

IMPACT OF GOVERNMENT BONDS ON ECONOMIC GROWTH IN NIGERIA

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Abstract: This study examined the impact of Government bond on economic growth in Nigeria for the period between 1999 and 2024. An ex-post-facto research design was adopted and the study was based on the theoretical framework of the Keynesian theory of public finance. Time series data on values of amount of government bonds issued (GBA), Number of government bond issues (GBN), average government bonds issued maturity period (GBM) and average government bonds yield (GBY) as independent variables and Gross Domestic Product Growth Rate (GDP_r) as dependent variable were collected from publications of CBN, NBS and World Banks. The data collected were subjected to both pre-estimation and post estimation tests for variables trend characteristics, descriptive statistics, unit root, co-integration, causality, serial correlation and normality. Secondly, a VECM technique of estimation was employed to determine the variable coefficients and T-statistic test of hypotheses was employed to determine their significance. Generally, the study found a significant relationship between the government bond variables and Nigeria's economic growth. On the individual variables findings, while amount of government bonds issued (GBA), Number of government bond issues (GBN) and Average bonds issued maturity period (GBM) have positive and significant impact, average government bonds yield (GBY) has negative but insignificant impact on economic growth during the period under review in Nigeria. While a unit change is GBA, GBN and GBM increases GDP_r by 1%, 4.32% and 39.05% respectively, a unit increase in GBY decreases GDP_r by 22.57%. The study recommended in addition to others that the Nigerian government should diversify and deepen its bond market by introducing various bond types and extending maturity profiles. This can attract a broader investor base, reduce borrowing costs, and ensure that the government can finance infrastructure projects more effectively over the long term, ultimately fostering more stable economic growth.

Keywords: Government Bonds, Economic Growth, VECM, Nigeria, Keynesian Public Finance.

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Introduction

The relationship between government bonds and economic growth has garnered significant scholarly and policy interest worldwide, especially in the context of the evolving global financial landscape. Globally, government bonds serve as critical instruments for financing public expenditure, stabilizing economies, and influencing monetary policy (El-Yaqub, Musa & Ismail, 2024). In advanced economies such as the United States and Eurozone countries, government bonds, particularly long-term securities, are pivotal in shaping investment climates, maintaining fiscal discipline, and supporting economic stability. For example, during the COVID-19 pandemic, the U.S. government issued unprecedented levels of debt over \$4 trillion in 2020 alone to support economic recovery efforts, which underscored the importance of government bonds in mitigating economic shocks (Federal Reserve, 2021). Similarly, in the Eurozone, the European Central Bank's large-scale asset purchase programs, including government bonds, played a crucial role in maintaining low-interest rates and fostering economic resilience (ECB, 2022).

Contrastingly, developing economies and African nations face unique challenges and opportunities concerning government bonds. This is an open access article under the [CC BY-NC](https://creativecommons.org/licenses/by-nc/4.0/) license

bonds. While these countries often rely on bonds to finance infrastructure projects, social programs, and development initiatives, their bond markets are typically less mature, characterized by higher yields, lower liquidity, and greater susceptibility to external shocks. For instance, African countries like Ghana and South Africa have increasingly issued sovereign bonds to fund development projects, but often grapple with high borrowing costs, currency risks, and fluctuating investor confidence (World Bank, 2022). The impact of such bonds on economic growth remains mixed; some studies suggest that well-managed bond issuance can boost growth by financing productive investments, whereas others warn of debt sustainability concerns that could hinder long-term development (El-Yaqub, Usman, Musa & Ismail, 2024).

Nigeria, being the Africa's largest economy and one of the continent's most significant emerging markets, the government has increasingly relied on bond issuance to diversify its financing sources amid fluctuating oil revenues, which historically account for a substantial share of fiscal income (El-Yaqub, Ismail, Usman, 2025). Nigeria's government bonds have been instrumental in

funding infrastructure, social development, and stabilization efforts, especially during periods of economic downturns. Recent data indicate that Nigeria's domestic bond market has expanded considerably, with the total outstanding bonds reaching over ₦4 trillion (approximately \$9 billion) in 2022, reflecting a growing investor base and increased government borrowing (Central Bank of Nigeria, 2022).

Despite this growth, Nigeria faces persistent challenges such as high debt-to-GDP ratios, inflationary pressures, and fiscal deficits, which complicate the assessment of how government bonds influence broader economic indicators like GDP growth, employment, and poverty reduction. Empirical evidence from Nigeria suggests that while government bonds can finance infrastructure development and stimulate economic activity, excessive reliance or mismanagement may lead to debt distress, crowding out private investment, and undermining economic stability (Afolabi & Ojo, 2021).

The motivation for this study stems from the critical need to understand the nuanced impact of government bond issuance on Nigeria's economic growth trajectory. Given the country's ongoing efforts to diversify its economy away from oil dependence and improve fiscal sustainability, insights into how government bonds contribute to or hinder economic expansion are vital for policymakers, investors, and development stakeholders.

With Nigeria's growing bond market and the backdrop of global financial shifts, this research aims to fill gaps in empirical understanding, providing evidence-based recommendations on optimizing bond strategies to foster sustainable economic growth. Ultimately, this study seeks to inform policy formulations that balance debt issuance with growth objectives, ensuring that bond financing becomes a catalyst for Nigeria's economic development rather than a source of fiscal vulnerability. The study is aimed to provide answer to the following questions:

- i. What is the impact of amount of government bonds issued on economic growth in Nigeria?
- ii. How has Number of bond issues impacted on economic growth in Nigeria?
- iii. How does average bonds issued maturity period impact on economic growth in Nigeria?
- iv. What impact does average government bonds yield has on economic growth in Nigeria?

The study is presented in five parts. Part one is the introduction, which discusses the background and statement of problem, and research questions. Part two focuses on literature review; reviewing the conceptual, theoretical, empirical studies as well as identifying the literature gaps. Part three describes the study methodology discussing the research design; theoretical framework; model for the study and model specification; method of data analysis presentation, and model estimation techniques. Part four deals with data presentations, analysis and results interpretations, test of the study hypotheses, and discussion of findings as well as policy implication of the results. Part five gives the summary, conclusion and recommendations.

Literature Review

Conceptual Review

Government bonds are debt instruments issued by national governments to finance public spending, infrastructure projects,

and other development initiatives, representing a promise to pay the bondholders a specified amount of interest over a predetermined period and to return the principal at maturity. Different authors and organizations have offered various definitions that collectively underscore the multifaceted nature of government bonds. According to the International Monetary Fund (IMF, 2020), government bonds are "marketable debt securities issued by a government to raise funds from the public and institutional investors, serving as a key instrument for fiscal management." This definition emphasizes the role of bonds as financial tools for mobilizing resources and managing fiscal deficits. Similarly, the World Bank (2021) describes government bonds as "long-term debt securities issued to finance public expenditure, which are backed by the full faith and credit of the issuing government," highlighting the guarantee aspect that reassures investors about the safety and reliability of the instrument.

The components of government bonds include the face value or principal amount, the coupon rate (interest rate), maturity date, issue price, and yield. The face value is the amount the issuer promises to pay the bondholder at maturity. The coupon rate determines the periodic interest payments, which can be fixed or variable, depending on the bond's structure (Ismail & El-Yaqub, 2025). The maturity date specifies when the principal will be repaid, influencing the bond's duration and risk profile. The issue price may be at par, premium, or discount, depending on prevailing interest rates and market conditions at issuance. The yield, often expressed as yield to maturity (YTM), reflects the overall return an investor can expect, considering the bond's purchase price, coupon payments, and time to maturity. Variables such as interest rates, inflation, credit ratings, and economic stability influence these components and, consequently, the bond's attractiveness to investors.

Government bonds have significantly impact on economic growth through multiple channels. When effectively issued and managed, they provide governments with crucial funding to invest in infrastructure, health, education, and social programs, which can stimulate economic activity and improve productivity. Moreover, government bonds influence interest rates across the economy, serving as benchmarks for other financial assets, thereby affecting private sector borrowing and investment. A well-functioning bond market enhances financial stability, promotes savings, and facilitates resource allocation, all of which are conducive to sustained growth (Aizenman & Jinjark, 2019). Conversely, excessive issuance or mismanagement of government bonds can lead to high debt levels, crowding out private investment, increasing fiscal vulnerability, and inducing inflationary pressures, which may hinder long-term economic growth. Therefore, the strategic issuance and management of government bonds are crucial for balancing fiscal needs with macroeconomic stability and growth objectives.

Economic growth on the other hand is a fundamental concept in development economics, representing an increase in a country's output of goods and services over time and serving as a critical indicator of a nation's economic health and development prospects (El-Yaqub, Ismail & Bappayo, 2024). Different scholars and organizations have offered various definitions that underscore the multifaceted nature of economic growth. The International Monetary Fund (IMF, 2021) defines economic growth as "the rate of increase in a country's real gross domestic product (GDP),

reflecting the expansion of economic activity and income.” This definition emphasizes the quantitative aspect of growth, highlighting the importance of measurable increases in economic output. Similarly, the World Bank (2022) describes economic growth as “the sustained rise in a country’s productive capacity, which results in higher levels of income, employment, and standards of living,” thereby linking growth to broader socio-economic improvements.

The components of economic growth typically include increases in gross domestic product (GDP), improvements in productivity, technological advancement, capital accumulation, and enhancements in human capital. These components are interconnected; for instance, technological progress and capital investment boost productivity, which in turn raises national output. The measurement of economic growth primarily relies on indices such as GDP and GDP per capita. Gross domestic product (GDP) measures the total market value of all finished goods and services produced within a country over a specific period, serving as the most common indicator of economic activity. GDP per capita adjusts this figure for population size, providing insights into the average income and living standards of individuals within the economy. Other indices include the Human Development Index (HDI), which combines income, education, and health indicators to offer a broader perspective on growth’s impact on human well-being. Additionally, productivity indices, such as labor productivity (output per worker), are used to assess efficiency improvements contributing to growth. These measurement tools collectively enable policymakers and analysts to evaluate the trajectory and quality of economic development, guiding strategic decisions.

To the researcher, the concept of economic growth encompasses a broad spectrum of definitions emphasizing increased output, improved living standards, productivity enhancements, and sustainability. Its measurement relies heavily on quantitative indices like GDP and GDP per capita, but increasingly incorporates qualitative indicators such as the HDI to reflect a more comprehensive view of development. Understanding these components and measurement tools is vital for designing effective economic policies aimed at fostering sustainable and inclusive growth that benefits society at large.

Theoretical Literature Review

The Keynesian Theory of Public Finance, introduced by John Maynard Keynes in 1936, emphasizes the role of government borrowing through bonds in stimulating aggregate demand during economic downturns. Keynes argued that government expenditure financed by bonds could offset private sector savings and investment shortfalls, thereby boosting economic activity and growth. The theory assumes that government spending has a multiplier effect on national income and that borrowing is an effective tool for managing economic fluctuations without necessarily triggering inflation or crowding out private investment. However, criticisms highlight that excessive borrowing may lead to high debt levels, inflation, and diminished private sector confidence. Despite these concerns, the Keynesian perspective remains relevant to Nigeria, where government bonds are used to finance infrastructure projects and stimulate growth during downturns, supporting overall economic development.

The Loanable Funds Theory, developed in the late 19th and early 20th centuries with contributions from Knut Wicksell and

Robert Barro, explains how government bonds interact within the broader financial market. It posits that the interest rate is determined by the equilibrium between the demand for loanable funds—comprising private investment and government borrowing—and the supply of savings. According to this theory, when the government issues bonds, it can increase the supply of loanable funds, potentially lowering interest rates and encouraging private investment, thus fostering economic growth. Nonetheless, critics argue that the theory oversimplifies the complexities of financial markets and overlooks how excessive government borrowing might crowd out private investment and lead to higher interest rates. In Nigeria, this theory highlights the importance of managing bond issuance carefully to influence interest rates favorably and support private sector growth without causing crowding out.

The Fiscal Policy Theory, rooted in Keynesian economics and advanced by Richard Musgrave, underscores the importance of government fiscal actions—including bond issuance—in stabilizing and promoting economic growth. It suggests that fiscal policy, through government spending and taxation, directly affects aggregate demand and supply (El-Yaqub, Musa & Ismail, 2024). When the government issues bonds to finance expenditures, it can either stimulate or restrain economic activity depending on the economic context. The fundamental assumption is that well-calibrated fiscal interventions can correct economic imbalances and foster growth. Critics warn that reliance on fiscal policy may result in deficits, increased public debt, and long-term sustainability challenges if not properly managed. In Nigeria, this theory is highly relevant, as government bonds serve as vital tools for financing development projects, stabilizing the economy, and encouraging growth, provided they are managed prudently to prevent inflation and debt crises.

The three theories collectively suggest that, when used prudently, government bonds can serve as effective instruments to mobilize resources, influence financial markets, and foster sustainable development in Nigeria, although careful management is essential to mitigate potential drawbacks such as debt overhang or crowding out private investment.

Empirical Studies Review

In the study by Perez and Sanchez (2023), the objective was to analyze the impact of government bonds on Colombia’s economic growth from 1990 to 2021. Data were sourced from Colombia’s National Department of Statistics and the IMF. The analysis used the Dynamic Panel Data (DPD) approach with the Generalized Method of Moments (GMM) estimator to control for endogeneity. The findings showed a positive and significant effect of bonds on growth, especially when bonds financed social infrastructure. The study suggested policy focus on bond market development and fiscal discipline, adding to the knowledge of bond effects in Latin American emerging markets.

The study by Adeyemi (2022) aimed to investigate the effect of government bond issuance on Nigeria’s economic growth from 2000 to 2020. The research utilized quarterly time-series data obtained from the Central Bank of Nigeria and the World Bank databases. The dependent variable was real GDP growth, while the independent variable was the volume of government bonds issued. The analysis employed the Autoregressive Distributed Lag (ARDL) bounds testing approach to examine long-run relationships. The major finding indicated a positive and

significant relationship between government bonds and economic growth in Nigeria, especially when bond issuance was channeled into productive sectors. The study recommended that Nigeria should adopt prudent bond management policies to foster sustainable growth and contribute to the existing literature by confirming bond growth linkage in a developing country context.

Adebayo and Oladipo (2022) analyzed Nigeria's bond market development and its effect on economic growth from 2005 to 2020. Data sources included Nigeria's Debt Management Office and the World Bank. The study used the ARDL model to investigate the short- and long-term relationships. Findings demonstrated that government bonds positively affected Nigeria's GDP growth, especially when bonds financed productive sectors. The authors advocated for policies aimed at deepening the bond market and improving fiscal governance, thereby enriching the literature on bonds and growth in resource-dependent economies.

Zhang and Wang (2021), the focus was on analyzing the impact of government bonds on the economic growth of emerging ASEAN economies from 2000 to 2019. Data sources included ASEAN statistical agencies and the IMF. The researchers used Panel Cointegration and System GMM estimators to address endogeneity and heterogeneity issues. The results confirmed that government bonds positively influenced growth, particularly through infrastructure investment. The major recommendation was to develop bond markets further and increase fiscal transparency, contributing to understanding regional bond-growth linkages.

Osei and Darko (2021) focused on Ghana's economic growth impact of government bonds from 2005 to 2020. Data sources included Ghana's Ministry of Finance and the World Bank. The dependent variable was GDP growth rate, and the independent variables included bond issuance and interest rates. The study used the Johansen cointegration test and error correction models to analyze long-term relationships. Results indicated a positive relationship between bond issuance and economic growth, driven by infrastructure investments. The authors recommended strengthening bond issuance mechanisms and increasing transparency to maximize growth effects, thus contributing to the understanding of bond-growth linkages in West Africa.

In the study conducted by Chen and Li (2021), the objective was to analyze the impact of sovereign bonds on China's economic growth between 1990 and 2019. The data sourced from the International Monetary Fund (IMF) and China's National Bureau of Statistics included annual GDP growth rates and government bond totals. The variables included real GDP growth (dependent) and government bond issuance (independent). The authors used the Vector Error Correction Model (VECM) to analyze long-term relationships and causality. The findings showed that government bonds positively influenced economic growth, mainly through stimulating investment. The paper suggested that China's government should continue to leverage bonds for fiscal stimulus, and the contribution lies in providing evidence of bonds' growth impact in a major emerging economy.

Kumar and Singh (2020) explored the influence of government bonds on India's economic development from 1995 to 2018. Data was obtained from the Reserve Bank of India and World Bank, with annual GDP growth as the dependent variable and government bond issuance as the independent variable. The researchers employed the Ordinary Least Squares (OLS) regression model, ensuring stationarity through Augmented Dickey-Fuller

tests. The results indicated a significant positive effect of government bonds on economic growth, especially when bonds financed infrastructure projects. The authors recommended strengthening bond markets and improving fiscal discipline to enhance growth benefits, contributing to policy formulation for bond-based fiscal expansion.

Finally, a study by Lee and Park (2020) examined the impact of government bonds on South Korea's economic growth from 1980 to 2018. The data came from the Bank of Korea and the Korean Statistical Office. The variables included GDP growth (dependent) and government bond issuance (independent). The analysis employed the Johansen cointegration technique and Vector Error Correction Model (VECM). Results indicated a long-term positive relationship, with bonds serving as a tool for fiscal stimulus. The authors recommended strengthening bond markets and ensuring fiscal sustainability, contributing insights into bond-growth dynamics in advanced Asian economies.

The existing studies generally find a positive link between government bonds and economic growth, but they often lack insight into the specific mechanisms involved. Many analyses focus on macro-level data and overlook heterogeneity across sectors, regions, or bond types. There is limited research on the quality and effectiveness of bond-financed investments, as well as the institutional factors that influence outcomes. Most studies concentrate on emerging economies, with fewer comparative analyses across different contexts. Additionally, potential risks of bond issuance, such as debt sustainability and crowding out private investment, are rarely examined. Finally, macroeconomic controls like inflation or exchange rates are often underrepresented, potentially confounding the true relationship between government bonds and growth. Addressing these gaps would deepen understanding and enhance policy relevance.

Methodology

Research Design and Data Sources

This study adopted the ex-post facto research design which is a type of correlational research design commonly utilized in the social sciences. It is characterized by the examination of relationships between variables after the events have already occurred, rather than manipulating variables or conducting experiments. In other words, researchers analyze data from events or situations that have already taken place to identify trends, causal relationships, or correlations.

For this study, the researcher made use of mainly time series data sourced including national statistical agencies, central banks that publish official figures on GDP growth, government bond issuance, and debt statistics and international organizations such as the IMF, World Bank, and OECD provide comprehensive datasets on economic performance and government debt indicators across countries.

Theoretical Frameworks and Model Specification

This study is hinged on the framework of the Keynesian Theory of Public Finance developed by John Maynard Keynes in 1936; which is based on the aggregate demand function, expressed as:

$$AD = C + I + G + (X - M) \quad (3.1)$$

Where: consumption (C), investment (I), government spending (G), and net exports (X - M) drive overall economic activity. Government bonds influence this framework primarily through their role in financing increased government expenditure (G).

When the government issues bonds to raise funds, it effectively increases G, shifting the aggregate demand curve outward. This direct increase in G raises total output (Y), as depicted in the Keynesian cross model, where equilibrium income is determined by the intersection of aggregate demand and aggregate supply. Additionally, bonds impact interest rates, which are crucial in the investment component (I). Through the money market, the demand for money (Md) depends on income (Y) and the interest rate (I), modelled as $Md = L(Y, I)$.

An increase in bond issuance raises bond supply, leading to lower bond yields (interest rates), which stimulates private investment due to reduced borrowing costs. This effect amplifies the initial fiscal stimulus via the multiplier effect, mathematically represented as:

$$\Delta Y = \frac{1}{1 - MPC} \Delta G \quad (3.2)$$

Where: MPC is the marginal propensity to consume (Keynes, 1936).

This study adopted the Keynesian Theory of Public Finance model with modifications. By replacing the variables of equation 3.1 with this study variables; AD is replaced by GDP_r and C, I, G and X-M are replaced by GBA, GBN, GBM, and GBY respectively and restated as thus:

$$GDP_r = GBA + GBN + GBM + GBY \quad (3.3)$$

Where:

GDP_r = Gross Domestic Product Growth Rate (%)

GBA = Government bonds issued Amount (N)

GBN = Government bond issues Number (N)

GBM = Government bonds issued maturity period (T)

GBY = Government bonds yield Rate (%)

The Keynesian money market model in equation 3.1, suggest that an increase in bond issuance raises bond supply, leading to lower bond yields (interest rates), which stimulates private investment due to reduced borrowing costs. This effect amplifies the initial fiscal stimulus via the multiplier effect, given as equation 3.2. Therefore, by replacing ΔY with GDP_r, and ΔG with government activities inform of bonds variables (GBA, GBN, GBM, & GBY) it is written thus:

$$GDP_r = \frac{1}{1 - MPC} (GBA + GBN + GBM + GBY) \quad (3.4)$$

By replacing the multiplier effect, $\frac{1}{1 - MPC}$ with β we, re-write equation 3.4 as:

$$GDP_r = \beta(GBA + GBN + GBM + GBY) \quad (3.5)$$

By opening the bracket of equation 3.5 and replacing each of the four variable's β with $\beta_1, \beta_2, \beta_3$ and β_4 , it is modified and written in stochastic linear econometric form as:

$$GDP_r = \beta_1 GBA + \beta_2 GBN + \beta_3 GBM + \beta_4 GBY + U_i \quad (3.6)$$

To convert the study variables into the same units of measurement, we take the log of equation 3.6 written as:

$$\ln GDP_r = \beta_1 \ln GBA + \beta_2 \ln GBN + \beta_3 \ln GBM + \beta_4 \ln GBY + U \quad (3.7)$$

Where:

β_0 = Intercept of the regression model;

$\beta_1, \beta_2, \beta_3$, and β_4 = Coefficient of the explanatory variables;

Ln = logarithm,

ECT = Error Correction Term

δ = Short term speed of adjustment

U_t = Error term at time

In the context of theoretical economic relationships (apriori expectation) are that while amount of government bonds issued (GBA) and Number of government bond issues (GBN) increases with increases in economic growth (GDP_r), average government bonds issued maturity period (GBM) and average government bonds yield (GBY) are all likely to decrease economic growth (GDP_r). That is, while β_1 & $\beta_2 > 0$, β_3 & $\beta_4 < 0$.

Definition and Measurement of variables:

Gross Domestic Product Growth Rate (GDP_r):- the percentage change in the country's gross domestic product over a specific period, typically measured annually. It reflects the overall economic performance and is calculated as $[(GDP \text{ in current year} - GDP \text{ in previous year}) / GDP \text{ in previous year}] \times 100$.

Government Bonds Issued Amount (GBA):- the total monetary value of government bonds issued within a given period. It is measured in local currency units (e.g., Nigerian Naira) and indicates the scale of government borrowing through bond issuance.

Government Bond Issues Number (GBN):- the total count of individual government bond issues within a specific timeframe. It provides insight into the frequency of bond issuance and is measured as a simple count or tally of separate bond offerings.

Government Bonds Issued Maturity Period (GBM):- the average duration, usually expressed in years, until the bonds mature. It is calculated by averaging the remaining maturity periods of all outstanding bonds issued during the period.

Government Bonds Yield Rate (GBY):- the average return or interest rate earned by investors on government bonds, typically expressed as a percentage. It is measured by the prevailing market yield on government bonds at a given time.

Method of Data Analyses

The study employed the Vector Error Correction Models (VECM) which is a powerful econometric tool used to analyze the relationship between multiple time series variables that exhibit cointegration. They are particularly useful when dealing with non-stationary variables that, despite having a long-run equilibrium relationship, can exhibit short-run fluctuations. The general form of a Vector Error Correction Model (VECM) equation for n variables with p lags is expressed as:

$$\Delta y_t = \pi y_{t-1} + \sum_{i=1}^p \pi_i \Delta y_{t-i} + \varepsilon_t \quad (3.8)$$

Where: y_t is an n times 1 vector of variables at time t , $\Delta y_t = y_t - y_{t-1}$ is the vector of first differences, Π is an n times n matrix that can be decomposed as $\Pi = \alpha/\beta$, (β an n times r) matrix of cointegrating vectors (with rank (r), representing the long-run relationships,

A VECM consists of two parts. The first is the Error Correction Term (ECT) which is the core of the model that captures the adjustment of the variables towards their long-run equilibrium. The ECT is often negative, indicating that deviations from the equilibrium are corrected over time. The second is the Short-Run Dynamics which captures the short-term relationships between the variables, typically modeled using lagged values of the variables themselves. Equation 3.7 is thus, estimated using the VECM technique, by introducing ECT as:

$$\text{LnGDP}_t = \beta_1 \text{LnGBA}_t + \beta_2 \text{LnGBN}_t + \beta_3 \text{LnGBM}_t + \beta_4 \text{LnGBY}_t + \delta \text{ECT} + U_t \quad (3.9)$$

Pre-Estimation Tests

The study first detected the presence or otherwise, of unit root in the series by examining the stationarity of the variables under consideration in order to avoid having spurious results using the augmented Dickey-Fuller (ADF) unit root method. The unit root property requires all variables to be stationary in levels of first order or second order differences. The following model was used to carry out the estimation.

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \Delta Y_{t-1} + U_t \dots \dots \dots (3.10)$$

Where: Y_t = variable under investigation; $\Delta Y_{t-1} = (Y_{t-1} - Y_{t-2})$ = Difference between first two lagged values of the variable under investigation; and U_t = pure white noise error term.

The tests is based on null hypothesis that:

$$H_0: \beta = 0 \text{ (}\beta \text{ has a unit root and are not stationary).}$$

$$H_1: \beta < 0 \text{ (}\beta \text{ has no unit root and are stationary).}$$

The decision rule is to reject the null hypothesis of non-stationary if the ADF t-statistic (t- calculated value) is greater than the critical (tabular) t-value and conclude that β has no unit root and are stationary; otherwise, accept the null hypothesis and conclude that β has unit root and are non-stationary.

The study in addition, conducted the Johansen cointegration test to determine whether there exists a long-term equilibrium relationship between multiple time series variables under investigation. The VAR Model is formulate as thus:

$$X_t = \Pi X_{t-1} + \Gamma_1 X_{t-2} + \dots + \Gamma_p X_{t-p} + \varepsilon_t \quad (3.11)$$

Where Π contains the information about the cointegration relationships.

The Johansen test uses two statistics; namely Trace test statistic and Maximum eigenvalue test statistic. For trace test, $H_0: r \leq k$ is tested against $H_1: r > k$ for $k = 0, 1, 2, \dots$; and for Maximum Eigenvalue Test using, $H_0: r = k$ is tested against $H_1: r = k + 1$.

Compare the test statistics to critical t-values to decide how many cointegration relationships exist. If the test statistics exceed the critical values, we reject the H_0 for those specified ranks, indicating the presence of cointegration relationships. Depending on the

outcome, the researcher conclude whether there are no, one, or multiple cointegration relationships among the variables.

The Granger causality test was conducted to determine the direction of causality between the variables. This test is based on the idea that if one variable (X) can be used to predict another variable (Y) better than Y 's past values alone, then X is said to Granger cause Y . According to Granger (1969), causation is established when past values of X contain useful information for forecasting Y . In essence, this implies that past events can help predict future outcomes, but future events cannot predict past ones. The analysis involved estimating specific models to assess these causal relationships.

$$Y_t = \alpha_0 + \sum_{i=1}^p \alpha_i Y_{t-i} + \sum_{j=1}^q \beta_j X_{t-j} + U_t, \quad I = 1 \dots \dots \dots (3.12)$$

and

$$X_t = \beta_0 + \sum_{i=1}^p \beta_i X_{t-i} + \sum_{j=1}^q \alpha_j Y_{t-j} + V_t, \quad I = 1 \dots \dots \dots (3.13)$$

Where X_t and Y_t are the variables to be tested while U_t and V_t are white noise disturbance terms.

Equation (3.10) states that current depends on its past values as well as those of inflation rate and others, equation (3.14).

The test hypotheses are stated thus:

$$H_0: \alpha_1 = \alpha_2 = 0 \text{ (} Y_t \text{ does not Granger-cause } X_t \text{)}$$

$$H_0: \beta_1 = \beta_2 = 0 \text{ (} X_t \text{ does not Granger-cause } Y_t \text{)}$$

The decision-making rule is based on the calculated probability (p-value), which lies between 0 and 1 and stated thus: Reject H_0 if the calculated p-value (p^*) is less than 5% ($p^* < 0.05$) level of significance and conclude that there is causality among the variables. Otherwise, do not reject H_0 if ($p^* > 0.05$) and conclude that there is no causality among the variable.

Post-Estimation Tests

The Breusch-Godfrey autocorrelation test which is a diagnostic tool used to check whether the residuals from a regression model are correlated with their past values or not. The test involves estimating the original regression model, then regressing the residuals on the original regressors along with their lagged residuals up to a certain order p using the general form of the auxiliary regression model as:

$$e_t = \rho_0 + \rho_1 x_{1t} + \dots + \rho_k x_{kt} + \phi_1 e_{t-1} + \dots + \phi_p e_{t-p} + (3.14)$$

Where e_t are residuals, and the lagged residuals are included to test for autocorrelation at multiple lags simultaneously.

The test is guided by the following null and alternative hypothesis:

$$H_0 = 0 \text{ (There is no autocorrelation up to the chosen lag } p, \text{ meaning all } \phi_i = 0).$$

$$H_1 \neq 0 \text{ (Autocorrelation exists at one or more lags, so at least one } \phi_i \neq 0).$$

Decision-making involves accepting H_0 if the p-value is greater than 0.05 significance level, and conclude that no significant autocorrelation. Otherwise, reject H_0 if the p-value of the test is less than 0.05 standard significance level, and conclude that autocorrelation exists.

Also, to ensure that our model satisfies the assumption of the classical normal linear regression model, we check the assumptions of normality of the disturbance term by employing the Jarque-Ber a (JB) test of normality which is an asymptotic test based on OLS residuals. It computes the skewness and kurtosis measures of the OLS residuals and uses the following test statistic:

$$Jb = n\left[\frac{s^2}{6} + \frac{k-3^2}{24}\right] \quad (3.15)$$

Where: n is the sample size, S, is the skewness coefficient, k– kurtosis coefficient. The null and alternative hypothesis of the test are as follows:

$H_0: = 0$ (Residuals are normally distributed).

$H_1: \neq 0$ (Residuals are not normally distributed).

The decision guide is to reject H_0 if $JB > \chi^2(2, \alpha)$ (critical value) or if the p-value < 0.05 , and conclude that the residuals are not normally distributed. Otherwise, fail to reject H_0 if $JB \leq \chi^2(2, \alpha)$ or if the p-value ≥ 0.05 , and conclude that the residuals are normally distributed.

Pre-Estimation Tests

Table 4.2: Augmented Dickey-Fuller (ADF) Test Results

Series	ADF Test Statistics	5% Critical T-Value	Order of Cointegration
LGDP	-4.796938	-2.943427	I (1)
LGBA	-6.921891	-2.943427	I (1)
LGBN	-3.894109	-2.943427	I (1)
LGBM	-11.48568	-2.943427	I (1)
LGBY	-9.36457	-2.943427	I (1)

Source: Author's Computation using E-view 12.0 2025

The Augmented Dickey-Fuller (ADF) test results indicate that all variables GDP, GBA, GBN, GBM, and GBY have test statistics more negative than their respective 5% critical value of -2.943427. Specifically, the test statistics for each variable are significantly below this threshold, with values such as -4.796938 for GDP and as low as -11.48568 for GBM. This suggests that all the series are stationary at their levels and do not require differencing. The results also confirm that each variable is integrated of order one, I(1), meaning they are suitable for cointegration analysis. The presence of cointegration among these variables implies a long-term equilibrium relationship exists between government bonds and Nigeria's economic growth.

Table 4.3: Johansen Cointegration Test Results

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized	Max-Eigen	0.05		
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.914656	59.06556	33.87687	0.0000
At most 1 *	0.705413	29.33231	27.58434	0.0295
At most 2	0.420346	13.08775	21.13162	0.4442
At most 3	0.130205	3.347953	14.26460	0.9209
At most 4	0.082890	2.076661	3.841465	0.1496

Source: Author's Computation using E-view 12.0 2025

$H_0: \beta^* = 0$ (parameter estimates are statistically insignificant)

$H_1: \beta^* \neq 0$ (parameter estimates are statistically significant).

The decision making guide is to reject H_0 if P-value > 0.05 , and conclude that the variables parameter estimates are statistically significance; otherwise, accept H_0 and conclude that the variables parameter estimates are statistically insignificance.

Data Presentation and Analysis

Data Presentation

The annual time series data collected on values of Gross Domestic Product Growth Rate (GDP), amount of government bonds issued (GBA), Number of government bond issues (GBN), average government bonds issued maturity period (GBM) and average government bonds yield (GBY) for the period between 1999 and 2024 were organized and presented in tabular form marked as appendix A attached.

The Unrestricted Cointegration Rank Test using the maximum eigenvalue indicates that there are two cointegrating equations among the variables at the 5% significance level. The eigenvalues and test statistics for these two relationships are high and exceed the critical values, with very low p-values, demonstrating strong evidence of long-term equilibrium relationships. However, tests for three or more cointegrating equations are not supported, as their statistics are below the critical thresholds and have high p-values. Overall, this suggests the existence of two long-term relationships among the variables, which are important for understanding their sustained interactions.

Table 4.4: Pairwise Granger Causality Test Results

Null Hypothesis:	Obs	F-Statistic	Prob.
LGBA does not Granger Cause LGDPR	24	0.27281	0.0442
LGDPR does not Granger Cause LGBA		0.41613	0.6655
LGBN does not Granger Cause LGDPR	24	1.30444	0.0945
LGDPR does not Granger Cause LGBN		1.57556	0.2328
LGBM does not Granger Cause LGDPR	24	1.59027	0.0298
LGDPR does not Granger Cause LGBM		1.84236	0.1856
LGBY does not Granger Cause LGDPR	24	0.22487	0.0007
LGDPR does not Granger Cause LGBY		3.90611	0.0379

Source: Author's Computation using E-view 12.0 2025

The pairwise Granger causality test results indicate that GBA (amount of government bonds issued) does not significantly cause GDP (GDP growth rate), as the p-value is 0.0442, which is marginally below the typical 0.05 threshold, suggesting a potential causal influence in one direction. Conversely, GDP does not significantly cause GBA, with a high p-value of 0.6655. For GBN (number of government bond issues), neither GBN nor GDP shows significant causality, as both p-values are above 0.05, indicating no evidence of causality in either direction. Regarding GBM (average maturity period), the test shows that GBM does not Granger cause GDP ($p = 0.0298$), but GDP does not cause GBM ($p = 0.1856$), suggesting a potential unidirectional causality from GBM to GDP. Lastly, GBY (average yield) does not Granger cause GDP ($p = 0.0007$), which is statistically significant, implying GBY may influence GDP growth, and GDP does not significantly cause GBY ($p = 0.0379$).

Regression Results

From the results of Vector Error Correction Model Estimates in appendix B attached, the long-run cointegration results demonstrate a significant relationship between the government bond variables and Nigeria's economic growth. The positive coefficient of 1.0 for LGBA indicates that an increase in the lagged amount of government bonds issued is associated with higher economic growth over time. Similarly, the number of bond

issues (LGBN) and the bond maturity period (LGBM) have large positive coefficients (4.32 and 39.06 respectively), suggesting that more bond issues and longer maturity periods tend to promote economic growth in the long run. Conversely, the negative coefficient for the bond yield (LGBY) at approximately -22.58 implies that higher yields may have a dampening effect on economic growth. These relationships are statistically significant, indicating that government bond issuance and related factors are integral to Nigeria's long-term economic performance.

In the short run, the error correction term (CointEq1) has a small negative coefficient of -0.0293, which suggests that deviations from the long-term equilibrium are corrected gradually, with about 2.9% of the disequilibrium being adjusted each period. The significance of this coefficient confirms a tendency for the system to revert to equilibrium over time, although the adjustment process is relatively slow. The coefficients on the lagged changes of the independent variables reveal mixed short-term effects; for example, the change in government bonds issued ($D(LGBA(-1))$) has an insignificant positive impact, while the change in the number of bond issues ($D(LGBN(-1))$) is negative and significant, implying that an increase in bond issues in the previous period might temporarily hinder growth. Other variables show insignificant effects, indicating limited short-term influence or that their impact is not statistically detectable within the model.

Post-estimation Tests

Table 4.5: VEC Residual Serial Correlation LM Tests

Null hypothesis: No serial correlation at lag h						
Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	11.64132	16	0.7683	0.670566	(16, 19.0)	0.7881

*Edgeworth expansion corrected likelihood ratio statistic.

The LM tests for residual serial correlation show that the high p-values (0.7683 for the individual lag test and 0.7881 for the test across lags) are all greater than 0.05. Similarly, the LRE* statistic of 11.64132 is not statistically significant. The study therefore accept H_0 and conclude that there is no evidence of autocorrelation in the residuals at lag 1. Suggesting that the residuals are independent over time. This implies that the model has adequately captured the dynamics in the data and that the residuals are not

serially correlated, which is important for the validity of the VECM estimates. The absence of serial correlation indicates that the error terms are well-behaved and that the model specifications are appropriate, increasing confidence in the robustness of the results. Overall, these tests confirm that the residuals meet the necessary assumptions, supporting the reliability of the model's inference regarding the impact of government bonds on Nigeria's economic growth.

VEC Residual Normality Tests

Component	Jarque-Bera	df	Prob.
1	0.231222	2	0.8908
2	1.083092	2	0.5818
3	0.356545	2	0.8367
4	8.570073	2	0.0138
Joint	10.24093	8	0.2485

*Approximate p-values do not account for coefficient estimation

The Jarque-Bera normality test results indicate that, for most components, the residuals do not significantly deviate from normality, as shown by the high p-values (0.8908, 0.5818, and 0.8367) for components 1, 2, and 3 which are all greater than 0.05. These suggest that the residuals for these components are approximately normally distributed, which supports the validity of the inference drawn from the model. However, component 4 exhibits a low p-value (0.0138), indicating some evidence of non-normality in that residual component. Despite this, the joint test across all components has a p-value of 0.2485, implying that overall, the residuals are consistent with a normal distribution. In summary, while most residuals appear normal, the non-normality observed in one component suggests caution, but overall, the model's residuals seem appropriately behaved for reliable analysis.

Test of Hypotheses

The study hypotheses were tested using the results of VECM estimation attached as appendix A as follows:

H₀₁: Amount of government bonds issued (GBA) has no significant impact on economic growth in Nigeria

From the RESULT obtained, the amount of government bonds issued (GBA) has positive coefficient (1.00). The study therefore rejected H_{01} and conclude that amount of government bonds issued (LGBA) has positive and significant impact on economic growth in Nigeria during the period under review.

H₀₂: Number of government bond issues (GBN) has no significant impact on economic growth in Nigeria.

Similarly, the results shows that the coefficient of GBN (4.32) is positive and its t-value (11.40) is greater than its standard critical value of 2.0 at 0.05 level of significance. The study therefore rejected H_{02} and conclude that Number of government bond issues (GBN) has positive and significant impact on economic growth in Nigeria during the period under review.

H₀₃: Average bonds issued maturity period (GBM) has no significant impact on economic growth in Nigeria.

The results also shows that the coefficient (39.05) of GBM is positive and its t-value (8.18) is greater than standard critical value of 2.0 at 0.05 level of significance. The study therefore rejected H_{03} and conclude that Average bonds issued maturity period (GBM)

has positive and significant impact on economic growth in Nigeria during the period under review.

H₀₄: Average government bonds yield (GBY) has no significant impact on economic growth in Nigeria.

Finally, the coefficient of GBY (-22.57) is negative and its t-value (-10.58) is less standard the critical t-value of 2.0 at 0.05 level of significance. The study have to accept H₀₄ and conclude that Average government bonds yield (GBY) has negative but no significant impact on economic growth during the period under review in Nigeria.

Discussion of Findings

The positive coefficient of 1.0 for LGBA suggests that, in the long run, an increase in the amount of government bonds issued is associated with higher economic growth in Nigeria. This aligns with the view that government borrowing can finance productive investments that stimulate economic activity. Recent empirical studies, such as Afolabi (2018), also found a positive long-term relationship between government debt and Nigeria's economic growth, supporting the idea that well-managed bond issuance can promote development. However, Afolabi cautioned that excessive borrowing might lead to debt sustainability issues, which is not directly addressed here. The agreement lies in the positive association, but the current results may overlook potential risks highlighted in other literature.

The coefficients for LGBN and LGBM, at 4.32 and 39.06 respectively, indicate that an increase in the number of bond issues and longer bond maturities tend to promote economic growth over time. This suggests that a more active and mature bond market provides flexible financing options that support long-term growth. Recent research by Amakom and Asongu (2020) on African economies found similar positive effects of bond market development—more issues and longer maturities help in mobilizing funds for investment and reducing financing costs. Their findings are consistent with this study, reinforcing the idea that a well-structured bond market can be a catalyst for sustainable growth, although the specific context of Nigeria's financial market nuances may influence the strength of these effects.

The negative coefficient for LGBY, approximately -22.58, implies that higher bond yields may have a dampening effect on Nigeria's economic growth. Elevated yields can increase borrowing costs, discourage private investment, and signal perceived risk, which aligns with economic theory and other empirical work. For instance, Nwankwo and Obi (2021) documented a similar inverse relationship in Nigeria, noting that rising bond yields during periods of fiscal or macroeconomic instability tend to slow growth. This contrasts with the positive effects of bond issuance, suggesting that while bonds can be beneficial, higher yields—possibly due to market uncertainty—may undermine growth prospects. Thus, maintaining reasonable yield levels appears crucial for fostering sustained economic development.

The error correction term of -0.0293 indicates that deviations from the long-term relationship between government bonds and growth are corrected gradually, with about 2.9% adjustment each period. This slow adjustment suggests structural or institutional factors in Nigeria delay the economy's return to equilibrium aftershocks. Similar findings by Eze and Ojo (2019) show that Nigeria's macroeconomic variables tend to adjust slowly due to policy lags and market imperfections. Both studies agree that while the long-

run relationship holds, short-term disequilibria persist, emphasizing the need for policies that can accelerate the reversion to equilibrium, especially in emerging economies with rigidities.

Regarding the short-term effects, the insignificant coefficient on D(LGBA(-1)) and the negative, significant impact of D(LGBN(-1)) suggest that short-term fluctuations in bond issuance have limited or mixed effects on growth. The negative impact of previous bond issues might reflect crowding-out effects or market saturation, which can temporarily hinder growth. Recent studies like Ojo and Balogun (2022) support this view, indicating that Nigeria's bond market often exhibits ambiguous short-term impacts due to market inefficiencies and policy uncertainties. These findings imply that short-term bond activities may not immediately translate into growth benefits and could sometimes exert adverse effects, highlighting the importance of stable and predictable bond market operations for sustained growth.

Policy Implication of the Findings

The findings suggest that the Nigerian government should prioritize issuing bonds strategically to foster long-term economic growth, ensuring that bond issuance is balanced with fiscal sustainability. Since longer maturity periods and increased bond issues positively influence growth, policymakers should develop a robust and liquid bond market to attract investors and finance developmental projects. However, the negative impact of higher bond yields on growth indicates the need for the government to maintain sound fiscal policies that keep yields at manageable levels to avoid crowding out private investment. Additionally, the slow adjustment process highlights the importance of implementing policies that enhance market efficiency and reduce structural rigidities.

Summary, Conclusion and Recommendations

Summary of Major Findings:

Using the VECM estimation, the long-run cointegration results demonstrate a significant relationship between the government bond variables and Nigeria's economic growth. On the individual variable's impacts, the study found as follows:

- i. Amount of government bonds issued (GBA) has positive and significant impact on economic growth in Nigeria; such that a unit increase in GBA leads to GDP_r to increase by 1%.
- ii. Number of government bond issues (GBN) has positive and significant impact on economic growth in Nigeria; such that a unit increase in GBN leads to increase in GDP_r by 4.32%.
- iii. Average bonds issued maturity period (GBM) has positive and significant impact on economic growth in Nigeria; such that a unit increase in GBN leads to increase in GDP_r by 39.05%.
- iv. Average government bonds yield (GBY) has negative but no significant impact on economic growth during the period under review in Nigeria; such that a unit increase in GBY leads to decrease in GDP_r by 22.57%..

Conclusion

The findings indicate that in Nigeria, long-term increases in government bond issuance—such as higher issuance volumes, more frequent issues, and longer maturity periods—are positively linked to economic growth, supporting the view that government

borrowing can foster development. Conversely, higher bond yields tend to impede growth, likely due to increased borrowing costs and perceived risks, aligning with research that associates rising yields with fiscal or economic stress. The error correction analysis reveals that deviations from the long-term equilibrium adjust gradually, suggesting that structural market factors and rigidities delay Nigeria's economy from quickly restoring balance aftershocks. In the short term, the impact of bond-related variables is mixed; some, like previous bond issues, may temporarily slow growth, while others are insignificant. Overall, these results underscore the need for a well-structured bond market with stable yields to support sustainable growth, while noting that short-term market inefficiencies can limit immediate gains. To harness the benefits of bond issuance, policymakers should prioritize transparent procedures, effective debt management, and investor confidence to ensure bond markets support productive investments without compromising debt sustainability.

Recommendations

Based on the study findings, the following recommendations were made:

- i. Given the positive impact of bond issues and longer maturity periods on economic growth, it is advisable for Nigeria to diversify and deepen its bond market by introducing various bond types and extending maturity profiles. This can attract a broader investor base, reduce borrowing costs, and ensure that the government can finance infrastructure projects more effectively over the long term, ultimately fostering more stable economic growth.
- ii. Considering the negative relationship between bond yields and economic growth, the Central Bank and government should coordinate policies to maintain bond yields at manageable levels. This might involve implementing monetary policies aimed at controlling inflation and macroeconomic stability, thereby reducing risk premiums and making bonds more attractive to investors without increasing borrowing costs excessively.
- iii. To address the slow adjustment process indicated by the error correction term, Nigeria's policymakers need to strengthen macroeconomic stability and improve institutional frameworks. This might include streamlining fiscal policies, improving market transparency, and enhancing financial regulation to facilitate quicker adjustments to shocks, ensuring that deviations from equilibrium do not persist for extended periods, which can hinder sustainable growth.
- iv. Given the mixed and sometimes insignificant short-term effects, it is essential to improve the efficiency and liquidity of Nigeria's bond markets. This could be achieved by increasing market participation, reducing transaction costs, and fostering investor education. Such measures can enhance the responsiveness of bond markets to economic changes, ensuring that short-term bond activities more effectively support immediate economic growth objectives.

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LIST OF APPENDICES

Appendix A:

YEAR	GDP _r	GBA	GBN	GBM	GBY	LGDP _r	LGBA	LGBN	LGBM	LGBY
1999	1.05	25.6	6.05	69.2	2.10	0.02	1.41	0.78	1.84	0.32
2000	0.78	23.73	-1.14	78.18	2.23	-0.11	1.38	0.00	1.89	0.35
2001	0.53	27.34	12.14	78.42	2.21	-0.28	1.44	1.08	1.89	0.34
2002	0.58	35.44	3.02	73.67	3.86	-0.24	1.55	0.48	1.87	0.59
2003	0.83	47.45	9.94	75.32	4.10	-0.08	1.68	1.00	1.88	0.61
2004	0.48	38.68	-2.6	86.27	4.15	-0.32	1.59	0.00	1.94	0.62
2005	0.80	26.85	-1.59	91.44	4.23	-0.10	1.43	0.00	1.96	0.63
2006	0.73	14.78	-5.63	90.53	4.33	-0.14	1.17	0.00	1.96	0.64
2007	0.73	12.47	9.19	99.56	4.81	-0.14	1.10	0.96	2.00	0.68
2008	8.03	11.63	6.68	92.64	5.21	0.90	1.07	0.82	1.97	0.72
2009	6.90	11.34	18.18	100	5.45	0.84	1.05	1.26	2.00	0.74
2010	7.90	11.86	1.07	100.5	5.95	0.90	1.07	0.03	2.00	0.77
2011	6.63	12.46	5.69	110.5	6.95	0.82	1.10	0.76	2.04	0.84
2012	6.63	13.75	6.22	117.5	7.96	0.82	1.14	0.79	2.07	0.90
2013	6.83	8.55	11.2	124.8	8.20	0.83	0.93	1.05	2.10	0.91
2014	6.23	7.84	11.36	119.9	9.20	0.79	0.89	1.06	2.08	0.96
2015	2.83	8.65	13.6	110.9	9.31	0.45	0.94	1.13	2.04	0.97
2016	-1.60	15.63	6.69	101.5	9.01	0.00	1.19	0.83	2.01	0.95

2017	0.78	15.64	5.79	109.9	8.66	-0.11	1.19	0.76	2.04	0.94
2018	1.93	11.64	6.06	124.2	8.60	0.28	1.07	0.78	2.09	0.93
2019	2.28	11.43	4.52	119.5	8.31	0.36	1.06	0.66	2.08	0.92
2020	-1.94	14.23	5.37	117	8.21	0.00	1.15	0.73	2.07	0.91
2021	3.37	17.33	1.23	117.1	8.11	0.53	1.24	0.09	2.07	0.91
2022	3.18	19.64	0.92	133.2	8.00	0.50	1.29	-0.04	2.12	0.90
2023	3.25	19.64	0.92	133.2	7.58	0.51	1.29	-0.04	2.12	0.88
2024	2.74	19.64	0.92	133.2	7.66	0.44	1.29	-0.04	2.12	0.88

SOURCE: Author's Compilation, 2025

Appendix B: VECM Long-run and Short-run Estimation Results

Cointegrating Eq:	CointEq1			
LGBA(-1)	1.000000			
LGBN(-1)	4.322686 (0.37905) [11.4039]			
LGBM(-1)	39.05645 (4.77336) [8.18217]			
LGBY(-1)	-22.57534 (2.13207) [-10.5885]			
C	-64.71766			
Error Correction:	D(LGBA)	D(LGBN)	D(LGBM)	D(LGBY)
CointEq1	-0.029324 (0.01890) [1.55177]	-0.156361 (0.06070) [-2.57584]	-0.005984 (0.00502) [-1.19290]	0.029569 (0.00661) [4.47281]
D(LGBA(-1))	0.115856 (0.27392) [0.42295]	-1.154218 (0.87992) [-1.31173]	-0.001267 (0.07272) [-0.01743]	-0.048235 (0.09583) [-0.50335]
D(LGBN(-1))	-0.081376 (0.09884) [-0.82328]	0.279508 (0.31751) [0.88030]	9.65E-05 (0.02624) [0.00368]	-0.075722 (0.03458) [-2.18988]
D(LGBM(-1))	-2.299822 (1.02868) [-2.23571]	-0.861445 (3.30440) [-0.26070]	0.024539 (0.27309) [0.08986]	-0.655043 (0.35986) [-1.82026]
D(LGBY(-1))	0.251645 (0.45898) [0.54828]	2.504555 (1.47436) [1.69874]	-0.011177 (0.12185) [-0.09173]	0.218552 (0.16056) [1.36116]

C	0.040587 (0.03110) [1.30515]	-0.140147 (0.09989) [-1.40297]	0.006046 (0.00826) [0.73239]	0.023683 (0.01088) [2.17701]
R-squared	0.731166	0.743242	0.529339	0.744955
Adj. R-squared	0.606589	0.565487	0.203496	0.568386
Sum sq. resids	0.133591	1.378493	0.009415	0.016349
S.E. equation	0.101372	0.325635	0.026912	0.035463
F-statistic	1.636485	4.181261	1.624524	4.219048
Log likelihood	26.57178	-0.268799	57.07498	50.72889
Akaike AIC	-1.441025	0.892939	-4.093477	-3.541643
Schwarz SC	-0.947332	1.386632	-3.599784	-3.047950
Mean dependent	-0.006246	-0.048714	0.009998	0.023471
S.D. dependent	0.113807	0.494002	0.030154	0.053979

SOURCE: Author's Computation using e-view 12.0 software package