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PRIMARY RESEARCH

Interconnectedness between stock market and economic growth in Nigeria: Evidence from Yamamoto and pairwise approaches

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Abstract

This study examines the causal relationship between the stock market and economic growth in Nigeria from 1980 to 2023. Four key indicators of the equity market - market capitalization ratio, total value of shares traded, number of quoted firms, and turnover ratio were employed to ascertain the flow of causality between stock market activity and economic performance. To achieve this, the study utilized the dynamic Toda-Yamamoto causality model alongside the conventional pairwise Granger causality technique for a comprehensive analysis. Notably, the two methods yielded somewhat divergent results; however, a key and reliable finding indicates a strong one-way causality from economic growth to stock market performance, particularly affecting market capitalization and turnover ratios. This outcome supports the demand-following hypothesis. Based on these findings, it is recommended that policymakers and regulatory authorities formulate and implement strategies aimed at increasing stock market listings and attracting new investors, thereby equipping the capital market with the necessary resources to significantly enhance Nigeria's economic development.

INTRODUCTION

The relationship between stock market activities and economic performance remains a subject of keen interest among scholars and practitioners. The central debate revolves around whether financial development drives economic growth or whether economic growth drives financial development. Some researchers argue for a bidirectional relationship, while others claim that no significant linkage exists between them. Investigating the direction of causality between finance and growth has gained importance, as clarification this relationship can aid policymakers in designing effective economic and development strategies.

Stock markets play a critical role in promoting economic development (Beck, Levine, & Loayza, 2000; Guru & Yadav, 2019; Redmond & Nasir, 2020; Rashid, Jehan, & Kanval, 2023; Shahbaz, Nasir, Hille, & Mahalik, 2020). They significantly enhance the functioning and efficiency of national economies (Hunjra, Azam, Bruna, & Taskin, 2022). McKinnon (1974), posit that this connection is largely grounded in the finance-led growth hypothesis. This is facilitated through financial intermediation, involving the mobilization and allocation of financial resources (Abbas, Afshan, & Mustifa, 2022; Caporale, Howells, & Soliman, 2005; Levine, 1991; Sulemana & Dramani, 2022). For instance, efficient allocation of savings enhances returns for surplus units, thereby incentivizing further savings. Consequently, the additional financial resources are channeled into the corporate sector, promoting further investments and fostering economic growth.

However, certain scholars strongly argue in favor of the growth-led finance hypothesis as the foundation of the stock market–economic relationship. Early proponents of this

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theory include Robinson (1952) and Lucas (1988). Similar assertions were made by Gurley and Shaw (1955), Gelb (1989), Singh (2008), Yahyaoui, Ibrahim, and Saggaf (2019). These scholars contend that the stock market does not significantly contribute to economic growth. Instead, they believe economic expansion stimulates the development of stock markets by increasing demand for financial instruments. Moreover, some studies argue that there is no definitive relationship between stock markets and economic performance (Mayer, 1988; Mazur & Alexander, 2001). According to this perspective, stock markets are largely inconsequential to the process of economic development. The debate remains ongoing, with researchers aligning themselves with varying theoretical positions.

Nigeria stands as the largest economy in Africa and, as of December 2022, holds the second-largest stock market capitalization in the region (US$91.43 billion), behind South Africa. Although the stock market has faced numerous setbacks due to economic disruptions, it has demonstrated resilience in contributing to national economic growth. Despite these market instabilities, it continues to attract foreign investors, with steady growth in foreign portfolio investments. This progress has been facilitated by improvements in market infrastructure and policy reforms. According to the National Bureau of Statistics (NBS), GDP has recorded steady growth since 2021, in contrast to the negative growth rates of -1.6% in 2016 and -1.8% in 2020. These declines were attributed to disruptions in the oil sector and the impacts of the COVID-19 pandemic, respectively.

This research seeks to uncover the causal dynamics between stock market development and economic progress in Nigeria, to establish evidence-based economic policies. The nature of this relationship remains contentious, particularly within the developing nations of Sub-Saharan Africa. This disagreement may stem from variations in methodologies, time frames examined, and the choice of economic indicators adopted in the analysis. The divergent findings in existing literature call for continued exploration of the subject. Bayraktar, Ozyilmaz, Toprak, Olgun, and Isik (2023) also advocated for further research on this unresolved controversy for more exhaustive discoveries. In contributing to the discourse, this study utilizes both pairwise Granger causality and the Toda-Yamamoto multivariate approach. The Toda-Yamamoto method is more robust, but seldom employed in Nigerian empirical research. Results from bivariate models can be biased and unreliable due to omitted variable issues. Such methodological limitations may result in omitted-variable bias, as highlighted by Gozgor, Lau, and Lu (2018). Consequently, the Toda-Yamamoto results will form the basis for our conclusions and policy suggestions, while the standard Granger causality test will be used for comparison to illustrate the advantages of the former.

It is therefore anticipated that this study will offer novelty, analytical rigor, and credibility in this line of research. Most existing Nigerian studies in this area rely solely on the pairwise Granger causality test, which suffers from limitations that may yield misleading conclusions. Furthermore, there is a noticeable gap in research that simultaneously applies both the Yamamoto and pairwise frameworks to analyze market-growth causality, especially within developing economies like Nigeria. This may be due to the complexity and demanding requirements associated with such dual-framework analysis. Additional strengths of this study include an extended observation period (1980–2023) and the use of more recent data than those employed in most related literature.

LITERATURE REVIEW

Market-Finance Hypothesis

The market-finance hypothesis posits that stock market development plays a foundational role in promoting economic growth. This position is well-established in classical and contemporary financial literature. Foundational works such as Gurley and Shaw (1955), and McKinnon (1974) argue that the provision of financial services through organized markets facilitates capital accumulation, innovation, and investment efficiency—key drivers of economic growth. Al-Yousif (2002), Asteriou and Spanos (2019) and Yang (2019) extend this argument by emphasizing the dynamic process of financial intermediation, where capital mobilization and allocation mechanisms contribute meaningfully to economic expansion. Further support is provided by Caporale et al. (2005), who highlight the critical role of efficient capital allocation.

Levine (1991) delineates two key mechanisms through which stock markets may influence growth: firstly, the enhancement of firm-level efficiency through improved human capital allocation. Secondly, firms' liquidity, which inherently attracts long-term investments. Both mechanisms, in his analysis, reinforce economic expansion by incentivizing capital formation and risk diversification. However, not all scholars align with this optimistic view. Critics such as Morck, Shleifer, and Vishny (1990) caution that excessive stock market liquidity could undermine corporate governance. They argue that heightened liquidity may foster short-term investor behavior (investor myopia), thereby

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weakening shareholders' incentives for long-term investmens. This can shift managerial priorities toward short-term gains rather than long-term value creation, potentially harming overall economic performance.

Growth-Finance Hypothesis

In contrast, the growth-finance hypothesis suggests that stock market development is a consequence rather than a cause of economic growth. Economic expansion, in this view, generates increased demand for financial instruments, leading to a natural evolution and development of stock markets. Robinson (1952) was among the first to assert that financial systems typically respond to the needs of the real sector, rather than driving it. Similar sentiments are echoed by Opoku, Ibrahim, and Sare (2019) and Tran, Walle, and Herwartz (2020), who argue that macroeconomic fundamentals primarily dictate financial sector performance. Lucas (1988) further downplays the significance of financial system, suggesting that any observed link between finance and growth likely reflects reverse causality. Gurley and Shaw (1955) and Gelb (1989) support this direction of causality, emphasizing that financial services evolve as economies grow and mature.

Singh (2008) provides additional insights, asserting that due to macroeconomic volatility and systemic uncertainties, stock markets are unlikely to drive growth in the least. On the other hand, Patrick (1966) offers a reconciliatory perspective, suggesting a bidirectional causality that varies across stages of development. In early stage of economic growth, stock market expansion may lead to economic progress. However, as the economy matures, demand for financial services intensifies, resulting in stock market responding to economic needs. This dynamic framework bridges the two opposing hypotheses.

Bi-Directional Hypothesis

The bi-directional causality hypothesis proposes a feedback loop between stock market development and economic growth. In this model, a well-developed stock market stimulates technological advancement and innovation, which in turn spurs demand for further financial development. Majid (2007) and Dawson (2008) support this framework, arguing that both variables are interdependent and mutually reinforcing, producing a cyclical pattern of causation. This is also corroborated by Adeyeye, Fapetu, Aluko, and Migiro (2015), Chow, Vieito, and Wong (2019), Nguyen, Le, Ho, Nguyen, and Vo (2022), Pradhan, Arvin, Nair, Bennett, and Hall (2018), Said and Hammam (2024) and Tripathy and Mishra (2023).

Independent Hypothesis

Contrary to all preceding views, the independent hypothesis maintains that there is no causality between stock market development and economic growth. Mazur and Alexander (2001) argue that the stock market operates independently of economic fundamentals. Mayer (1988) adds that even large stock exchanges often serve as marginal sources of business finance.

EMPIRICAL REVIEW

Numerous empirical studies, both global and domestic, have explored the causality between stock market development and economic growth, yielding mixed results (see Table 1). While some report unidirectional causality—either from stock market to growth or vice versa—others identify bidirectional or no causality at all. A common methodological tool in many Nigerian studies is the Granger causality test. However, this technique is sensitive to data properties, such as stationarity and error term independence (Gujarati & Porter, 2009). In many instances, these preconditions were either inadequately tested or omitted, casting doubt on the robustness of the findings. Furthermore, statistical results obtained with Granger causality test broposed by Granger (1969) in the presence of stochastic trends and non-valid *F*-test may suffer credibility problem except if the variables are co-integrated (Toda & Yamamoto, 1995).

TABLE 1. Summary of empirical review

Authors	Country	Topic	Method	Result
Bayraktar et al. (2023)	Cross country analysis	Financial development and economic performance in transition countries: institutional role.	Dutmitrescu-Hurlin	Bidirectional causality between market capitalization ratio and economic progress

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Authors	Country	Topic	Method	Result
Nguyen et al. (2022)	Cross country analysis	Financial development and economic growth in emerging markets.	Panel Granger causality test	Strong bidirectional feedback between financial development and economic growth
Olayungbo and Quadri (2019).	SSA	Remittances, financial development and economic growth in SSA	VAR based causality test	Unidirectional causality from financial development to economic growth
Islam and Alhamad (2022)	Cross country analysis	Effect of financial development and institutions on remittance growth	Dutmitrescu-Hurlin	Financial development causes economic growth via institutions
Oseni and Nwosa (2011)	Nigeria	Analyzing the nexus between equity market and economic improvement.	EGARCH and LA-VAR Causality Model	There was feedback between stock market volatility and real GDP volatility.
Aye (2013)	Nigeria	The causal relationship among financial depth, economic performance and poverty in Nigeria	VAR Based Causality Test	Unidirectional causality from growth to poverty via finance.
Adefeso, Egbetunde, and Alley (2013)	Nigeria	Stock market and economic growth causal relationship	VECM based causality model	Economic growth causes stock market.
Ogbo and Oladipo (2013)	Nigeria	Examined the linkage between stock market and economic wellbeing	Granger causality test	Unidirectional relationship running from economic growth to stock market
Ozurumba and Chigbu (2013)	Nigeria	Studied causal relationship between stock market and economic growth	Granger causality test	Showed unidirectional relationship running from economic growth to capital market
Anigbogu, Nduka, et al. (2014)	Nigeria	Investigate long-run causal link between stock market and economic growth	Granger causality test	Feedback relationship
Singh (2008)	India	Financial development and economic growth nexus in India.	Toda and Yamamoto estimator	Bidirectional link between financial development and economic growth
Zang and Kim (2007)	Cross country analysis	Does Financial Development Precede Growth? Robinson and Lucas Might be Right,	Sims-Geweke causality test	Financial development follows Economic growth

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Authors	Country	Topic	Method	Result
Masih et al (2009)	Saudi Arabia	Financial Development and Economic Growth causal relationship	VECM and variance decomposition	Financial development caused economic growth.
Ananwude and Osakwe (2017)	Nigeria	Causality between stock market and economic growth.	Granger causality test	Economic growth is independent of stock market operation.
Ajayi and Araoye (2019)	Nigeria	Direction of causation between stock market and economic growth	Granger causality	One-way causality from economic improvement to stock market.

Surprisingly, the Toda-Yamamoto causality framework, which overcomes many of these limitations, remains underutilized in Nigerian empirical literature despite its statistical robustness and flexibility. Additionally, the relatively short time horizons (often averaging 20 years or less) in many prior studies further weaken the generalizability of their conclusions. This study addresses these methodological gaps by employing a longer dataset and a more sophisticated causality testing framework.

DATA AND METHODS

The data for this study were obtained from the following official government agencies: Nigerian Exchange (NSE) Fact Book, the Security and Exchange Commission (SEC) and the Central Bank of Nigeria (CBN) Statistical Bulletins. The study sample range from 1980 to 2023 totaling 44 years of observations for the analytical investigation. The choice of 1980 as a starting point is based on the availability of data. To ensure the suitability of the test statistics and the subsequent integrity of our results the following steps were taken:

PRELIMINARY

This stage involves tests for determining the characterization, behavior and goodness of data before they are employed for model estimation. These include descriptive behaviour, stationarity test, correlational dissection and graphical analysis tools.

METHODS

Pairwise Granger Causality General Model

$$Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \cdots + \alpha_l Y_{t-l} + \beta_1 x_{t-1} + \cdots + \beta_l x_{t-l} + \xi_t \quad (1)$$

$$x_t = \alpha_0 + \alpha_1 x_{t-1} + \cdots + \alpha_l x_{t-l} + \beta_1 Y_{t-1} + \cdots + \beta_l Y_{t-l} + U_t \quad (2)$$

Toda-Yamamoto Causality Test

Granger-causality is commonly used method for causal relationship between variables. It indicates when a variable (Y) has an influence on parameter (X) in a significant level, or conversely. One of its assumptions is that the disturbance terms are uncorrelated. However, the technique is faced with many drawbacks. First, one of the requirements for employing Granger causality method is that the time series must be stationary (Gujarati & Porter, 2009). Unfortunately, this is rarely obtained as they are frequently non-stationary (Maddala & Lahiri, 1992). Consequently, this poses serious challenge of obtaining credible results.

Second, Gujarati and Porter (2009) has warned that a two-variable Granger-causality test is prone to models specification problems, which questions its statistical outcomes. The test usually neglects the influence of other variables and thus making it susceptible to potential specification bias. When a relevant variable is not incorporated in the model, it produces varied outcomes.

To address these challenges, the use of the Wald Test (MWALD) introduced by Dolado and Lütkepohl (1996) is essential. This technique is more advanced to the ordinary Granger causality test as it will not entail preliminary test for co-integration. It can be used without consideration to whether the observations are I(0), I(1) or I(2), co-integrated or non-co-integrated. In a very positive perspective, this eliminates the possible bias related to unit roots and co-integrating tests. In addition, Toda and Yamamoto tech-

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nique is a multivariate causality test, hence helping to evade the trouble of specification bias. Furthermore, because of the dynamic nature of this method, the question of auto correlation is inherently dealt with.

Yamamoto Causality General Model

$$\begin{bmatrix} Y_t \\ X_t \end{bmatrix} = \begin{bmatrix} \omega_{10} \\ \omega_{20} \end{bmatrix} + \begin{bmatrix} \omega_{11}^{(1)} & \omega_{12}^{(1)} \\ \omega_{21}^{(1)} & \omega_{22}^{(1)} \end{bmatrix} \begin{bmatrix} Y_{t-1} \\ X_{t-1} \end{bmatrix} + \begin{bmatrix} \omega_{11}^{(2)} & \omega_{12}^{(2)} \\ \omega_{21}^{(2)} & \omega_{22}^{(2)} \end{bmatrix} \begin{bmatrix} Y_{t-2} \\ X_{t-2} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix} \quad (3)$$

Where denotes the coefficient vector of indicators of stock market, while = vector of error terms.
Fitting our variables, we derive equation 3.

$$\begin{bmatrix} MC_t \\ NC_t \\ TVT_t \\ TR_t \\ RGDP_t \end{bmatrix} = \omega_0 + \omega_1 \begin{bmatrix} MC_{t-1} \\ NC_{t-1} \\ TVT_{t-1} \\ TR_{t-1} \\ RGDP_{t-1} \end{bmatrix} + \omega_2 \begin{bmatrix} MC_{t-2} \\ NC_{t-2} \\ TVT_{t-2} \\ TR_{t-2} \\ RGDP_{t-2} \end{bmatrix} + \omega_3 \begin{bmatrix} MC_{t-3} \\ NC_{t-3} \\ TVT_{t-3} \\ TR_{t-3} \\ RGDP_{t-3} \end{bmatrix} + \omega_4 \begin{bmatrix} MC_{t-4} \\ NC_{t-4} \\ TVT_{t-4} \\ TR_{t-4} \\ RGDP_{t-4} \end{bmatrix} + \varepsilon_t \quad (4)$$

Where: MCR, NLC, RGDPR, TR and TVR stand for market capitalization ratio, number of listed companies, real gross domestic product growth rate, turnover ratio and total value traded ratio respectively.

ESTIMATIONS AND DISCUSSIONS

TABLE 2. Descriptive statistics

Variable	RGDPR	NLC	MCR	TR	TVR
Mean	4.297059	172.3235	8.917647	6.979412	0.920000
Median	4.200000	185.0000	7.800000	6.100000	0.450000
Std. Dev	3.354462	39.03667	5.700211	6.826809	1.453773
Skewness	0.272067	-0.963868	1.771342	2.075531	2.960497
Kurtosis	2.863809	2.580288	7.523217	9.017977	11.39109
Jarque-Bera	0.445727	5.514128	46.76432	75.71710	149.4139
Probability	0.800224	0.063478	0.000000	0.000000	0.000000
Observations	43	43	43	43	43

Table 2 presents the descriptive statistics for the key variables in this study. The mean and median values for each variable are relatively close, suggesting a degree of consistency and reliability in the dataset. The standard deviation reveals that NLC exhibits the highest variability, while MCR and TR display moderate dispersion. Conversely, RGDPR and TVR exhibit relatively low deviations, indicating less fluctuation around their respective means. Regarding distributional characteristics, all variables except RGDPR and NLC are leptokurtic, indicating heavier tails than the normal distribution. Additionally, only RGDPR passes the Jarque–Bera test for normality at the 5% level, confirming its normal distribution, while the remaining variables do not. These findings provide important insights for the subsequent econometric modeling.

TABLE 3. Correlation matrix

	RGDPR	MCR	NLC	TVR	TR
RGDPR	1.000				
MCR	0.303	1.000			
NLC	0.581	0.709	1.000		
TVR	0.314	0.901	0.522.	1.000.	
TR	0.354	0.812	0.703	0.949	1.000

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Test of Linear Association

Table 3 provides the correlation matrix for the variables under study. The results show that stock market size indicators (MCR and NLC) and liquidity indicators (TVR and TR) are positively associated with economic growth (RGDPR). Furthermore, measures of market size show strong positive correlations with liquidity indicators, implying that growth in stock market size enhances market liquidity. Specifically, the two size indicators (MCR and NLC) are correlated at approximately 70%, while liquidity indicators (TVR and TR) show an even stronger relationship at 95%. While high correlation values often raise concerns about multicollinearity, Gujarati and Porter (2009) cautions that such associations do not inherently imply multicollinearity, noting that multicollinearity can also exist when correlations are relatively low. The results of the Wald test (Table 4) confirm that multicollinearity is not a problem in this model, as both the F-statistic and Chi-square values are statistically significant. The Wald test verifies the joint significance of explanatory variables, justifying the inclusion of both liquidity measures due to their theoretical relevance and complementary role in capturing market liquidity.

TABLE 4. Wald test

Test Statistic	Value	Probability
F-statistic	7. 2830	0.0007
Chi-Square	52.228	0.0001

Test for Stationary Properties of the Series

TABLE 5. ADF and PP unit root tests results

Variables	ADF Level Stat	ADF Level CV/Prob	ADF First diff Stat	ADF First diff CV/Prob	PP Level Stat	PP Level CV/Prob	PP First diff Stat	PP First diff CV/Prob
MCR	-2.34	-2.95(0.1648)	-5.96	-3.56(0.0002)	-2.18	-2.95(0.2165)	-7.82	-2.95(0.0000)
NLC	-2.56	-2.95 (0.1095)	-4.93	-4.27(0.0020)	-2.23	-2.95(0.1975)	-3.52	-2.95(0.0136)
RGDPR	-4.80	-2.95(0.0005)	-4.66	-3.55(0.0037)	-4.84	-2.95(0.0004)	-4.84	-2.95(0.0004)
TR	-2.32	-2.95(0.1706)	-5.55	-3.56(0.0004)	-2.23	-2.95(0.1981)	-7.55	-2.95(0.0000)
TVR	-2.53	-2.95(0.1170)	-5.99	-3.56(0.0000)	-2.49	-2.95(0.1257)	-7.15	-2.95(0.0000)

To ascertain the time-series properties of the variables, unit root tests were conducted using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) methods, as shown in Table 5. The null hypothesis of a unit root was tested against the alternative of stationarity. The results reveal that RGDPR is stationary at level under both tests, while MCR, NLC, TR, and TVR become stationary after first differencing, indicating they are integrated of order one, I(1).

Toda Yamamoto Estimate

Three important steps are involved in the estimation of Toda Yamamoto technique. Firstly, the maximum order of integration (dmax) needs to be determined. This is already ascertained in table 5 above which it showed to be 1, that is I(1).

Lag Length Selection

The next step in the Toda-Yamamoto estimation is selecting the appropriate lag length (P). As shown in Table 6, various information criteria such as FPE, AIC, and HQ consistently suggest an optimal lag length of 3. Thus, the VAR model was estimated using three lags (p = 3).

TABLE 6. Selection criteria of VAR lag

LAG	LOGL	LR	FPE	AIC	SIC	HQ
0	-112.3415	NA	0.0005	7.1205	6.8796	6.9768
1	-5.1708	153.7631	6.23e-07	2.3417	3.8321	2.6589
2	29.4123	50.3245	3.89e-07	1.6423	3.9867	2.3875
3	62.9032	35.3321	3.13e-07*	0.9431*	4.5267	2.2045*

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With confirmation of stationarity, lag appropriateness, and model validity, we proceed with the final stage, estimation of the Toda-Yamamoto causality using VAR (3 + dmax) which amounts to VAR(4). Meanwhile it can be seen in table 7 that the statistical disclosures of Chi-square degrees of freedom (3), is in agreement with the lag length of 3.

TABLE 7. Toda Yamamoto causality results

Equation	Excluded	MWALD Test	DF	Prob(ChiSquare)
LNMCR	LNNLC	13.9212	3	0.0028
LNMCR	LNTR	4.9473	3	0.1689
LNMCR	LNTVR	3.2531	3	0.3143
LNMCR	RGDPR	7.9804	3	0.0482
LNMCR	ALL	29.8673	12	0.0041
LNNLC	LNMCR	3.2410	3	0.3821
LNNLC	LNTR	4.1078	3	0.2935
LNNLC	LNTVR	5.2314	3	0.1739
LNNLC	RGDPR	2.0786	3	0.5562
LNNLC	ALL	17.9280	12	0.1529
LNTR	LNMCR	34.8749	3	0.0000
LNTR	LNNLC	23.2190	3	0.0000
LNTR	LNTVR	35.8462	3	0.0000
LNTR	RGDPR	16.3591	3	0.0008
LNTR	ALL	98.8706	12	0.0000
LNTVR	LNMCR	11.1085	3	0.0091
LNTVR	LNNLC	18.2537	3	0.0004
LNTVR	LNTR	10.9783	3	0.0096
LNTVR	RGDPR	1.4928	3	0.6732
LNTVR	ALL	52.9142	12	0.0000
RGDPR	LNMCR	0.1973	3	0.9960
RGDPR	LNNLC	0.7749	3	0.8612
RGDPR	LNTR	0.3951	3	0.9412
RGDPR	LNTVR	0.2150	3	0.9869
RGDPR	ALL	2.4903	12	0.9986

TABLE 8. Reliability and validity results

LNNLC does not cause LNMCR	4.3674	0.0227	LNNLC → LNMCR	13.9212	0.0028	LNNLC → LNMCR
LNMCR does not cause LNNLC	0.7517	0.4812	—	3.2410	0.3821	—
LNTR does not cause LNMCR	4.3250	0.0235	LNTR ↔ LNMCR	4.9473	0.1689	LNMCR → LNTR
LNMCR does not cause LNTR	4.5131	0.0204		34.8749	0.0000	
LNTVR does not cause LNMCR	4.9418	0.0148	LNTVR → LNMCR	3.2531	0.3143	LNMCR → LNTVR
LNMCR does not cause LNTVR	1.9192	0.1662		11.1085	0.0091	
RGDPR does not cause LNMCR	0.2604	0.7726	↛	7.9804	0.0482	RGDPR → LNMCR
LNMCR does not cause RGDPR	0.3183	0.7300		0.1973	0.9960	
LNTR does not cause LNNLC	1.4186	0.2595	LNNLC → LNTR	4.1078	0.2935	LNNLC → LNTR
LNNLC does not cause LNTR	4.4007	0.0222		23.2190	0.0000	
LNTVR does not cause LNNLC	1.6559	0.2097	LNNLC → LNTVR	5.2314	0.1739	LNNLC → LNTVR
LNNLC does not cause LNTVR	5.7176	0.0085		18.2537	0.0004	
RGDPR does not cause LNNLC	0.0605	0.9413	↛	2.0786	0.5562	↛
LNNLC does not cause RGDPR	0.5471	0.5849		0.7749	0.8612	

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LNNLC does not cause LNMCR	4.3674	0.0227	LNNLC → LNMCR	13.9212	0.0028	LNNLC → LNMCR
LNTVR does not cause LNTR	2.2096	0.1292	↛	35.8462	0.0000	LNTVR ↔ LNTR
LNTR does not cause LNTVR	0.1229	0.8848		10.9783	0.0096	
RGDPR does not cause LNTR	2.2658	0.1231	LNTR → RGDPR	16.3591	0.0008	RGDPR → LNTR
LNTR does not cause RGDPR	3.9185	0.0321		0.3951	0.9412	
RGDPR does not cause LNTVR	3.8969	0.0326	RGDPR → LNTVR	1.4928	0.6732	↛
LNTVR does not cause RGDPR	2.1706	0.1336		0.2150	0.9869	

The findings in Table 8 reveal several causal relationships. Notably, Economic Growth (RGDPR) Granger-causes the Market Capitalization Ratio (MCR) and turnover ratio, but not vice versa. No causality was found between RGDPR and the number of quoted firms or total value traded ratio. Additionally, in the interrelationships among the market indicators themselves, there is unidirectional causality from listed companies to market capitalization, while turnover ratio appears to be strongly influenced by all other variables in the system. The overall joint Wald statistics affirm the robustness of these individual relationships between RGDPR and market indicators implying that the latter does not influence the former but the other way round.

Comparison of Pairwise and Toda-Yamamoto Causality Results

Table 8 presents a comparative interpretation of both the Pairwise Granger and Toda-Yamamoto causality results. Notable discrepancies are observed between the two methods. For example, while the Toda-Yamamoto test indicates that economic growth Granger-causes MCR and TR, the pairwise approach suggests otherwise. This finding supports the argument for using a more robust estimation technique like Toda-Yamamoto. Moreover, the Toda-Yamamoto technique shows no evidence that stock market indicators Granger-cause economic growth, suggesting that economic expansion drives stock market development, not the other way around. This supports the demand-following hypothesis. Interestingly, the pairwise test shows some spurious causal paths that are not confirmed by the more comprehensive multivariate analysis. For instance, it indicates that TR causes RGDPR. The analysis also reveals no causal relationship between economic growth and the number of listed companies across both methods.

Theoretical Implications and Alignment

The findings of this study lend strong support to the demand-following hypothesis, which posits that economic growth spurs stock market activities. Specifically, market capitalization ratio and turnover ratio were found to be driven by economic performance, establishing unidirectional causality from the real sector to financial markets. These results align with the theoretical propositions of Robinson (1952), Lucas (1988), and Gelb (1989), and are consistent with empirical evidence provided by Ajayi and Araoye (2019) and Onwumere, Ibe, Okafor, and Uche (2012), who reported a bidirectional relationship.

Diagnostic Tests

Prior to conducting causality analysis, standard diagnostic checks were performed. These are normality, autocorrelation and stability tests. Table 9 summarizes the results of the Jarque-Bera test for residual normality. The findings indicate that the residuals of all individual equations, as well as the joint system, follow a normal distribution, as we fail to reject the null hypothesis of normality at the 5% level. Furthermore, the Lagrange Multiplier (LM) test for serial correlation (Table 10) shows no evidence of autocorrelation across lags 1 to 4. The VAR system also passed the stability test, as the inverse roots of the characteristic AR polynomial lie within the unit circle (Figure 2), confirming the dynamic stability of the VAR(3) model.

TABLE 9. VAR Jarque-Bera result

Equations	Chi-Square	DF	Prob (Chi-Square)
LNMCR	0.0891	2	0.9405
LNNLC	2.5476	2	0.2976
LNTR	0.5892	2	0.7963
LNTVR	1.6423	2	0.5231
RGDPR	1.5173	2	0.5342
JOINT	5.8234	10	0.8327

TABLE 10. VAR LM results

Lag	Chi-Square	DF	Prob. (Chi-Square)
1	26.9563	25	0.3849
2	30.8734	25	0.2198
3	19.7492	25	0.7949
4	28.9650	25	0.2853

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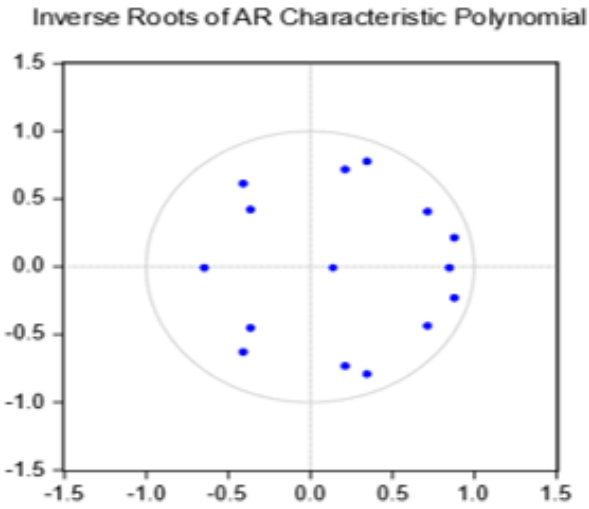

FIGURE 1. AR polynomial graph

CONCLUSION AND IMPLICATIONS

This research examines the causal relationship between stock market activities and economic performance in Nigeria over the interval spanning from 1980 to 2023. The analysis employed both the Toda-Yamamoto and Pairwise Granger causality approaches, complemented by preliminary tests of stationarity and correlation, as well as diagnostic checks such as autocorrelation, Wald test, normality, and AR polynomial diagnostics, to ensure the robustness and reliability of the results. Notably, the outcomes derived from the two causality models were somewhat contradictory. Due to concerns about credibility, preference was given to the results obtained from the more recent Toda and Yamamoto (1995) technique, which is considered more advanced than the traditional Granger causality test. The Toda-Yamamoto causality method has the advantage of not requiring pre-testing for integration and allows for a multivariate and more dynamic analysis of causality. The model's dynamic nature and methodological strengths informed the decision to rely on its results for drawing conclusions.

The stock market was disaggregated into components such as market capitalization, total value of shares traded, turnover ratio, and the number of quoted companies, which were each analyzed in relation to economic growth. When examined individually, the analysis revealed a unidirectional causality from economic growth to market capitalization ratio, with no evidence of complementarity. Similarly, a unidirectional causal relationship was found from economic growth to turnover ratio, again with no reciprocal effect observed. However, no causality was detected between economic growth and the total value of shares traded. Furthermore, when the stock market indicators were considered collectively as exogenous variables, they were found not to Granger-cause economic growth. In summary, the direction of causality during the study period ran from economic growth to stock market development rather than the reverse. This finding supports the argument made by Ajayi and Araoye (2019) that the Nigerian stock market remains underdeveloped and has not yet matured enough to significantly contribute to economic growth. Theoretically the results of this study support the demand following hypothesis. Ideally, in a developing economy, a well-functioning stock market should be capable of mobilizing investment capital to boost economic productivity and output. However, institutional weaknesses, structural limitations, and policy inefficiencies, including lack of market depth might have hindered the effectiveness of the Nigerian stock market. These constraints help explain the lack of causality flowing from stock market development to broader economic performance. Moreover, the market's concentration among a few numbers of listed companies, which reduces the breadth and depth of the market, poses a challenge to its overall impact.

Practical Implicatons

The practical implication of these findings is that since economic growth drives stock market development in Nigeria, government efforts should focus on policies that stimulate real sector activities—such as investments in infrastructure, agriculture and manufacturing, which, in turn, will deepen and strengthen the stock market. These reforms will ensure that as the economy grows, the capital market is well-positioned to absorb and intermediate capital efficiently. Additionally, continued improvements in stock market infrastructure, regulatory frameworks, and investor pro-

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tection are essential. Policymakers should enhance the linkages between the capital market and productive sectors of the economy by creating incentives for firms to list on the stock exchange, thereby increasing access to long-term financing. This will help reduce the dominance by Nigeria's banks which provide a greater percent of financial needs in the country. And thus position stock market to stimulate growth as envisaged in developing economies. Furthermore, the dominance of a few companies in Nigerian stock market such as Dangote Group and MTN should be addressed. Additionally, diversifying the market, especially through the introduction of derivative instruments, can help unlock its potential to drive economic growth. Intervention is also required to establish strong institutional frameworks that can foster investment and stimulate growth.

Limitations and Suggestions for Further Studies

According to theoretical literature, market concentration ratio is an important measure of stock market development, however the indicator is missing in this study. This paper was not able to include it due to data unavailability. Furthermore, another relevant factor that is not included in the analysis is institutional quality which can be a ground for future research.

Based on the limitations of the paper and its findings, we suggest that future research in this area should include market concentration ratio and institutional measures as variables so as to achieve an all-inclusiveness and more robust analysis. Since the study focuses on Nigeria, the policy implications and recommendations are more relevant to Nigeria setting and situation. It will therefore be remarkable for future studies to consider a simultaneous short and long run cross-country analysis involving other Sub-Saharan African economies which can help assess whether the demand-following hypothesis holds consistently across the region or is unique to Nigeria, thus enriching the study's outcomes. Furthermore, durmitrescu-Hurlin causality model which is a more advanced and more recent technique should be used for future analysis.

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