Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Central Bank Independence, Institutional Quality and Inflation Control in Africa: Evidence of Regional Heterogeneity

Ike Okereke

okerekei@babcock.edu.ng

Babcock University

Bolanle Amusa

Gateway ICT polytechnic

Research Article

Keywords: Central bank independence, Institutional quality, Inflation, Exchange-rate depreciation, Regional heterogeneity

Posted Date: October 30th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-11132153/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Central Bank Independence, Institutional Quality and Inflation Control in Africa: Evidence of Regional Heterogeneity

Okereke, Ike Godslove
Department of Economics
Babcock University
Ilishan Remo, Ogun State, Nigeria
Corresponding author: Okereke, Ike Godslove
Email: okerekei@babcock.edu.ng

Amusa, Bolanle Olubunmi
bolabunmiakanni@gmail.com
Department of Banking and Finance
Gateway ICT Polytechnic
Saapade, Ogun State, Nigeria

Abstract

This study examined the effect of central bank independence on inflation outcomes in Africa and also examined whether institutional quality conditions the CBI–inflation relationship and whether this relationship varies across African sub-regions. The CBI weighted index, computed by Garriga (2025), was used to measure central bank independence. Inflation was measured using the inflation rate (GDP deflator). The composite institutional quality index was computed using all six dimensions of institutional quality with the use of PCA. Control variables are GDP growth rate, exchange rate, M2 (% of GDP), and trade openness. The study employed Two-way fixed-effects models with Driscoll–Kraay standard errors complemented by regional interaction models, split-sample estimations, System GMM, and panel threshold analysis. The results show that CBI has a negative but statistically insignificant effect on inflation. However, the interaction between CBI and institutional quality is negative and statistically significant. This conditioning effect exhibits substantial regional heterogeneity, as confirmed by a joint Wald test of the regional interaction terms. In contrast, the panel threshold analysis finds no statistically significant institutional-quality threshold, suggesting that the moderating effect operates more continuously than through discrete

institutional regimes. Exchange-rate depreciation is positively and significantly associated with inflation across the African regions, while the System GMM estimates provide further support for the negative CBI–institutional quality interaction. The study concludes that central bank independence is not sufficient, by itself, to deliver inflation control in Africa; its effectiveness depends critically on the broader institutional environment. The study recommends that African governments should strengthen the legal and operational independence of central banks, particularly by protecting monetary authorities from short-term political pressures and fiscal dominance.

Keywords: Central bank independence; Institutional quality; Inflation; Exchange-rate depreciation; Regional heterogeneity

1. INTRODUCTION

In Africa, challenges facing macroeconomic stability are almost exclusively attributed to inflation. This shows the extent to which inflation has affected African economies. However, its intensity has varied considerably across countries and over time. This study covers the period 1996–2023. The data generated from World Development Indicators show that within the period, all fifty-two (52) countries in Africa exhibit substantial heterogeneity in inflation outcomes. The median inflation rate for the countries is approximately 6%, while the mean is considerably higher at about 17%, indicating the influence of episodes of exceptionally high inflation in some economies.

This heterogeneity is particularly pronounced when the continent is disaggregated into its five UN sub-regions. Middle Africa records the highest average inflation rate of the sub-regions, at approximately 49%, driven largely by extreme outliers such as Angola with 239% inflation rate and the Democratic Republic of Congo 155%, even though its median of 6% is close to the continental figure underscoring how a handful of high-inflation economies can distort the sub-regional mean. Eastern Africa follows with an average of about 14%, elevated chiefly by Zimbabwe's average of approximately 88%, while most other economies in the sub-region such as Comoros and Mauritius, both averaging under 5% recorded far more modest inflation. Northern Africa averages about 12%, with Sudan 37% as the principal outlier against otherwise low rates in Morocco 2% and Tunisia 5%. By contrast, Southern Africa has 7% and Western Africa 7% recorded the lowest and most tightly clustered average inflation rates among the sub-regions, with countries such as Botswana, Namibia, and Cabo Verde consistently in single digits.

The cross-country mean inflation rate for the continent as a whole was about 120% in 1996 and 70% in 2000, declined to approximately 3% in 2015, but increased again to about 23% in 2023. These sub-regional and temporal variations suggest that inflation control in Africa is not simply a consequence of common continental or even sub-regional conditions but may also reflect country-specific differences in the institutional capacity to formulate and implement credible monetary policy capable of controlling the inflation rate.

In view of the high inflation rate over the period in Africa, central bank independence (CBI) remains the institutional arrangement that has received considerable attention in the pursuit of price stability. The underlying argument is that monetary authorities insulated from short-term political pressures are better positioned to achieve their primary objective, which is to pursue price stability. In Africa, for example, political authorities may face incentives to pursue expansionary monetary policies in response to fiscal pressures, output fluctuations, or short-term political considerations, potentially generating persistent inflation. So, in such a situation, it becomes imperative to grant central banks greater autonomy to strengthen monetary discipline and reduce the scope for politically motivated monetary expansion. However, central bank independence does not necessarily imply that monetary authorities possess effective autonomy in practice. The institutional and political environment in which central banks operate may determine whether formal independence is translated into credible and effective monetary policy. This implies that central bank independence might not translate to price stability automatically; institutions have roles to play in ensuring that central bank independence yields positive outcomes.

Evidence from empirical literature shows that the institutional environment plays an important role in ensuring the inflation-control role of central bank independence. The study of Bodea and Hicks (2015) shows that CBI contributes to price stability through both monetary discipline and credibility. More importantly, their findings indicate that political institutions condition the discipline effect of central bank independence on the inflation rate. This suggests that the effectiveness of CBI depends not only on the legal autonomy granted to the central bank but also on the institutional constraints surrounding political decision-making. Similarly, Garriga and Rodriguez (2020), found that CBI leads to a lower inflation rate, with the effect being stronger in more democratic countries. These findings suggest that the inflationary consequences of CBI cannot be fully understood without considering the quality of the institutional environment within which monetary policy is implemented.

The role institutions plan in the CBI-inflation nexus is pertinent in Africa because there are differences in the quality of political and economic institutions. Central banks in SSA operate in environments characterized by varying degrees of government effectiveness, political stability, regulatory quality, rule of law, accountability and control of corruption. These institutional characteristics can influence the ability of monetary authorities to resist political interference, enforce monetary rules, communicate policy credibly and maintain public confidence in their commitment to price stability. Thus, countries with similar levels of central bank independence may not experience the same inflation outcomes if the institutional environments in which their central banks operate differ remarkably. The study of Agoba et al. (2017) supports this assertion as they found that the effectiveness of CBI in reducing inflation depends partly on the institutional environment. In particular, their findings indicate that higher institutional quality enhances the effectiveness of central bank independence in controlling inflation.

Most empirical studies in Africa concentrated on the direct effect of central bank independence on the inflation rate. For example, Strong (2021) studied the effect of central bank independence on inflation control in CFA and non-CFA economies. Gyeke-Dako et al. (2022), using 44 SSA countries over 1970–2012, examined both legal and de facto dimensions of central bank independence on inflation control. Agoba et al., (2017) examined the roles of institutional quality and banking-sector development on the effect of central bank independence on inflation control in

Africa. Okoli and Meyer (2024), using panel data for 36 African economies over 1996–2021, studied the interaction between monetary policy and government effectiveness in reducing inflation in Africa. Similarly, Agoba (2021) finds that stronger political institutions enhance the ability of monetary and financial institutions to minimize the inflationary effects of fiscal deficits in Africa, reinforcing the broader argument that institutional conditions influence macroeconomic stability. Gahamanyi and Tchouassi (2026), examining 32 African countries, employ all six WGI dimensions and report substantial institutional heterogeneity across countries, reinforcing the relevance of multidimensional institutional quality in African economic analysis. Okereke et al., (2026) examine the effect of central bank independence on inflation in Nigeria. Evidence from these studies create an important gap in Africa as regards the role institutions play in the central bank independence and inflation nexus in Africa.

This study addresses this gap by using institutional quality as a multidimensional construct rather than relying on a single governance measure. Specifically, institutional quality is captured through the six dimensions of the World Bank's Worldwide Governance Indicators: Voice and Accountability, Political Stability and Absence of Violence/Terrorism, Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption. Accordingly, this study examines the relationship between central bank independence and inflation in Africa, with particular emphasis on the moderating role of institutional quality**.**

Research Hypotheses

$H_0$1: There is no significant negative effect of Central bank independence on inflation in Sub-Saharan Africa.

$H_0$2: Institutional quality has no significant negative effect on inflation in Sub-Saharan Africa. Institutional Quality as a Moderator of the CBI–Inflation Relationship

$H_0$3: Institutional quality does not significantly moderate the relationship between central bank independence and inflation in Sub-Saharan Africa.

$H_0$4: Institutional quality does not significantly moderate the relationship between central bank independence and inflation across African sub-regions (i.e., the CBI–inflation relationship is homogeneous across sub-regions).

2. LITERATURE REVIEW

2.1 Conceptual Review

Central Bank Independence

The term Central Bank Independence (CBI) refers to the extent to which the monetary policy of the central bank can be formulated and implemented without undue interference from political authorities. It represents an institutional arrangement designed to separate monetary-policy decisions from short-term political considerations and to provide monetary authorities with autonomy to pursue price stability. Bodea and Hicks (2015) explain that CBI can affect price stability through both a discipline channel, whereby greater autonomy constrains excessive

monetary expansion, and a credibility channel, whereby independence strengthens confidence in the central bank's commitment to price stability, which is its primary objective.

Inflation

Inflation refers to an increase in the general price level of goods and services over time in an economy. The increase in general prices always results in a decline in the purchasing power of money. This implies that inflation affects the real value of money, increasing uncertainty, distorting relative prices, reducing the real value of incomes and savings, and complicating investment and consumption decisions. Therefore, Inflation is regarded as a fundamental indicator of macroeconomic stability and an important measure of monetary-policy performance (Barro & Gordon, 1983; Bodea & Hicks, 2015). Inflation can be measured using different price indices depending on the analytical purpose of a study. The GDP deflator provides a broad measure of economy-wide price movements because it captures changes in the prices of domestically produced final goods and services rather than focusing exclusively on a fixed basket of consumer goods. Thus, the GDP deflator is useful in cross-country macroeconomic analysis where the objective is to examine broad changes in the domestic price level (Cukierman et al., 1992; Bodea & Hicks, 2015).

Institutional Quality

According to North (1990, 1991), institutions are the formal and informal rules that structure interactions among economic and political actors and shape incentives and constraints. Institutional quality therefore is the effectiveness, credibility, and predictability of the institutions and governance arrangements through which political and economic authority is exercised. Institutions are important in the effective running of economies. They influence economic outcomes by reducing uncertainty, constraining opportunistic behaviour and establishing predictable rules for decision-making. Thus, good institutional quality is associated with institutions that are capable of formulating and implementing policies effectively, enforcing rules consistently, and constraining arbitrary exercise of power. There are six dimensions of institutional quality captured in the World Bank's Worldwide Governance Indicators (WGI)**.** These dimensions are voice and accountability, political stability and absence of violence/terrorism, government effectiveness, regulatory quality, rule of law, and control of corruption. These dimensions capture different aspects of the institutional environment, ranging from citizens' ability to participate in governance to the capacity of governments to formulate and implement policies and the extent to which public power is exercised for private gain. The WGI governance estimates are expressed in standard normal units, approximately ranging from −2.5 to +2.5, with higher values indicating better governance. Given this multidimensional character, institutional quality in this study is treated as a broader institutional construct rather than a single governance attribute.

2.2 Theoretical Review

2.1 Time Inconsistency Theory

The Time Inconsistency Theory was developed by Kydland and Prescott (1977) and applied to monetary policy by Barro and Gordon (1983). This theory explains why discretionary monetary policy may generate an inflationary bias. According to Kydland and Prescott (1977), policymakers may have incentives to deviate from previously announced low-inflation policies after economic agents have formed their expectations. In the short run, expansionary monetary policy can lead to

an increase in output or employment. Thus, rational economic agents eventually anticipate such behaviour and incorporate expected inflation into wages, prices, and contracts. Time Inconsistency Theory emphasizes the importance of policy credibility and commitment in achieving price stability. This implies that a monetary authority that can credibly commit to low inflation is less likely to generate the inflationary bias associated with discretionary policymaking (Kydland & Prescott, 1977; Barro & Gordon, 1983).

Time inconsistency creates problems, and an institutional mechanism such as central bank independence can address them. This could be achieved by insulating monetary authorities from short-term political pressures. Thus, central bank independence can strengthen the credibility of the commitment to price stability and reduce incentives for politically motivated monetary expansion. The emphasis of central bank independence should be on long-term price stability rather than on short-term political objectives. The core assumption of Time Inconsistency Theory is in agreement with empirical evidence (Bodea & Hicks, 2015; Garriga & Rodriguez, 2020) that central bank independence should reduce inflation outcomes, and this could be achieved through greater monetary discipline and credibility. In the context of SSA, however, the effectiveness of central bank independence in reducing inflation outcomes may depend on whether the broader institutional environment protects and supports central bank autonomy.

2.3 Empirical Review

Central Bank Independence and Inflation

Evidence from empirical literature shows that there is an inverse relationship between central bank independence and inflation. This evidence is also supported by the Time Inconsistency Theory developed by Kydland and Prescott (1977). Early cross-country evidence by Cukierman et al. (1992) found that central bank independence is an important institutional determinant of inflation performance. The study of Neyapti (2006) argues that measurement error in conventional CBI indicators can obscure the underlying relationship and finds a strong negative association between CBI and inflation after accounting for this problem. More so, Garriga and Rodriguez (2020) provided broader evidence using legal CBI data for 118 developing countries over 1980–2013. They found that there is a negative effect of CBI on the inflation rate in both democratic and non-democratic countries.

Empirical evidence from Africa also shows the same direction. For example, Agoba et al. (2017) examine 48 African countries and find that CBI alone is not effective in reducing the inflation rate in Africa. Their findings show that CBI becomes more effective in reducing inflation when moderated by banking-sector development and institutional quality. This suggests that the institutional environment influences the ability of central banks to translate formal independence into effective monetary discipline. Furthermore, Minea et al. (2021) found in their study that adoption of inflation targeting significantly improves institutional quality, suggesting that monetary-policy frameworks and institutional development can be mutually reinforcing. Okoli and Meyer (2024), using panel data for 36 African economies over 1996–2021, found that government effectiveness enhances monetary-policy effectiveness in controlling inflation. Their findings indicate that the interaction between monetary policy and government effectiveness significantly

reduces inflation. Similarly, Agoba (2021) finds that stronger political institutions enhance the ability of monetary and financial institutions to minimize the inflationary effects of fiscal deficits in Africa. This finding also reinforces the broader argument that institutional conditions influence macroeconomic stability. A recent study from Africa by Gahamanyi and Tchouassi (2026) using 32 African countries and employing all six WGI dimensions found a substantial institutional heterogeneity across African countries, reinforcing the relevance of multidimensional institutional quality in African economic analysis. Gyeke-Dako et al. (2022), studied the effect of CBI on inflation in Africa. The study used 44 SSA countries covering 1970–2012. They found that CBI had a significant negative effect on the inflation rate in SSA.

Empirical evidence from other regions found similar results. For example, Kunaedi and Darwanto (2020), who examined 20 Asian countries using a dynamic panel GMM approach, found that the effectiveness of central bank independence in reducing inflation depends on the quality of institutions. Mouatassim et al. (2025), using 16 MENA countries and a two-stage least-squares approach, directly examine institutional quality as a moderator of the CBI–inflation relationship. Their findings show that higher CBI is associated with lower inflation and, importantly, that institutional quality not only has a direct inflation-reducing effect but also strengthens the negative effect of CBI on inflation. Further African evidence from Yahaya et al. (2022) provides additional support for the inflation-reducing role of CBI. Using 14 African countries over 1985–2019. They found that there is a significant negative effect of CBI on inflation. The study of Vermeulen (2024) is also in agreement with the previous findings.

Contrary to these findings, Strong (2021) studied the influence of political interference on CBI and inflation in 31 African countries, comprising 13 CFA-zone and 18 non-CFA countries, over 1980–2009. The study noted that higher governor turnover is associated with higher inflation, with the result remaining robust when turnover is decomposed into premature removals and politically connected replacements. Specifically, the study found that there is no significant effect of central bank autonomy on inflation among CFA-zone countries. However, inflation is instead more strongly influenced by the fixed exchange-rate regime and commodity-price shocks. Mbobo and Effiong (2026), using Nigerian data from 1981–2023, find that CBI reduces inflation in the short run while it exhibits a positive and statistically insignificant effect in the long-run. Similarly, Okereke et al. (2026), using Nigerian data for 1975–2023, reported a positive, insignificant effect of CBI on inflation in both the short and long run. They noted that central bank independence does not automatically translate into effective inflation control.

Research Gap

Most of the empirical literature supports the Time Inconsistency Theory that central bank independence should hurt the inflation rate. This implies that the proposition that central bank independence contributes to lower inflation by strengthening monetary discipline and policy credibility is highly supported by empirical studies. However, despite these supports and contributions, significant gaps exist in the literature.

Several existing African studies have relied on individual or relatively narrow measures of institutional quality. Agoba et al. (2017), for example, used political rights as a measure of institutional quality, while Okoli and Meyer (2024) used government effectiveness as a measure of institutional quality. The single measure of institutional quality may provide useful insight, but they not adequately capture the multidimensional nature of institutional quality. Gahamanyi and

Tchouassi (2026) used all six dimensions of the World Bank's Worldwide Governance Indicators in studying the effect of institutional quality on inflation in Africa. The study did not use institutional quality as a moderator between the CBI-inflation nexus. Most empirical studies either examine individual African countries or treat Africa as a single regional bloc. A dedicated SSA analysis is therefore necessary because the effectiveness of central bank independence may depend on the distinctive political, institutional, and macroeconomic characteristics of the region.

Furthermore, while previous research provides evidence that institutional conditions may influence the effectiveness of central bank independence, relatively few studies explicitly model institutional quality as a moderating variable in the CBI–inflation relationship in Africa. Agoba et al. (2017), for example, provide evidence that institutional quality can enhance the inflation-reducing effect of CBI in African countries. Although their analysis covers the broader African region but fails to look at heterogeneity in the African region. Therefore, whether CBI effectiveness systematically varies with institutional quality in Africa remains insufficiently established. Studies on the CBI–inflation relationship in Africa rely on Garriga (2015) CBI computed variables. relatively earlier periods of observation. Given the substantial monetary, institutional, and exchange-rate developments experienced by African economies in recent years, including episodes of significant inflationary and currency pressures, evidence based on earlier periods may not adequately reflect the contemporary regional environment. Extending the analysis through 2023 therefore provides a more current assessment of whether the CBI–inflation relationship remains relevant in Africa and its regional heterogeneity evidence.

These identified gaps are addressed in this study as the study constructed institutional quality index with all six dimensions of institutional quality, modelling institutional quality as a moderator of the CBI–inflation nexus and extending the observation period to 2023.

Conceptual Framework

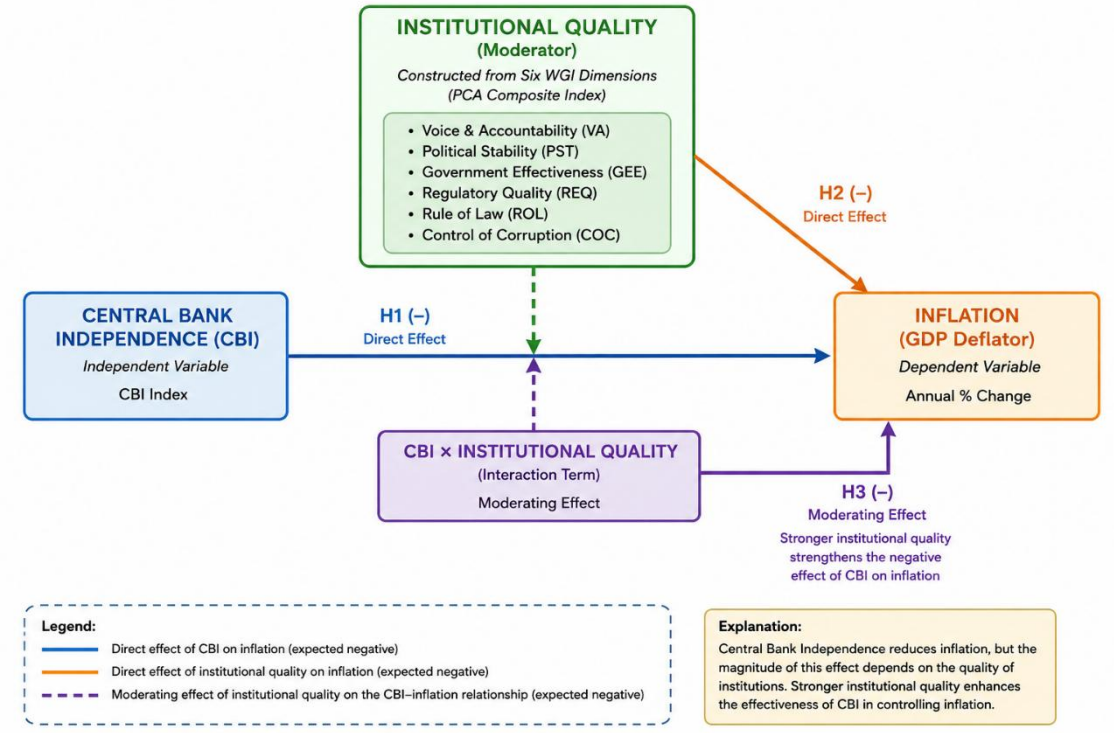


Figure 5: Conceptual Framework

In this study, institutional quality is measured using a composite index constructed through Principal Component Analysis (PCA) from the six World Governance Indicators: Voice and Accountability, Political Stability, Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption. The framework proposes that stronger institutional quality should not only directly contribute to lower inflation but also strengthen the negative relationship between CBI and inflation. Thus, the interaction between CBI and institutional quality represents the key moderating relationship examined in the study.

3. METHODOLOGY

3.1 Research Design

The study employed a quantitative longitudinal research design based on a multi-country panel dataset covering 1996–2023. The study period starts from 1996 because the Worldwide Governance Indicators (WGI), which are used to construct the institutional quality measure has available data from 1996. The updated central bank independence data developed by Garriga (2025) ends in 2023. The empirical analysis primarily employed country and year fixed-effects models with Driscoll–Kraay standard errors to control for unobserved country-specific heterogeneity and to address heteroskedasticity, serial correlation, and cross-sectional dependence across countries. Given the persistence of inflation and the potential for endogeneity and reverse causality between institutional arrangements and inflation, a dynamic panel estimation approach was also employed. The dynamic specification incorporates the lagged dependent variable to capture inflation persistence and provides a framework for addressing potential endogeneity in the relationship between institutional variables and inflation. In addition, the study employed a panel threshold model to investigate whether the relationship between central bank independence and inflation varies across distinct institutional-quality regimes.

The study sample comprises 52 African countries, covering 1996–2023 (28 years). The 52 countries are classified into five sub-regions using the United Nations geoscheme for Africa to enable the study's regional heterogeneity analysis:

1. Northern Africa (6 countries): Algeria, Egypt, Libya, Morocco, Sudan, Tunisia
2. Eastern Africa (18 countries): Burundi, Comoros, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Rwanda, Seychelles, Somalia, South Sudan, Tanzania, Uganda, Zambia, Zimbabwe
3. Middle Africa (9 countries): Angola, Cameroon, Central African Republic, Chad, Republic of Congo, Democratic Republic of Congo, Equatorial Guinea, Gabon, São Tomé and Príncipe
4. Southern Africa (5 countries): Botswana, Eswatini, Lesotho, Namibia, South Africa
5. Western Africa (16 countries): Benin, Burkina Faso, Cabo Verde, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, Togo

The full country-year dataset contains 1,456 observations, corresponding to 52 countries observed over 28 years ($52 \times 28 = 1{,}456$), and is structurally balanced over the study period. However, the

effective estimation sample varies across econometric specifications because of missing observations in individual variables and the transformations required by particular models. For example, the baseline fixed-effects estimation uses 1,068 observations across 48 countries. The reduction in observations reflects the availability of complete observations for the variables included in the respective regression specification. For the panel threshold analysis, a more restrictive sample was required to satisfy the balanced-panel structure of the estimation procedure. Consequently, the threshold model was estimated using a balanced panel of 31 countries over 27 years, from 1997 to 2023, resulting in 837 country-year observations (31 × 27 = 837). This restricted sample should therefore be distinguished from the 48-country estimation sample used in the fixed-effects models and from the full 52-country study population.

3.2 Theoretical Framework

This study is anchored in the Time Inconsistency Theory developed by Kydland and Prescott (1977) and formalised Barro and Gordon (1983). The theory explains why policymakers may have incentives to deviate from previously announced or socially desirable monetary policy commitments. According to the theory, if private agents predict inflation based on prevailing economic policy, policymakers may generate unexpected inflation to achieve short-run output or employment objectives. This therefore may result in higher inflation without corresponding gains in real economic activity.

In its simplified form, inflation can be represented as:

$\pi_t = \pi^e_t + b_t$……1

where:

π_t = actual inflation;

π^e_t = expected inflation; and

b = the inflationary bias arising from discretionary monetary policy.

The inflationary bias can be expressed as a function of central bank independence:

$b_t = f(CBI_t)$ ……..2

with the expected relationship:

$\frac{dbt}{dCBIt} < 0$

Equation 2 implies that greater central bank independence (CBI) is theoretically expected to reduce inflationary bias. Substituting this relationship into Equation (1) gives:

$\frac{d\pi t}{dCBIt} < 0$……3

Equation (3) is the theoretical basis for the first hypothesis of the study: greater central bank independence should be associated with lower inflation.

However, central bank independence may not necessarily guarantee lower inflation. This is because the extent to which an independent central bank can be effective may depend on the broader institutional environment in which it operates. This study therefore argues that institutional quality conditions the effectiveness of central bank independence. This implies that if institutions are strong, it may strengthen CBI to deliver price stability and verse versa

Consequently, the inflation relationship can be expressed as:

$\pi_{it} = f(CBI_{it}, IQ_{it}, CBI_{it} \times IQ_{it} X_{it})$……4

where:

X_{it} = represents the control variables.

Equation 4 is crucial in this study because it denotes whether institutional quality in SSA strengthens or weakens the effect of central bank independence on inflation.

The study extends by demonstrating the moderation mechanism

$\frac{d\pi it}{dCBIit} = \beta_1 + \beta_3 IQ_{it}$……5

Therefore:

$\frac{d\pi it}{dCBIitdIQit} = \beta_3$……6

Equation provides the mathematical basis for the moderation hypothesis.

If:

$\beta_3 < 0$

then higher institutional quality strengthens the inflation-reducing effect of CBI**.**

If:

$\beta_3 > 0$

then higher institutional quality weakens the inflation-reducing effect of CBI

If:

$\beta_3 = 0$

then institutional quality does not moderate the relationship between CBI and inflation

3.3 Model Specification

The empirical model of this study is written thus:
$INF_{it} = \beta_0 + \beta_1 CBI_{it} + \beta_2 IQ_{it} + \beta_3 (CBI_{it} * IQ_{it}) + \gamma X_{it} + \mu_i + \lambda_t + \varepsilon_{it}$……..7

Where:

INF = inflation;

CBI = central bank independence;

IQ = institutional quality;

$INF_{it} * IQ_{it}$ = interaction between central bank independence and institutional quality;

X = control variables (M2GDP, GDPG, EXCH and TOPEN)

μ_i = country-specific effects;

λ_t = time effects; and

ε_{it} = error term

Result from unit root test shows that only inflation rate and GDPG are stationary at levels. So, other variables were transformed to first difference. Due to extreme values in inflation rate and negative values, inflation was transformed into Inverse hyperbolic sine transformation which takes care of both positive, negative and zero inflation rate.



Source: Author's computation

Figure 2: Variables Transformation

After the variable transformation, empirical models are presented as follows:

$$IHSINF_{it} = \beta_0 + \beta_1 \Delta CBI_{it} + \beta_2 \Delta \ln(M2GDP)_{it} + \beta_3 GDPG_{it} + \beta_4 \Delta \ln(EXCH)_{it} + \beta_5 \Delta TOPEN_{it} + \mu_i + \lambda_t + \varepsilon_{it} \ldots\ldots 8$$

$IHSINF_{it} = \beta_0 + \beta_1 \Delta CBI_{it} + \beta_2 \Delta IQ_{it} + \beta_3 \Delta \ln(M2GDP)_{it} + \beta_4 GDPG_{it} + \beta_5 \Delta \ln(EXCH)_{it} + \beta_6 \Delta TOPEN_{it} + \mu_i + \lambda_t + \varepsilon_{it} \ldots\ldots 9$

$IHSINF_{it} = \beta_0 + \beta_1 \Delta CBI^c_{it} + \beta_2 \Delta IQ^c_{it} + \beta_3 (\Delta CBI^c_{it} * \Delta IQ^c_{it}) + \beta_4 \Delta \ln(M2GDP)_{it} + \beta_5 GDPG_{it} + \beta_6 \Delta \ln(EXCH)_{it} + \beta_7 \Delta TOPEN_{it} + \mu_i + \lambda_t + \varepsilon_{it} \ldots\ldots 10$

Where:

The subscripts i and t = index country and year respectively,

μi = country fixed effects,

λt denotes year fixed effects,

and εit = idiosyncratic error term.

Equation 8 tests Hypothesis 1 (the direct effect of CBI on inflation);

Equation 9 adds institutional quality to test Hypothesis 2;

and equation 10 adds the mean-centred CBI×IQ interaction term to test Hypothesis 3. Centring CBI and IQ before interacting them reduces mechanical collinearity between the interaction term and its constituent components.

3.3.1 Regional Heterogeneity Specification (Hypothesis 4)

In achieving the main objective of the study (whether the CBI–inflation relationship is homogeneous across African sub-regions), equation 10 is extended in two complementary ways, both estimated with two-way fixed effects and Driscoll-Kraay standard errors. Firstly:

CBI×Sub-region and IQ×Sub-region interaction terms are added to equation 10, with Eastern Africa as the omitted base category:

$IHS_INF_{it} = \beta_0 + \beta_1 \Delta CBI^c_{it} + \beta 2 \Delta IQ^c it + \beta_3 \Delta CBI_IQit + \sum r\ \delta 4r\ (\Delta CBI^c_{it} \times Subregion_r) + \sum r\ \delta 5r\ (\Delta IQ^c_{it} \times Subregion_r) + \theta X_{it} + \mu_i + \lambda_t + \varepsilon_{it}$ *11*

Where:

Subregionr = sub-region dummy variables

r= Northern, Middle, Southern, Western regions

$\sum r\ \delta 4r\ (\Delta CBI^{c}_{it} \times Subregionr)$ and $\sum r\ \delta 5r\ (\Delta IQ^{c}_{it} \times Subregionr)$ = corresponding sets of CBI×Sub-region and IQ×Sub-region interaction terms,

and X_{it} = the vector of control variables (ΔlnM2, GDPG, ΔlnEXCH, ΔTOPEN).

A Wald test is conducted on the joint significance of each set of interaction terms (H0: $\delta 41 = \delta 42 = \delta 43 = \delta 44 = 0$, and separately for the δ5r coefficients).

Second, as a corroborating, non-parametric approach to the same hypothesis, the unrestricted baseline equation 10 is re-estimated separately for each of the five sub-regions (split-sample estimation), allowing the CBI, IQ and CBI×IQ coefficients to vary completely freely by region rather than being constrained to a common slope with region-specific shifts:

$$IHS_INF_{it} = \beta_{0r} + \beta_{1r}\,\Delta CBI^{c}_{it} + \beta_{2r}\,\Delta IQ^{c}_{it} + \beta_{3r}\Delta CBI^{c}_{it} * IQ^{c}_{it} + \theta r X_{it} + \mu_i + \lambda_t + \varepsilon_{it},\ i \in Subregion_r \ldots\ldots\ldots\ldots 12$$

3.3.2 Dynamic System GMM Specification Robustness Check

As the study comprises African regions, inflation is likely to be persistent, and CBI and IQ may be jointly determined with inflation (reverse causality) or correlated with omitted country-specific shocks. If this happens, the baseline fixed-effects results may be biased and inconsistent. Thus, a robustness check using a dynamic panel using the two-step System Generalised Method of Moments (GMM) estimator. The equation is stated as:

$$IHS_INF_{it} = \beta_0 + \rho\ IHS_INF_{i,t-1} + \beta_1 \Delta CBI^{c}_{it} + \beta_2 \Delta IQ^{c}_{it} + \beta_3 \Delta (CBI^{c}_{it} * IQ^{c}_{it}) + \beta_4 \Delta ln(M2GDP)_{it} + \beta_5 GDPG_{it} + \beta_6 \Delta LN(EXCH)_{it} + \beta_7 \Delta TOPEN_{it} + Sub\text{-}regioni + \lambda_t + \varepsilon_{it} \ldots\ldots\ldots\ldots 13$$

Where:

$IHS_INF_{i,t-1}$ = captures inflation persistence, while sub-region and year dummies are entered as instrument-free exogenous controls.

3.3.3 Panel Threshold Specification

Examining whether the moderating role of institutional quality operates as a smooth, linear interaction (as assumed in equation 10) or instead exhibits a regime-switching pattern once

institutional quality crosses some critical level, a dynamic panel threshold model was estimated with the specifications below:

$$IHS_INF_{it} = \mu_i + \beta_1 \Delta CBI^c_{it} \cdot I(\Delta IQ^c_{it} \leq \gamma) + \beta_2 \Delta CBI^c_{it} \cdot I(\Delta IQ^c_{it} > \gamma) + \theta X_{it} + \varepsilon_{it} \ldots\ldots\ldots\ldots 14$$

Where:

ΔIQ^c = threshold variable

Γ = endogenously estimated threshold value of institutional quality,

$I(\cdot)$ = indicator function defining the below- and above-threshold regimes,

X_{it} = vector of control variables.

Table 1. Data Sources and Measurement of Variables

Variable	Measurement	Role	Data Source
Inflation (INF)	Annual percentage change in the GDP deflator; transformed using the inverse hyperbolic sine (IHS): (IHSINF = asinh(INF)	Dependent variable	World Development Indicators (WDI), World Bank
Central Bank Independence (CBI)	LVAW-Garriga weighted Central Bank Independence Index	Independent variable	Garriga Central Bank Independence Dataset
Institutional Quality (IQ)	PCA composite index constructed from the six Worldwide Governance Indicators (WGI) dimensions	Independent variable / Moderator	Worldwide Governance Indicators (WGI), World Bank
Broad Money (M2GDP)	Broad money as a percentage of GDP; transformed as the annual change in its logarithm, Δln(M2GDP)	Control variable	World Development Indicators (WDI), World Bank
Economic Growth (GDPG)	Annual percentage growth of real GDP	Control variable	World Development Indicators (WDI), World Bank
Exchange Rate (EXCH)	Official exchange rate (LCU per US$), transformed as the first difference of its natural logarithm, Δln(EXCH)	Control variable	World Development Indicators (WDI), World Bank
Trade Openness (TOPEN)	((Exports + Imports)/GDP \times 100)	Control variable	World Development

			Indicators (WDI), World Bank
CBI×IQ	Interaction of centred CBI and centred IQ	Interaction variable	Derived
Sub-region	Categorical UN-geoscheme classification (Northern, Eastern, Middle, Southern, Western Africa)	Dummy-coded; interacted with ΔCBI^c and ΔIQ^c; base category = Eastern Africa	UN geoscheme

4. ANALYSIS RESULTS AND DISCUSSION OF FINDINGS

4.1 Preliminary Analysis

Table 2. Pairwise Correlations Among Governance Indicators

Indicator	COC	PST	REQ	ROL	GEE	VA
COC	1.000	-	-	-	-	-
PST	0.708***	1.000	-	-	-	-
REQ	0.784***	0.681***	1.000	-	-	-
ROL	0.879***	0.793***	0.890***	1.000	-	-
GEE	0.811***	0.673***	0.884***	0.867***	1.000	-
VA	0.744***	0.681***	0.750***	0.827***	0.673***	1.000

*** p<0.01. N = 1,450 country-year observations. All pairwise correlations are positive and statistically significant, confirming the six indicators are suitable for data reduction via PCA.

Table 3. PCA Eigenvalues and Eigenvectors of the Governance Indicators

Component / Variable	Comp1	Comp2	Comp3	Comp4	Comp5	Comp6
Panel A: Eigenvalues						
Eigenvalue	4.8886	0.3985	0.3254	0.2201	0.1017	0.0656
Difference	4.4901	0.0732	0.1052	0.1184	0.0361	–
Proportion	0.8148	0.0664	0.0542	0.0367	0.0170	0.0109
Cumulative	0.8148	0.8812	0.9354	0.9721	0.9891	1.0000
Panel B: Eigenvectors (Component Loadings)						
COC	**0.4115**	-0.1075	0.0113	-0.8552	-0.1339	0.2640
PST	**0.3759**	0.7237	0.5395	0.1395	0.0315	0.1533
REQ	**0.4191**	-0.3579	-0.0047	0.4563	-0.5841	0.3832
ROL	**0.4396**	-0.0170	-0.0203	-0.0135	-0.2502	-0.8621
GEE	**0.4115**	-0.4793	0.2743	0.1523	0.7088	0.0047
VA	**0.3888**	0.3265	-0.7957	0.1326	0.2737	0.1290

N = 1,450 country-year observations. Panel A reports the eigenvalues, proportion and cumulative proportion of total variance explained by each of the six unrotated principal components. Panel B reports the corresponding eigenvectors (component loadings)

of the six governance indicators – Control of Corruption (COC), Political Stability (PST), Regulatory Quality (REQ), Rule of Law (ROL), Government Effectiveness (GEE) and Voice and Accountability (VA) – on each component.

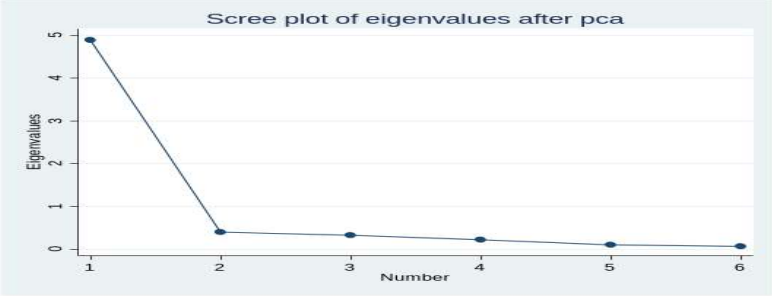
Component 1 alone has an eigenvalue of 4.89 and explains 81.48% of total variance, comfortably exceeding the Kaiser criterion (eigenvalue > 1); no other component does. All six variables load positively and with comparable magnitude (0.376–0.440, bolded) on Component 1, indicating each contributes similarly to the latent institutional-quality construct, and none loads more heavily on any of Components 2–6. The predicted Component 1 factor score is retained as the Institutional Quality (IQ) index used in all subsequent models.

Table 4. Summary of PCA Results and Decision Rule for the IQ Index

Item	Result
Input indicators	COC, PST, REQ, ROL, GEE, VA (6 WGI governance indicators)
Sample size	N = 1,450 country-year observations (52 countries, 1996–2023)
Suitability for PCA	All 15 pairwise correlations positive and significant at $p<0.01$ (range 0.673–0.890)
Components with eigenvalue > 1	1 (Component 1 only; Kaiser criterion)
Variance explained by Component 1	81.48%
Scree plot	Clear "elbow" after Component 1 (Figure 4.1), confirming a single-factor solution
Sign and magnitude of loadings	All six indicators load positively on Component 1, magnitude 0.376–0.440 (broadly even weighting)
Unexplained variance per indicator	0% for all six indicators under the full 6-component solution
Components retained	1
Index construction method	Regression-scored Component 1 factor score
Resulting index	Institutional Quality (IQ), standardised, mean ≈ 0

This table summarises the diagnostics in Tables 4.1 and 4.2 into a single decision record. On every criterion – the Kaiser rule, the scree plot, and the even, positive sign of the loadings – the data support collapsing the six WGI indicators into one retained component, which is used as the Institutional Quality (IQ) index in all subsequent regression models.

Figure 4.1: Scree Plot of Eigenvalues after PCA



The pronounced drop between Component 1 and Component 2, followed by a flat trajectory, visually confirms the single-factor solution reported in Tables 4.2 and 4.3.

Table 5. Descriptive Statistics – Pooled Sample

Variable	Obs	Mean	Std. Dev.	Min	Max
IHS_INF (inflation, IHS)	1,444	2.1131	1.7399	-4.1455	9.1696
CBI	1,432	0.5146	0.1374	0.135	0.829
IQ	1,450	1.28e-10	2.2110	-5.6294	5.6010
LOG_M2 (money supply)	1,356	0.7056	1.2875	0.0282	5.2852
GDPG (GDP growth, %)	1,444	4.3294	7.8224	-50.339	149.973
LOG_EXCH (exchange rate)	1,421	4.4222	2.4385	-4.6038	22.6288
TOPEN (trade openness, %)	1,194	68.5769	37.1108	3.0308	282.544

Pooled panel: 52 countries, 1996–2023. IHS_INF denotes the inverse hyperbolic sine transformation of inflation, used in place of log-inflation because raw inflation includes negative and zero values. IQ is the standardised PCA-based institutional quality score (mean ≈ 0).

Table 6. Mean Values of Key Variables by Sub-Region

Sub-region	IHS_INF	CBI	IQ	LOG_M2	GDPG	LOG_EXCH	TOPEN
Eastern Africa	2.4088	0.5002	-0.0871	0.3022	4.6137	4.8467	65.723
Middle Africa	1.8529	0.5080	-1.4493	0.1660	4.7610	5.5771	81.793

Sub-region	IHS_INF	CBI	IQ	LOG_M2	GDPG	LOG_EXCH	TOPEN
Northern Africa	2.2488	0.4134	-0.4150	3.6215	3.0672	1.8398	65.179
Southern Africa	2.3995	0.4680	2.8243	0.3480	2.9313	2.1582	100.498
Western Africa	1.8312	0.5880	-1.4728	0.3753	4.7201	5.0523	56.373
Pooled total	**2.1131**	**0.5146**	**1.3e-10**	**0.7056**	**4.3294**	**4.4222**	**68.577**

Values are unweighted sub-regional means. Sub-regional Ns for IHS_INF range from 140 (Southern Africa) to 448 (Western Africa); pooled N = 1,444.

Northern Africa stands out with markedly higher LOG_M2 and LOG_EXCH values and the lowest average GDP growth, while Southern Africa shows the highest average trade openness and Institutional Quality score. Middle and Western Africa exhibit the highest average CBI scores but comparatively weak institutional quality (negative IQ means).

Table 7. Pairwise Correlations Among Regression Variables

Variable	CBI_c	IQ_c	CBI_IQ	LOG_M2	GDPG	LOG_EXCH	TOPEN
CBI_c	1.000	-	-	-	-	-	-
IQ_c	0.001	1.000	-	-	-	-	-
CBI_IQ	0.045	-0.234***	1.000	-	-	-	-
LOG_M2	-0.157***	0.046*	0.079***	1.000	-	-	-
GDPG	0.033	-0.029	-0.023	-0.049*	1.000	-	-
LOG_EXCH	0.415***	-0.290***	-0.073***	-0.424***	0.039	1.000	-
TOPEN	-0.075***	0.364***	-0.005	0.015	0.055*	-0.339***	1.000

*** p<0.01, * p<0.10. CBI_c and IQ_c are the mean-centred CBI and IQ scores; CBI_IQ is their centred interaction term.

Correlations among regressors are generally modest, the largest being between LOG_EXCH and CBI_c (0.415) and LOG_EXCH and TOPEN (-0.339).

Table 8. Variance Inflation Factors (VIF)

Variable	VIF	1/VIF
LOG_EXCH	1.91	0.5232
CBI_c	1.36	0.7357
LOG_M2	1.31	0.7653
IQ_c	1.29	0.7756
TOPEN	1.28	0.7823
CBI_IQ	1.13	0.8853
GDPG	1.01	0.9905
Mean VIF	**1.33**	–

All VIF values are well below the conventional threshold of 10 (mean VIF = 1.33), indicating multicollinearity is not a material concern for the pooled regression models.

Table 9. Fisher-Type Panel Unit Root Tests – Levels

Variable	Inverse χ^2 (P)	p-value	Decision
IHS_INF	487.71	0.0000	Stationary I(0)
CBI	82.99	0.9995	Non-stationary
IQ	121.38	0.1171	Non-stationary
LOG_M2	83.20	0.9991	Non-stationary
GDPG	547.70	0.0000	Stationary I(0)
LOG_EXCH	102.10	0.5245	Non-stationary

Variable	Inverse χ^2 (P)	p-value	Decision
TOPEN	116.10	0.0796	Non-stationary (borderline)

Null hypothesis (H0): all panels contain unit roots. Statistic reported is the Inverse chi-squared (P) form of the Fisher-type test. IHS_INF and GDPG are stationary in levels; CBI, IQ, LOG_M2, LOG_EXCH and TOPEN are non-stationary (or borderline) in levels and are first-differenced before estimation.

Table 10. Fisher-Type Panel Unit Root Tests – First Differences

Variable	Inverse χ^2 (P)	p-value	Decision
D_CBI	409.75	0.0000	Stationary
D_IQ	520.30	0.0000	Stationary
D_LOG_M2	600.65	0.0000	Stationary
D_LOG_EXCH	505.51	0.0000	Stationary
D_TOPEN	717.36	0.0000	Stationary

All five variables that were non-stationary in levels become stationary after first-differencing (p = 0.0000 in every case), confirming they are integrated of order one, I(1). Accordingly, the regression models use first-differenced (and, where relevant, mean-centred) CBI, IQ, LOG_M2, LOG_EXCH and TOPEN, alongside the level-stationary IHS_INF and GDPG.

Table 11. Summary of Panel Diagnostic Tests

Test	Statistic	p-value	Conclusion
Hausman test (FE vs RE)	$\chi^2(25) = 101.37$	0.0000	Fixed effects preferred
Modified Wald test for groupwise heteroskedasticity	$\chi^2(48) = 2{,}667.14$	0.0000	Heteroskedasticity present
Wooldridge test for serial correlation	$F(1,47) = 8.908$	0.0045	Autocorrelation present
Pesaran-type CD test (xtcd2, power-enhanced)	CDw+ = 756.77	0.000	Localised cross-sectional dependence

The Hausman rank of the differenced variance matrix (25) does not equal the number of coefficients tested (33), a common outcome with many time dummies, but the test statistic is nonetheless highly significant and, together with theoretical priors, supports the fixed-effects specification.

The raw CD statistic is small and insignificant (0.02, p = 0.987), while the power-enhanced CDw+ statistic is highly significant, suggesting weak/localised rather than global cross-sectional dependence.

Jointly, the presence of heteroskedasticity, first-order serial correlation and cross-sectional dependence rules out simple pooled OLS or cluster-robust standard errors, and justifies the use of Driscoll-Kraay standard errors (xtscc, maximum lag 2) for all fixed-effects models reported in this chapter.

4.2 Baseline Fixed-Effects Regression Results

Table 12. Baseline Fixed-Effects Estimates of Inflation (Dependent Variable: IHS_INF)

Variable	Equation 8	Equation 9	Equation 10
D_CBI / D_CBI_c	-0.457 (0.399)	-0.372 (0.421)	-0.999*** (0.351)
D_IQ / D_IQ_c	–	0.243 (0.158)	0.291* (0.152)
D_CBI_IQ (interaction)	–	–	-4.178*** (1.400)
GDPG	-0.0003 (0.0098)	-0.0024 (0.0183)	-0.0028 (0.0102)
D_LOG_M2	-0.174 (0.361)	-0.187 (0.356)	-0.189 (0.355)
D_LOG_EXCH	2.587*** (0.424)	2.603*** (0.421)	2.586*** (0.426)
D_TOPEN	-0.0129* (0.0064)	-0.0132* (0.0064)	-0.0129* (0.0064)
Constant	2.260*** (0.0713)	2.261*** (0.0788)	2.264*** (0.0715)

Variable	Equation 8	Equation 9	Equation 10
Year fixed effects	Yes	Yes	Yes
Observations	1,068	1,068	1,068
Number of countries	48	48	48
Within R^2	0.1892	0.1909	0.1932

Driscoll-Kraay standard errors in parentheses (maximum lag 2). *** p<0.01, ** p<0.05, * p<0.10. All models include full year fixed effects (coefficients not reported for brevity).
In Model 3, where CBI and IQ are mean-centred and interacted, CBI (D_CBI_c) enters negative and statistically significant (−0.999, p<0.01), consistent with H1. IQ (D_IQ_c) is positive and marginally significant (0.291, p<0.10) – an unexpected sign discussed further in Section 4.7 in light of regional heterogeneity. The interaction term D_CBI_IQ is negative and significant (−4.178, p<0.01), supporting H3: higher institutional quality strengthens (makes more negative) the disinflationary effect of central bank independence. Neither D_CBI nor D_IQ is significant in the simpler Models 1–2, indicating the interaction specification in Model 3 better captures the true CBI–inflation relationship. D_LOG_EXCH is positive and highly significant across all three models, confirming exchange-rate depreciation as the dominant driver of inflation in the pooled African sample; D_TOPEN is negative and marginally significant.

4.3 Regional Heterogeneity in the CBI–Inflation Relationship

Table 13. Pooled Fixed-Effects Model with Sub-Region Interaction Terms (Base category: Eastern Africa)

Variable	Coef.	Std. Err.	p-value
D_CBI_c (Eastern Africa, base)	0.247	1.346	0.856
D_CBI_c × Middle Africa	3.345	2.106	0.124
D_CBI_c × Northern Africa	-0.589	1.220	0.633
D_CBI_c × Southern Africa	-0.020	2.707	0.994
D_CBI_c × Western Africa	-1.411	1.225	0.260
D_IQ_c (Eastern Africa, base)	-0.112	0.175	0.527
D_IQ_c × Middle Africa	0.508	0.794	0.528
D_IQ_c × Northern Africa	1.456**	0.622	0.027
D_IQ_c × Southern Africa	0.372	0.327	0.267
D_IQ_c × Western Africa	0.200	0.312	0.527
GDPG	-0.0073	0.0113	0.521
D_LOG_M2	-0.165	0.350	0.640
D_LOG_EXCH	2.586***	0.413	0.000
D_TOPEN	-0.0131**	0.0063	0.049
Constant	2.288***	0.0652	0.000
Observations	1,068		
Number of countries	48		
Within R^2	0.1999		

Driscoll-Kraay standard errors (max lag 2); year fixed effects included but not reported. *** p<0.01, ** p<0.05. None of the individual CBI×Sub-region interaction terms is significant on its own, but their joint significance is tested formally in Table 4.14. The IQ×Northern Africa interaction is positive and significant, i.e., in Northern Africa the marginal effect of institutional quality on inflation is significantly less negative (more positive) than in the Eastern Africa base category.

Table 14. Split-Sample Fixed-Effects Estimates by Sub-Region (Dependent Variable: IHS_INF)

Variable	Eastern	Middle	Northern	Southern	Western
D_CBI_c	-1.459* (0.780)	-4.497* (2.442)	-3.830*** (1.330)	-1.723 (1.694)	-1.482*** (0.413)
D_IQ_c	0.117 (0.222)	-0.242 (0.676)	1.439*** (0.450)	0.659 (0.410)	0.274 (0.336)
D_CBI_IQ	-2.410 (1.652)	-18.704** (8.004)	-8.286*** (2.603)	4.763 (5.431)	-4.213*** (1.428)
GDPG	-0.118*** (0.023)	-0.019 (0.051)	-0.047*** (0.010)	-0.054 (0.042)	-0.018 (0.033)
D_LOG_M2	-16.285*** (3.105)	-15.637 (10.644)	-6.660*** (0.918)	-8.951** (4.262)	0.228 (0.141)
D_LOG_EXCH	1.619*** (0.316)	3.027*** (0.669)	1.106 (0.679)	3.522*** (4.559)	1.086 (0.734)
D_TOPEN	-0.0036 (0.0055)	-0.0352** (0.0155)	-0.0313** (0.0141)	-0.0189 (0.0159)	-0.0068 (0.0071)
Observations	310	130	148	125	355
Number of countries	15	6	6	5	16
Within R^2	0.3920	0.5993	0.5586	0.3906	0.2356

Driscoll-Kraay standard errors in parentheses; year fixed effects included in every regression but not reported. *** p<0.01, ** p<0.05, * p<0.10.

The CBI–IQ interaction (D_CBI_IQ) is negative and statistically significant in Middle, Northern and Western Africa – supporting H3 in those sub-regions – but insignificant in Eastern and Southern Africa. Northern Africa is distinctive in having a significant positive main effect of IQ (0.117 to 1.439) alongside a significant negative interaction term, implying institutional quality alone is associated with higher inflation there, while institutional quality still strengthens the disinflationary power of CBI. Southern and Northern Africa are the thinnest panels (5 and 6 countries respectively) and results for these sub-regions should be treated as indicative only.

Table 15. Wald Tests for Joint Significance of Sub-Region Interaction Terms

Joint hypothesis test	F-statistic	p-value	Conclusion
H0: all CBI×Sub-region interactions = 0	F(4,26) = 3.58	0.0188	Reject H0
H0: all IQ×Sub-region interactions = 0	F(4,26) = 2.10	0.1108	Fail to reject H0

The joint Wald test rejects the null of homogeneity in the CBI–inflation relationship across sub-regions (p = 0.0188), providing formal statistical support for regional heterogeneity (H4). The equivalent joint test for the IQ–inflation relationship is not significant at conventional levels (p = 0.1108), indicating institutional quality's average effect is comparatively more stable across sub-regions, notwithstanding the individually significant Northern Africa interaction reported in Table 4.12.

4.4 System GMM Robustness Check

Table 16. System GMM Robustness Check (Two-Step, Windmeijer-Corrected Standard Errors)

Variable	Coef.	Std. Err.	p-value
L.IHS_INF (lagged inflation)	-0.2354	0.4277	0.585
D_CBI_c	-1.3254	0.8620	0.131
D_IQ_c	0.2629	0.1552	0.097*
D_CBI_IQ	-2.3970	1.2071	0.018*
GDPG	-0.0048	0.0183	0.795
D_LOG_M2	-0.1176	0.0999	0.246

Variable	Coef.	Std. Err.	p-value
D_LOG_EXCH	3.0545***	0.5793	0.000
D_TOPEN	-0.0188**	0.0079	0.021
Constant	1.4519	0.7403	0.056*
Observations	1,068		
Number of countries	48		
Number of instruments	42		

Table 17. System GMM Diagnostic Tests

Diagnostic test	Statistic	p-value	Conclusion
Arellano-Bond AR(1)	z = -0.67	0.506	As expected
Arellano-Bond AR(2)	z = -1.01	0.313	No 2nd-order autocorrelation
Hansen test of overidentifying restrictions	$\chi^2(3) = 1.98$	0.576	Instruments valid
Difference-in-Hansen (GMM instruments for levels)	$\chi^2(1) = 0.24$	0.621	Exogeneity not rejected

*** p<0.01, ** p<0.05, * p<0.10. Model estimated via xtabond2, gmm(L.IHS_INF, lag(3 5), collapse), with sub-region and year dummies as instrument-free (iv) controls; two-step, robust, small-sample corrected.
All diagnostic tests support the validity of the GMM specification: no second-order serial correlation (AR2 p = 0.313) and the Hansen and Difference-in-Hansen tests do not reject the null of instrument exogeneity.
Under the dynamic GMM specification, the CBI, IQ coefficients all lose statistical significance, while CBI×IQ, D_LOG_EXCH and D_TOPEN remain significant.

4.5 Panel Threshold Analysis

To examine whether the moderating role of institutional quality is regime-switching rather than smoothly linear, a Hansen/Wang (2015) panel threshold model was estimated with institutional quality (D_IQ_c) as the threshold variable and CBI (D_CBI_c) as the regime-dependent regressor, on a balanced 31-country restricted panel (1997–2023).

Table 18. Panel Threshold Estimation Results

Parameter	Estimate	95% CI
Threshold estimate (D_IQ_c)	-0.7566	Not identified
Below-threshold D_CBI_c coefficient	9.040* (p = 0.086)	–
Above-threshold D_CBI_c coefficient	0.319 (p = 0.754)	–

Table 19. Bootstrap Threshold-Effect Test

Threshold	F-statistic	p-value	Crit. 10%	Crit. 5%	Crit. 1%
Single threshold	2.68	0.4433	6.2448	6.9764	9.5353

Restricted balanced panel: 31 countries, T = 27 (1997–2023), N = 837. Bootstrap replications = 300.
The bootstrap threshold-effect test fails to reject the null of no threshold effect (F = 2.68, p = 0.4433, well below the 10% critical value of 6.2448). Although a point estimate of the threshold in institutional quality is obtained (D_IQ_c = −0.7566), it is not statistically identified, and the regime-specific coefficients therefore cannot be meaningfully interpreted as separate CBI–inflation regimes.

This null result is treated as an exploratory robustness check: it suggests the CBI×IQ moderation documented in Sections 4.6 and 4.7 is more consistent with a smooth, linear interaction effect than with a discrete regime-switching (threshold) process.

Table 20. Summary of Key Findings

Hypothesis / Issue	Statement	Empirical Finding	Decision	Evidence Table
IQ construction	A single institutional quality (IQ) index can be extracted from the six WGI governance indicators.	Component 1 has eigenvalue 4.89 and explains 81.5% of total variance; all six indicators load positively and evenly (0.376–0.440).	Confirmed	Tables 4.2–4.3
H1	Central bank independence (CBI) is negatively associated with inflation.	D_CBI_c is negative and significant in the pooled interaction model (−0.999, $p<0.01$) and in Eastern, Middle, Northern and Western Africa split-sample models.	Supported	Tables 4.11, 4.13
H3	Institutional quality moderates (strengthens) the disinflationary effect of CBI.	The CBI×IQ interaction is negative and significant in the pooled model (−4.178, $p<0.01$) and in Middle, Northern and Western Africa.	Supported	Tables 4.11, 4.13
H4	The CBI–inflation relationship is heterogeneous across African sub-regions.	Joint Wald test rejects homogeneity of CBI×Sub-region interactions ($F(4,26) = 3.58$, $p = 0.0188$); coefficient signs/magnitudes vary markedly across sub-regions.	Supported	Tables 4.12, 4.14
Regime-switching (threshold)	The CBI–IQ moderation reflects a discrete institutional-quality threshold rather than a smooth interaction.	Bootstrap threshold-effect test is insignificant ($F = 2.68$, $p = 0.4433$); threshold location not statistically identified.	Not supported	Tables 4.17–4.18
Dynamic robustness	The CBI, IQ and CBI×IQ effects are robust to a dynamic GMM specification that addresses endogeneity and inflation persistence.	CBI, IQ lose statistical significance under two-step System GMM; diagnostics (AR2, Hansen) support instrument validity.	Caveat /robust	Tables 4.15–4.16
Macro control	Exchange-rate movements are a key driver of inflation in Africa.	D_LOG_EXCH is positive and significant ($p<0.01$) in almost every specification estimated in the chapter.	Confirmed	Tables 4.11–4.13, 4.15

"Supported" indicates the hypothesised relationship is statistically significant and correctly signed in the primary fixed-effects models; "Caveat / not robust" indicates the relationship does not survive an alternative (dynamic GMM) specification and should be interpreted with that limitation in mind.

4.6 Discussion of Findings

The empirical results from equation one in Table 12 show that central bank independence had a negative, insignificant effect on the inflation rate in Africa. From equation two, when institutional quality was introduced, central bank independence had a negative, significant effect on inflation. The interaction between central bank independence and institutional quality had a negative, significant effect on the inflation rate. These findings show that central bank independence alone is not effective in controlling inflation in Africa. However, its effectiveness depends greatly on the institutional environment in which they operate. It also demonstrates that central bank independence does not operate in isolation. The result is consistent with the broader empirical literature, which generally identifies a negative relationship between central bank independence

and inflation, although the strength of this relationship varies across countries, institutional settings, and estimation methods (Klomp & de Haan, 2010; Gyeke-Dako et al., 2022; Agoba et al., 2017; and Yahaya et al.). The present study therefore reinforces the argument that monetary-policy independence can be an important institutional mechanism for maintaining price stability in African economies.

Additionally, the regional evidence. It was found in this study that the CBI–inflation relationship varies considerably across the five African sub-regions, with CBI being negative and statistically significant in Eastern, Middle, Northern and Western Africa but insignificant in Southern Africa. The joint Wald test further confirms that the differences across sub-regions are statistically significant. This shows that the effectiveness of central bank independence is context-dependent. This finding is closely related to Strong (2021), who found that the effect of CBI in Africa varies with institutional and monetary arrangements, particularly between CFA and non-CFA countries.

The findings concerning institutional quality are more nuanced. While the CBI×IQ interaction is negative, the direct coefficient of IQ is positive and marginally significant in the pooled interaction model. Northern Africa is particularly distinctive, with institutional quality positively associated with inflation while simultaneously strengthening the disinflationary effect of the CBI. This seemingly counterintuitive result suggests that improvements in governance may not automatically translate into lower inflation in the short run. Rather, the principal contribution of institutional quality may be to create an environment in which independent monetary authorities can implement credible and effective policy. This interpretation is broadly consistent with Agoba et al. (2017), who emphasised the conditional role of institutional quality in the CBI–inflation relationship.

Another important finding is the consistently positive and highly significant effect of exchange-rate depreciation on inflation. Across the pooled fixed-effects models, regional specifications, and System GMM, exchange-rate movements remain one of the strongest predictors of inflation. This suggests that exchange-rate instability represents a major inflation transmission channel in Africa**,** potentially reflecting the high import dependence and foreign-exchange vulnerability of many African economies. The result also helps explain why institutional reforms alone may not be sufficient to guarantee price stability.

The threshold analysis does not identify a statistically significant institutional-quality threshold. The bootstrap test fails to reject the null hypothesis of no threshold effect, suggesting that the moderating role of institutional quality is better characterised as a continuous interaction rather than a discrete regime change**.** This is an important contribution because it suggests that there is no single institutional-quality level at which CBI suddenly becomes effective. Instead, improvements in institutional quality appear to progressively enhance the capacity of independent central banks to pursue price stability.

5. Conclusion/Recommendations

The effect of central bank independence on inflation control in Africa and also whether institutional quality conditions this relationship across African sub-regions has been successfully examined in this study. The findings show that the effectiveness of central bank independence in controlling inflation depends on the institutional environment in which monetary policy operates.

This implies that central bank independence alone cannot achieved price stability in African regions. Additionally, the study also establishes significant regional heterogeneity. It was noted that the CBI–inflation relationship differs across African sub-regions, confirming that monetary institutional reforms cannot be designed effectively through a uniform continental approach. A robustness check using GMM found that the interaction between central bank independence and institutional quality has a negative effect on the inflation rate in Africa. The study noted that central bank independence matters, institutions matter more, and context matters most**.** Central banks are more likely to deliver price stability when their independence is supported by credible governance structures and complemented by policies that address exchange-rate pressures. Therefore, based on the findings, the study recommends that African governments should strengthen the legal and operational independence of central banks, particularly by protecting monetary authorities from short-term political pressures and fiscal dominance. Independence should, however, be accompanied by clear accountability mechanisms. Governments should also strengthen the rule of law, regulatory quality, government effectiveness, control of corruption, political stability, and accountability rather than treating CBI as an isolated reform. Exchange-rate movements emerge as the most consistent inflation driver across the African regions. Consequently, inflation-targeting frameworks should be complemented by credible exchange-rate management, adequate foreign-exchange buffers, and policies that reduce excessive exchange-rate volatility.

Declarations

Ethics approval

Not applicable. This study used secondary, publicly available country-level data and did not involve human participants, human subjects, or the collection of personally identifiable information.

Consent to participate

Not applicable.

Consent to publish

Not applicable.

Clinical Trial Registration

Not applicable. This study did not involve a clinical trial.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Competing interests

The authors declare that they have no competing interests.

Data availability statement

The data supporting this study's findings come from publicly available secondary sources. Data on central bank independence were obtained from the Cukierman–Garriga central bank independence dataset, as updated by Garriga (2025). Macroeconomic and development indicators were obtained from the World Bank's World Development Indicators (WDI), while institutional quality measures were obtained from the Worldwide Governance Indicators (WGI). The authors constructed the analytical dataset by merging these publicly available sources for 52 African countries from 1996–2023. The data and replication files used for the empirical analysis are available from the corresponding author upon reasonable request.

References

Agoba, A. M., Abor, J., Osei, K. A., & Sa-Aadu, J. (2017). Central bank independence and inflation in Africa: The role of financial systems and institutional quality. *Central Bank Review, 17*(4), *131–146*. https://doi.org/10.1016/j.cbrev.2017.11.001

Agoba, A. M., Fiador, V., Sarpong-Kumankoma, E., & Sa-Aadu, J. (2022). Central bank independence, exchange rate regime, monetary policy and inflation in Africa. In J. Y. Abor & C. K. D. Adjasi (Eds.), *The economics of banking and finance in Africa*, *3(2), 183-198.* https://doi.org/10.1007/978-3-031-04162-4_6

Barro, R. J., & Gordon, D. B. (1983). Rules, discretion and reputation in a model of monetary policy. *Journal of Monetary Economics, 12*(1), 101–121. https://doi.org/10.1016/0304-3932(83)90051-X

Bodea, C., & Hicks, R. (2015). Price stability and central bank independence: Discipline, credibility, and democratic institutions. *International Organization, 69(1), 35–61. https://doi.org/10.1017/S0020818314000277*

Cukierman, A., Webb, S. B., & Neyapti, B. (1992). Measuring the independence of central banks and its effect on policy outcomes. *The World Bank Economic Review, 6(3), 353–398. https://doi.org/10.1093/wber/6.3.353*

Garriga, A. C., & Rodriguez, C. M. (2020). More effective than we thought: Central bank independence and inflation in developing countries. *Economic Modelling, 85*, 87–105. https://doi.org/10.1016/j.econmod.2019.05.009

Gyeke-Dako, A., Agbloyor, E. K., Agoba, A. M., Turkson, F., & Abbey, E. (2022). Central bank independence, inflation, and poverty in Africa. *Journal of Emerging Market Finance, 21*(2), 211–236. https://doi.org/10.1177/09726527221078434

Haoudi, A., & Touati, A. B. (2023). Central bank independence: The case of North African central banks. *Journal of Central Banking Theory and Practice, 2023*(3), 61–85. https://doi.org/10.2478/jcbtp-2023-0025

Klomp, J., & de Haan, J. (2010). Inflation and central bank independence: A meta-regression analysis. *Journal of Economic Surveys, 24*(4), 593–621. https://doi.org/10.1111/j.1467-6419.2009.00597.x

Kydland, F. E., & Prescott, E. C. (1977). Rules rather than discretion: The inconsistency of optimal plans. *Journal of Political Economy, 85*(3), 473–491. https://doi.org/10.1086/260580

Mbobo, E., & Effiong, U. (2026). Monetary policy, central bank independence, and inflation control in Nigeria. *African Journal of Commercial Studies, 7*(4), 58–72. https://doi.org/10.59413/ajocs/v7.i4.8

Ngongang, E., & Soulemanou, S. (2025). Central bank independence in Sub-Saharan Africa. *Applied Economics and Finance, 12*(2), 10–21. https://doi.org/10.11114/aef.v12i2.7594

North, D. C. (1990). Institutions, institutional change and economic performance. Cambridge University Press.

North, D. C. (1991). Institutions. *Journal of Economic Perspectives, 5(1), 97–112. https://doi.org/10.1257/jep.5.1.97*

Odusola, A. F. (2007). Inflation targeting as a tool of monetary management: International experiences. *Economic and Financial Review, 45*(4), 189–213.

Okereke, I. G., Olajide, O., Opadotun, O., Ude, C. B., Olatunbosun, E., & Adagboyi, E. (2026). Central bank independence and inflation performance in Nigeria. *Ayden Journal of Management and Social Sciences, 14*(2), 13–?. https://doi.org/10.5281/zenodo.19733405

Strong, C. O. (2021). Political influence, central bank independence and inflation in Africa: A comparative analysis. *European Journal of Political Economy, 69*, 102004. https://doi.org/10.1016/j.ejpoleco.2021.102004

Toure, A. A. (2019). Central bank independence and inflation in Sub-Saharan African economies. *International Journal of Advances in Management and Economics, 8*(4), 31–38.

Vermeulen, C. (2024). Central bank independence, inflation and money growth: Evidence from South Africa. *Southern African Business Review, 28*, Article 14375. https://doi.org/10.25159/1998-8125/14375

Yahaya, A., Saidu, M. T., & Sadi, A. (2022). Effects of central bank independence and financial stability on inflation in selected African countries. *CBN Journal of Applied Statistics, 13*(2), 155–184. https://doi.org/10.33429/Cjas.13222.5/7