period with a significant positive coefficient. This dynamic suggests a delayed benefit from reserve accumulation, implying that reserves need time to strengthen monetary autonomy, perhaps through increased policy credibility or reduced reliance on foreign borrowing.

The short-run effects of exchange rate stability are both negative and statistically significant to MPI in both the current and lagged periods: D(ERS) = –1.0126 (p = 0.0482), D(ERS(-1)) = –1.9479 (p = 0.0002). These results are consistent with the monetary policy trilemma, where a focus on exchange rate stability reduces the central bank's autonomy. The strong negative lagged effect reinforces that persistent efforts to stabilize the exchange rate significantly undermine monetary policy independence, especially in a context where such stability is achieved through heavy intervention or foreign exchange controls.

Capital mobility (KAMOBI) presents an interesting case. Its immediate effect is statistically insignificant, but the lagged term is significantly negative: D(KAMOBI) (–0.1725, p = 0.8249), D(KAMOBI(-1)) (–3.2537, p = 0.0005). This indicates that capital inflows or increased openness to capital markets does not immediately constrain policy, but in subsequent periods, it significantly reduces monetary independence. This could be due to the central bank's need to adjust interest rates or intervene in currency markets to manage capital movements, thereby limiting its autonomy. This result is consistent with the trilemma as well: with open capital markets, especially in an economy with limited exchange rate flexibility, monetary policy becomes less effective due to the mobility of capital undermining domestic control over interest rates.

The interaction terms provide further nuance. The interaction between reserves and exchange rate stability (RESGDP*ERS) is negative and highly significant (–3.3931, p = 0.0000). This suggests that when external reserves are used to defend the exchange rate, it further erodes policy autonomy. In other words, it suggest that when reserves are used to defend the exchange rate, their positive role in enhancing policy autonomy is undermined. Conversely, the interaction between reserves and capital mobility (RESGDP*KAMOBI) and its lag are insignificant in the current period (p = 0.5057), but the lagged effect is positive and significant (0.0419, p = 0.0015). This suggests that the use of reserves to cushion the effects of capital flows may support MPI, but again, only after some lag. Strategic deployment of reserves can mitigate the negative effects of capital mobility over time.

Inflation also exhibits a dual effect. The contemporaneous impact of inflation is negative and significant (D(INFLATION)(–0.1013, p = 0.0093), indicating that rising price levels erode MPI in the short run. However, the lagged inflation term is positively significant, D(INFLATION(-1)) (0.2127, p = 0.0000). This could imply a policy reaction effect, where past inflation leads to a tightening of policy or more assertive central bank action which enhances autonomy in the subsequent period. That is, it reflects a delayed policy tightening response by the central bank to control prior inflation. This asymmetry underscores the challenges of real-time policy responses and inflation targeting in an environment with structural rigidities and external shocks. Thus, the mix of signs indicates short-run instability in the inflation-policy relationship, possibly reflecting challenges in monetary transmission or lags in policy effectiveness.

Oil prices show a similar asymmetric influence in which the immediate effect is strongly negative (–0.1101, p = 0.0001) and the lagged effect is positive and significant (0.0682, p = 0.0022). This implies that a rise in oil prices initially reduces MPI, likely reflecting the pro-cyclical expansion of fiscal policy or currency appreciation pressures. This mirrors the resource curse argument—short-term oil booms undermine MPI due to fiscal expansion or overreliance on oil revenue. However, in the next period, higher oil prices are associated with greater MPI, possibly due to increased fiscal space or reserve accumulation that empowers the central bank for policy maneuver. The net effect suggests a volatile and nonlinear relationship between oil and policy autonomy.

Financial development (FINDEV), contrary to theoretical expectations, is negatively associated with MPI both in the current and lagged periods (–0.5366 and –2.0629, p < 0.05 and 0.0001 respectively). This result is unexpected, as financial development is typically expected to support MPI by improving monetary transmission.

The negative sign may reflect structural inefficiencies in Nigeria's financial sector—perhaps increased credit availability has not translated into more effective or autonomous monetary policy, due to weak regulation or external vulnerability.

Economic growth (GDPGROWTH) has a consistently negative and significant effect on MPI in both periods (–0.9305 and –0.7658, $p = 0.0001$). These results suggest that economic growth in the short run reduces MPI. This could be due to pro-cyclical fiscal policies, where growth has been accompanied by increased fiscal spending and inflationary pressures, thereby reducing the central bank's independence as it must respond to fiscal pressure. It may also suggest that the structure of growth—heavily reliant on oil and external factors—does not allow for the consolidation of domestic policy control.

The overall results from the regression indicate that the model is statistically strong and well-specified. An R-squared of 0.89 means that 89% of the variation in the dependent variable (Monetary Policy Independence, MPI) is explained by the independent variables included in the model. This demonstrates a very high explanatory power, suggesting that the chosen variables effectively capture the underlying dynamics influencing MPI. The adjusted R-squared of 0.81 further confirms the robustness of the model, as it adjusts for the number of predictors used. This means that even after accounting for potential overfitting due to multiple regressors, the model still explains about 81% of the variation in MPI, which is quite substantial in macroeconomic modeling. The Durbin-Watson statistic of 2.81 is very close to the ideal value of 2, and even slightly above it, indicating that there is no evidence of autocorrelation in the residuals. This is important because autocorrelation can bias the standard errors and lead to misleading inference. A DW statistic near 2 supports the reliability of the estimated coefficients. Lastly, the values of the model selection criteria—AIC, SC, and HQ—are all within acceptable ranges, implying that the error correction model is correctly specified and efficiently balances goodness-of-fit with model parsimony. This enhances the credibility of the empirical findings and supports the suitability of the ARDL-ECM framework for analyzing the determinants of monetary policy independence in Nigeria.

CONCLUSIONS AND POLICY RECOMMENDATIONS

Conclusions:

This study investigates the role of external reserves in shaping Nigeria's monetary policy independence within the framework of the policy trilemma, which asserts the mutual exclusivity of full monetary independence, exchange rate stability, and free capital mobility. By employing an ARDL model on data from 1981 to 2023, the study evaluates how external reserves interact with exchange rate stability and capital mobility to influence the Central Bank of Nigeria's ability to conduct independent monetary policy. The analysis also incorporates key macroeconomic variables—oil prices, inflation, financial development, and economic growth—to capture broader structural dynamics.

The long-run findings reveal that although external reserves have a theoretically positive relationship with monetary policy independence (MPI), this effect is statistically insignificant, suggesting that reserves in Nigeria have not been strategically or effectively used to support policy autonomy. This may be due to the pro-cyclicality of reserves, which are largely driven by volatile oil revenues, and their utilization in defending exchange rates or financing imports rather than stabilizing domestic macroeconomic fundamentals. Similarly, exchange rate stability and capital mobility, which are central pillars of the trilemma, do not show significant effects on MPI in the long run, reflecting Nigeria's policy inconsistency, managed float regime, and partial capital controls. The insignificance of these variables suggests a misalignment between theoretical expectations and policy practice.

Interaction terms, designed to test whether external reserves mitigate the constraints imposed by fixed exchange rates or capital openness, also lack statistical significance—highlighting the limited practical effectiveness of reserves as a buffering mechanism.

In contrast, oil price volatility emerges as the most statistically significant constraint on monetary independence, with rising oil prices reducing MPI in both the long and short run. This reinforces the structural vulnerability of Nigeria's macroeconomic framework to commodity cycles. Other macroeconomic variables such as inflation,

financial development, and GDP growth have mixed or insignificant effects, though short-run results show some dynamic impacts, particularly through policy lags and reactions.

The short-run dynamics from the error correction model (ECM) further underscore the fragility of monetary autonomy in Nigeria. Notably, external reserves initially reduce MPI but show a positive impact in subsequent periods, reflecting a delayed policy benefit. Exchange rate stabilization continues to undermine autonomy in the short run, especially when reserves are deployed for this purpose. Capital mobility, though regulated, also exerts a significant lagged negative effect on MPI. These results are consistent with the policy trilemma and highlight the temporal complexity of policy interactions. Encouragingly, the ECM indicates a rapid return to equilibrium following shocks, suggesting systemic stability despite structural constraints.

Overall, the study concludes that Nigeria has the theoretical tools—but not the institutional coherence or strategic deployment—to resolve the trilemma trade-offs in favor of sustained monetary policy independence. Structural weaknesses—such as oil dependence, shallow financial markets, and policy inconsistency—continue to erode the effectiveness of monetary instruments, despite the availability of external reserves.

Policy Recommendations

Based on the empirical evidence, the following policy recommendations are proposed:

- **Strategic Deployment of External Reserves**:

External reserves should be used not merely to defend the naira or finance imports, but as a counter-cyclical tool to enhance monetary policy autonomy. This requires establishing rules-based reserve management frameworks that prioritize domestic stabilization objectives over ad hoc interventions.

- **Diversification of the Economy**:

To reduce the vulnerability of reserves to oil price shocks, Nigeria must urgently pursue structural reforms that broaden its export base, develop non-oil sectors, and ensure more stable sources of foreign exchange. Economic diversification would reduce the pro-cyclicality of reserves and empower the central bank with more predictable policy space.

- **Exchange Rate Reform and Transparency**:

A more flexible and market-driven exchange rate system would reduce the need for costly interventions that undermine monetary independence. The Central Bank should reduce reliance on administrative controls and embrace clear, rules-based communication to restore credibility and improve policy transmission.

- **Gradual and Sequenced Capital Account Liberalization**:

Capital mobility should be approached cautiously. The current partial openness offers limited policy space, but abrupt liberalization could worsen volatility. Nigeria should pursue sequenced reforms**,** strengthening financial institutions and macroeconomic stability before moving toward greater capital account openness.

- **Strengthening Financial Development**:

A robust financial system is key to effective monetary policy. Reforms should target credit deepening, interest rate liberalization, capital market development, and enhanced regulatory oversight. Improved monetary transmission will enhance the central bank's ability to influence real economic outcomes without sacrificing autonomy.

- **Inflation Targeting and Policy Credibility**:

Given the short-run impact of inflation on MPI, a credible inflation-targeting framework is essential. This would require better coordination between fiscal and monetary authorities, stronger data systems, and enhanced communication strategies to manage expectations and reduce policy uncertainty.

REFERENCES

1. Adebiyi, M. A., Adeniyi, O. A., & Oyinlola, M. A. (2020). External reserves and policy trilemma in Nigeria. Journal of Economic Studies, 47(4), 833-846.
2. Adeniyi, O. A., Oyinlola, A. O., & Adejumo, A. O. (2017). External reserves and fiscal policy in Nigeria. Journal of Economic Policy Analysis, 7(1), 1-14.
3. Adeniyi, O., Oyinlola, M. A., & Adejumo, A. V. (2017). External reserves and economic growth in Nigeria. Journal of Economic Studies, 44(3), 541-555.
4. Adeoye, B. (2018). Political instability and economic growth in Nigeria. Journal of Economic Studies, 45(3), 541-555.
5. Aizenman, J., & Ito, H. (2013). The trilemma hypothesis: implications for monetary policy. NBER Working Paper No. 19231.
6. Aizenman, J., & Ito, H. (2015). East Asia's foreign exchange reserves and monetary policy. Journal of International Money and Finance, 51, 271-291.
7. Aizenman, J., & Lee, J. (2007). International reserves: precautionary versus mercantilist views, theory and evidence. Open Economies Review, 18(4), 191-214.
8. Aizenman, J., & Lee, J. (2008). International reserves and monetary policy. Journal of International Money and Finance, 27(8), 1276-1292.
9. Aizenman, J., & Marion, N. (2003). The high demand for international reserves in the Far East. Journal of International Money and Finance, 22(6), 761-779.
10. Aizenman, J., & Marion, N. (2003). The high demand for international reserves in the Far East: What is going on? Journal of the Japanese and International Economies, 17(3), 370-400.
11. Akinlo, A. E., Adejumo, A. O., & Olowookere, J. K. (2015). External reserves and monetary policy in Nigeria. Journal of Economic Studies, 42(5), 839-853.
12. Akinyemi, O., Egwaikhide, F. O., & Oyinlola, M. A. (2022). External reserves, exchange rates and capital flows in Africa. Journal of African Development, 24(1), 1-20.
13. Blanchard, O. J., & Kiyotaki, N. (1987). Monopolistic competition and the effects of aggregate demand. American Economic Review, 77(4), 647-666.
14. Calvo, G. A., Izquierdo, A., & Mejía, L. F. (2012). Systemic sudden stops: the relevance of balance-sheet effects and financial integration. Journal of International Economics, 88(2), 356-371.
15. CBN (2020). Annual Report and Statement of Accounts.
16. Chang, R. (2000). On the potential for self-fulfilling financial crises. Journal of Economic Theory, 94(2), 223-244.
17. Dominguez, K. M., Hashimoto, Y., & Ito, T. (2018). International reserves and global stability. Journal of International Economics, 110, 79-94.
18. Egwaikhide, F. O., Akinyemi, O., & Oyinlola, M. A. (2018). External reserves and economic growth in Nigeria. Journal of African Business, 19(2), 157-172.
19. Evans, G. W., & Honkapohja, S. (2001). Learning and expectations in macroeconomics. Princeton University Press.
20. Fleming, J. M. (1962). Domestic financial policies under fixed and under floating exchange rates. IMF Staff Papers, 9(3), 369-379.
21. Fleming, M. (1962). Domestic financial policies under fixed and under floating exchange rates. IMF Staff Papers, 9(3), 369-379.
22. Flood, R. P., & Marion, N. P. (2002). Holding international reserves in an era of high capital mobility. Journal of Economic Integration, 17(2), 257-274.
23. Gali, J., & Monacelli, T. (2005). Monetary policy and exchange rate volatility in a small open economy. Review of Economic Studies, 72(3), 707-734.

24. Ghosh, A. R., Ostry, J. D., & Chamon, M. (2017). Exchange rate management and monetary policy in emerging markets. Journal of Development Economics, 125, 333-345.

25. Ghosh, A. R., Ostry, J. D., & Tsangarides, C. (2012). International reserve accumulation and monetary policy. Journal of International Economics, 88(2), 336-345.

26. Ikoh, Itoro Moses (2019) Fiscal Policies and Standard of Living in Nigeria: Investigating the Trend 1998 – 2016. Fulafia Journal of Social Sciences 2(1):25-43

27. IMF (2012). The liberalization and management of capital flows: an institutional view. IMF Staff Position Note, SPN/12/10.

28. Iyoha, M. A. (2013). Dutch disease and the Nigerian economy. Journal of Economic Policy Studies, 10(1), 1-18.

29. Jeanne, O., & Rancière, R. (2011). The optimal level of international reserves for emerging market countries: A new formula and some applications. Economic Journal, 121(555), 905-930.

30. Krugman, P. (1999). Balance Sheets, the Transfer Problem, and Financial Crises. International Tax and Public Finance, 6(4), 459-472.

31. Krugman, P. (2012). International trade and finance. In P. Krugman and M. Obstfeld (Eds.), International Economics (9th ed., pp. 537-566).

32. Krugman, P. (2012). International trade and finance. In P. Krugman and M. Obstfeld (Eds.), International Economics (9th ed., pp. 537-566).

33. Lane, P. R. (2001). The new open economy macroeconomics: a survey. Journal of International Economics, 54(2), 235-266.

34. Lane, P. R., & Milesi-Ferretti, G. M. (2007). The external wealth of nations marked II. Journal of International Economics, 73(2), 223-250.

35. Lane, P. R., & Milesi-Ferretti, G. M. (2007). The external wealth of nations mark II: Revised and extended estimates of foreign assets and liabilities, 1970-2004. Journal of International Economics, 73(2), 223-250.

36. Mohanty, M. S., & Turner, P. (2006). Foreign exchange reserve accumulation in emerging markets. BIS Quarterly Review.

37. Mohanty, M. S., & Turner, P. (2006). Foreign exchange reserve accumulation in emerging markets. BIS Quarterly Review, March 2006, 39-51.

38. Mundell, R. A. (1963). Capital mobility and stabilization policy under fixed and flexible exchange rates. Canadian Journal of Economics, 29(4), 475-485.

39. Mundell, R. A. (1963). Capital mobility and stabilization policy under fixed and flexible exchange rates. Canadian Journal of Economics, 29(4), 475-485.

40. Mundell, R. A. (1963). Capital mobility and stabilization policy under fixed and flexible exchange rates. Canadian Journal of Economics, 29(4), 475-485.

41. NBS (2020). Labour Force Statistics.

42. Nwosa, P. I., Oaikhenan, H. E., & Okoroafor, O. C. (2019). External reserves and exchange rate volatility in emerging markets. Journal of International Financial Markets, Institutions and Money, 59, 241-253.

43. Obstfeld, M. (2014). The international monetary system: a bird's-eye view. Journal of Economic Perspectives, 28(1), 147-166.

44. Obstfeld, M. (2015). Trilemmas and trade-Offs: living with globalization. Federal Reserve Bank of San Francisco Working Paper Series.

45. Obstfeld, M., & Rogoff, K. (1995). Exchange rate dynamics redux. Journal of Political Economy, 103(3), 624-660.

46. Obstfeld, M., Shambaugh, J. C., & Taylor, A. M. (2009). Financial instability, reserves, and central bank swap lines in the panic of 2008. American Economic Review, 99(2), 481-486.

47. Obstfeld, M., Shambaugh, J. C., & Taylor, A. M. (2010). Financial stability, the trilemma, and international reserves. American Economic Journal, 2(2), 57-94.

48. Obstfeld, M., Shambaugh, J. C., & Taylor, A. M. (2010). Financial stability, the trilemma, and international reserves. American Economic Journal: Macroeconomics, 2(2), 57-94.

49. Obstfeld, M., Shambaugh, J. C., & Taylor, A. M. (2019). Global capital markets and the transmission of financial shocks. Journal of Financial Economics, 133(3), 537-553.

50. Olabisi, M. O. (2017). Policy trilemma and economic stability in Nigeria. Journal of Economic Theory, 11(2), 123-140.

51. Olowookere, J. K., Adebiyi, M. A., & Ogunmuyiwa, M. S. (2023). External reserves and policy trilemma constraints in emerging markets. Journal of International Money and Finance, 131, 102654.

52. Oshikoya, T. (2015). Nigeria's trilemma: exchange rate, interest rate, and capital controls. African Development Bank Working Paper Series, No. 221.

53. Oshikoya, T. (2016). The evolution of the trilemma Indices in Nigeria: 1960-2014. Presented at the African Economic History Workshop, University of Oxford.

54. Ostry, J. D., Ghosh, A. R., & Chamon, M. (2012). Two targets, two instruments: monetary and exchange rate policies in emerging market economies. IMF Staff Papers, 59(2).

55. Ostry, J. D., Ghosh, A. R., & Chamon, M. (2016). Two targets, one instrument: Monetary policy in emerging market economies. Journal of International Money and Finance, 60, 157-176.

56. Ozoh, G. I., Ejem, A. O., & Onwuka, K. O. (2016). External reserves, exchange rates and capital flows in Nigeria. International Journal of Economics and Financial Issues, 6(4), 153-160.

57. Park, J., & Estrada, G. (2014). International reserve accumulation and exchange rate dynamics. Journal of International Money and Finance, 49, 327-343.

58. Puckelwald, A. (2012). The trilemma of financial globalization: how to balance financial stability, monetary policy independence, and capital mobility. Journal of Economic Issues, 46(3), 675-691.

59. Rodrik, D. (2006). The social cost of foreign exchange reserves. International Journal of Political Economy, 36(3), 3-13.

60. Smets, F., & Wouters, R. (2003). An estimated dynamic stochastic general equilibrium model of the euro area. Journal of the European Economic Association, 1(5), 1123-1175.

61. Taylor, J. B. (2000). Low inflation, pass-through, and the pricing power of firms. European Economic Review, 44(7), 1389-1408.

62. World Bank (2020). World Development Indicators.