Financial Statistical Journal 2024, 7(2), 7495.
https://doi.org/10.24294/fsj7495

Article

Effect of capital market on economic growth: An analysis using the autoregressive distributed lag (ARDL) approach

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CITATION

Ogundunmade TP. Effect of capital market on economic growth: An analysis using the autoregressive distributed lag (ARDL) approach. Financial Statistical Journal. 2024; 7(2): 7495. https://doi.org/10.24294/fsj7495

ARTICLE INFO

Received: 23 May 2024
Accepted: 27 June 2024
Available online: 6 July 2024

Abstract: The limits testing method known as ARDL (Autoregressive Distributed Lag) examines Nigerian capital market improvement and monetary development. Relevant indicators about the capital market are taken into account during analysis while considering influencing factors as well. This study aims to explore the relationship between the capital market and financial development in Nigeria. The study's theoretical framework, which is based on the ARDL framework, includes both short- and long-term dynamics. The data used in this analysis was collected from the Central Bank of Nigeria (CBN), the World Bank database, and the Nigerian Stock Exchange (NSE). In this study, the Nigerian All-Share Index, foreign direct investment, currency exchange rates, and inflation rates are the free factors, while the increase in GDP is the dependent factor. Through cointegration analysis using the ARDL framework, it was discovered that in Nigeria there's a lengthy equilibrium correlation between economic expansion and financial development. The coefficients determined allow for a deeper understanding of how capital market factors affect economic growth over time. Furthermore, utilizing an error correction model derived from the ARDL analysis offers insight into both brief dynamics and modified speed toward reaching a lasting state of balance. By utilizing the ARDL approach, this study adds to the continuing discourse surrounding how capital markets impact growth in Nigeria. Its empirical evidence provides valuable knowledge for policymakers and stakeholders looking to utilize capital markets effectively toward achieving long-lasting economic development within the country.

Keywords: capital market; economic growth; auto regressive distributed lag model; granger causality

1. Introduction

The Nigerian capital market plays a significant and essential part in the expansion and development of the nation's economy. It is a crucial platform for raising long-term capital for investments and giving companies a venue to issue securities to raise money. The financial system is a vital source of finance for companies, and it also serves as an avenue for individuals to invest and grow their wealth. In recent times, the capital market in Nigeria has undergone significant expansion, and it has become a robust market that attracts domestic and foreign investors [1]. Nigeria's economy has grown significantly over time, and the capital market has played a vital role in this expansion. The Nigerian economy is largely dependent on the oil sector, but the government has been working to lessen the nation's reliance on oil and broaden the economy. The financial system permits companies to raise funds to finance their operations, and this has helped to create employment opportunities, increase production, and boost economic growth [2]. While investment in developing the nation's currency marketplace has been notable, their precise influence on the expansion of the economy remains debatable. While proponents advocate for its role

in promoting investment, entrepreneurship, and innovation, others highlight potential drawbacks such as financial instability and increased inequality. This lack of clarity on the precise nature and strength of the relationship complicates policymakers' efforts to design effective strategies for harnessing the capital market's potential for boosting the Nigerian economy.

The financial industry is intricately intertwined with the expansion of the business, as it serves to allocate resources. In Nigeria, financing economic expansion depends on the crucial role played by its capital market in channeling funds towards investment projects pursued by governments and businesses across different sectors. Nonetheless, this association between economic progress and the capital market presents a multifaceted dynamic that requires statistical evaluation through tools like Auto Regressive Distributed Lag (ARDL) model analysis, which forms part of our study's objectives.

The ARDL method is an econometric tool commonly employed to explain both the immediate and far future components of many different factors. Given its capacity for detecting the enduring connection between financial market activity as well as financial performance in the nation, this approach proves helpful since it permits the calculation of said correlation across various timescales. The effectiveness of this model has been verified by previous studies [3,4], which have respectively assessed discrepancies within capital markets or reached a state of balance-related thereto but involving already developed economies. Evidence that is based on actual observations or experiences rather than theory or speculation. Studies based on empirical evidence reveal that the Nigerian financial market is essential in promoting economic expansion. Notably, Zhou et al. [5] suggest that firms' integrated reporting containing details of their performance in South Africa had positive effects on both the actual and financial markets. Similarly, according to Afolabi [6], businesses under market pressure tend to adhere to tax avoidance practices conducive to investing further in this same sector. All these data bolster claims about how imperative it is to look deeper at Nigeria's capital market as a vital source of funding for enhancing its economy even more effectively than before—given such encouraging signs already seen from previous analyses done thus far! Several studies have focused on the relationship between the nation's financial market and economic expansion. Badertscher et al. [7] highlight that the financial sector possesses a significant impact on the financial system, as it provides a platform for mobilizing savings and investing in productive ventures. Similarly, Briggs [8] posits that the capital market serves as a vital channel for resource allocation, which is essential for generating economic growth. Therefore, this research seeks to investigate how the country's financial system impacts the country's economic growth using an ARDL model.

The purpose of this research is to investigate the correlation between Nigeria's economic expansion and capital market through the application of this technique. The theoretical framework adopted in this framework comprises both temporal and permanent dynamics embedded within the ARDL framework. Previous empirical data affirm an affirmative relationship connecting Nigerian financial exchange trading with economic development [7,8]. This forthcoming investigation intends to provide new knowledge regarding how Nigerian stock exchanges influence its economy while adding to existing literature concerning said subject material.

2. Literature review

The capital market operates as a medium for enabling extended credit facilities, provisioning both fixed and operating cash reserves along with intermediate- to deep-rooted debt loans in aiding the monetary requirements of central, state, and regional administrations [9]. Acting as an instrumentality towards supporting long-term ventures amongst businesses, households, and governments alike [10], it involves transactions encompassing prolonged debts and equity instruments. The size and performance of a capital market are indicated by its market capitalization, which is an important factor in the financial industry. It represents the total market value of stocks within a given location [11], calculated by multiplying share price by shares outstanding for businesses [12]. Securities like Exchange Traded Funds (ETFs) and bonds fall under this metric as well, making it both an indication measure of development effectiveness [13,14].

The NSE ASI serves as a market index that evaluates the general direction and performance of the Nigerian stock market [15,16]. Consolidating stock values against a base value within a predetermined timeframe enables continual monitoring of market fluctuations [15,17], while also enabling comparative assessments among industries and companies alike [15]. Furthermore, the Nigerian Stock Exchange (NSE) quarterly report includes a comprehensive account of traded shares on the stock market. The total transaction volume reveals crucial data regarding exchange floor activities, with NGN 15.84bn recorded in Q3 2020, according to Emmanuel and Elizabeth's study findings. The connection between the capital market and economic expansion has always been a vital area of research, particularly when the economy is developing. Recent research has continued to accentuate the decisive role of well-functioning capital markets in promoting economic development. Notably, studies by Guo et al. [18] and Hu et al. [19] have emphasized the beneficiary link between the expansion of the stock market and economic expansion, citing mechanisms such as resource mobilization, investment efficiency, and risk diversification [20].

Lee et al. [21] have identified the financial market as a significant contributor to the expansion of the economy in Nigeria. By offering an avenue for firms to acquire long-term funds, it enables investment that stimulates further economic progress. Nonetheless, various factors can affect this dynamic relationship between the economy and the capital markets. Lin's [22] research highlights commercial banks' contribution towards small-scale enterprises, which significantly influence activity within Nigerian economics. They suggest that when these establishments access credit from such entities, they can create job opportunities while increasing their productivity of goods and services—all driving economic expansion forward.

Numerous investigations have analyzed how the Nigerian economy is affected by crude oil price shocks. Park's [23] research delves into viable legal and policy strategies to alleviate these impacts, whereas Sharpe [24] scrutinizes the consequences of capital flight on Nigeria's economic growth and development—indicating a detrimental effect. Ultimately, both studies conclude that external factors such as crude oil price fluctuations and capital outflow significantly impact the Nigerian economy.

3. Materials and methods

The research takes a quantitative study plan to look into the statistical connection between the commercial market and economic expansion. The focus is analyzing historical data through econometric modeling. This study will employ yearly time series data from 2003–2022 and will be retrieved from https://worldbankdata.org/indicator. To assess the influence of financial market indicators on Nigeria's economic expansion, it shall employ its surrogates as relevant parameters. That is, an increased rate of GDP will be employed as a stand-in for economic expansion. Nigerian Foreign Direct Investment (NFDI) is the chosen financial market indicator for this search, though inflation rates (IR) and exchange rates (ER) are control factors and financial indicators.

3.1. Data for the study

Data for this research are collected from the CBN, World Bank database, and NSE. The data is yearly data that spans from 2003 to 2022. The dependent variable for this research is GDP growth, while the independent variables include inflation rates, exchange rates, the Nigerian All-Share Index, and foreign direct investment. There are 32 observations, and this makes the choice of ARDL approach appropriate because of the high performance of ARDL on small samples [25].

3.2. Study model

This research will employ the approach of multiple linear regression, which is popular among authors because it emphasizes supplying more than two factors in the estimate. Consequently, we efficiently define the study's model using the specified parameters as follows:

$$\text{GGDP} = f(\text{INF}, \text{EXR}, \text{NFDI}) \tag{1}$$

This equation is linearly represented as follows;

$$\text{GGDP}_t = \beta_0 + \beta_1 \text{INF}_{t-1} + \beta_2 \text{EXR}_{t-1} + \beta_3 \text{NFDI}_{t-1} + e_t \tag{2}$$

where GGDP = increase rate of GDP, NFDI = Nigerian Foreign Direct Investment, INF = Inflation Rates, EXR = Exchange Rates, and Et = Error term.

3.3. ARDL technique

The ARDL technique will be employed to investigate the connections between the prospective and temporary behavior of commercial and economic expansion in Nigeria. This model allows for the investigation of cointegration and short-run dynamics simultaneously. The factors that are autonomous and reliant in ARDL models are linear time series models where the relationship is not just contemporaneous but likewise over past (lagged) values. Specifically, given y_t as the dependent variable and $x1$, ..., x_k as the k explanatory factors, the general ARDL (p, q_1, ..., q_k) model may be obtained as follows:

$$y_t = a_0 + a_1 t + \sum_{i=1}^{p} \psi_i y_{t-1} + \sum_{j=1}^{k} \sum_{l_j=0}^{q_j} \beta_{j,} l_j x_{j,t-l_j} + \varepsilon_t \quad (3)$$

where a_0 is a constant term, ε_t denotes the usual innovations, and a1, φ_i, and β_j, l_j are the coefficients corresponding to a linear trend, y_t lags, and k regressor x_j, t for $j = 1, \ldots k = 1, \ldots$ Alternatively, define $\psi(L)$ and $\beta_j(L)$ as the lag polynomials, and let L stand for the standard lag operator:

$$\psi(L) = 1 - \sum_{i=1}^{p} \psi_i L^i$$

$$\beta_j = \sum_{l_j=0}^{q_j} \beta_{j,l_j} L^{l_j}$$

ARDL is argued by Kim and Song [20] to be beneficial in its ability to manage cointegration with built-in resilience to incorrect integration orders of some pertinent variables.

3.4. Cointegration analysis

The study will conduct cointegration tests, such as the Engle-Granger and Johansen tests, to identify the existence of a sustained correlation between factors in the stock market and economic expansion. The test of Johansen cointegration will be chosen for this study because the approach may display more than two cointegrating associations if there are more than two variables, which is the Engle-Granger method's restriction. Its single equation model is another drawback. Cointegration is based on the concept that two or more non-stationary time series variables might be related in the long run, even if they individually display unit roots. Think of a k-system of non-stationary variables $y_t = (y_1t, y_2t, ..., y_kt)$'. If there is a straight-line combination of these factors β'yt that results in a static process, then yt is said to be cointegrated. Formally, if β'yt is I(0), then yt is cointegrated.

The classic representation of cointegration can be expressed in the framework of an error correction model (ECM). Let Δyt denote the first difference of yt, and Δd denote the d-th difference operator. The ECM takes the form:

$$\Delta y_t = \alpha + \sum_{i=1}^{p} \Gamma_i \Delta y_{t-1} + \beta (y_{t-1} - \sum_{i=1}^{p} \phi_i y_{t-1}) + \varepsilon_t \quad (4)$$

where:

α is a constant term.

Γ_i are coefficients for lagged differences of y_t.

β is the symbol for the error correction term's coefficient.

ϕ_i are coefficients for lagged values of y_t.

ε_t is the error term.

The term $(y_{t-1} - \sum_{i=1}^{p} \phi_i y_{t-i})$ captures the deviation from the equilibrium over time relationship, combining β representing the rate of modification towards equilibrium.

4. Results and discussion

The details of the data for this research are presented below, which is yearly data

with a range from 2003 to 2022. It shows observations for the following macro-economic variables or indicators under study, which include the increase in GDP, which is based on the measure of monetary expansion, inflation (INF), currency rate (EXR), and foreign direct investment (FDI).

4.1. Descriptive statistics

The variables' descriptive figures findings are displayed in this section. **Table 1** displays the variables for inflation, exchange prices, foreign direct investment, and the total household income together with their range of minimum, maximum, and count values along with their mean, standard error, median, standard deviation, sample variance, kurtosis, and skewness. **Figures 1–4** show the line plots for the variables GDP, foreign direct investment, inflation rate, and exchange rate respectively.

Table 1. Descriptive statistics of variables.

	Inflation rate	Exchange rate	Foreign Direct Investment	Gross Domestic Product
Mean	18.41967558	150.8797005	3,060,824,339	$2.72312 \times 10^{+11}$
Standard Error	2.872347607	20.46722074	465,519,213.4	29,825,528,540
Median	12.94177615	130.2483417	2,155,226,687	$2.58358 \times 10^{+11}$
Standard Deviation	16.24845177	115.7800846	2,633,374,341	$1.68719 \times 10^{+11}$
Sample Variance	264.0121848	13405.028	$6.93466 \times 10^{+18}$	$2.8466 \times 10^{+22}$
Kurtosis	4.473721983	0.124146206	−0.33472763	−1.48643578
Skewness	2.266855211	0.872433124	0.876396493	0.114363885
Range	67.44749433	416.0696664	9,027,854,480	$5.22126 \times 10^{+11}$
Minimum	5.388007969	9.909491667	186,792,428.9	52,058,181,854
Maximum	72.8355023	425.9791581	8,841,062,051	$5.74184 \times 10^{+11}$
Count	32	32	32	32

Source: Author's computation from MS-Excel (2024).

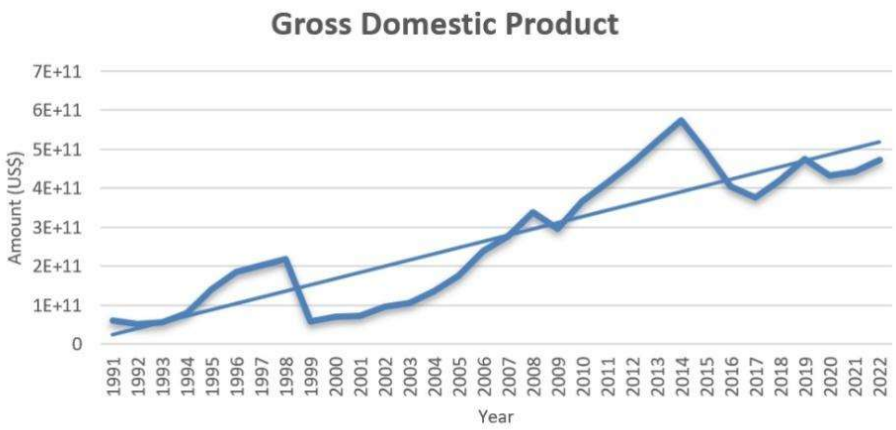

Figure 1. Line Graph for (GDP) growth.

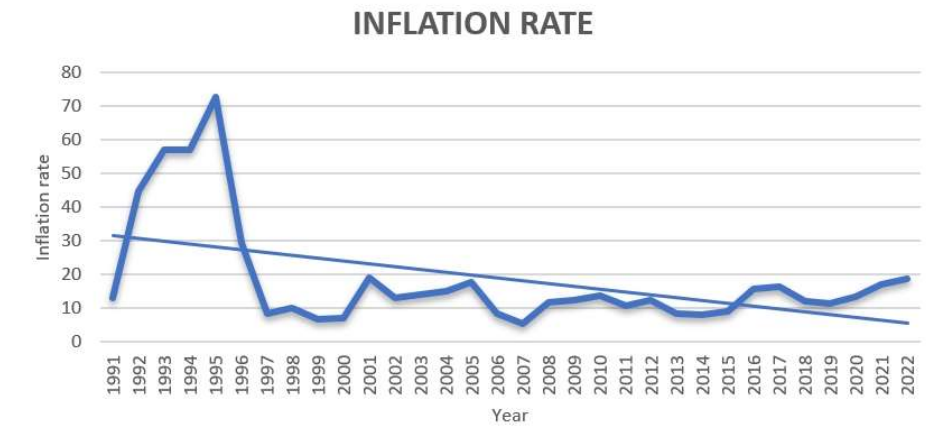

Figure 2. Line graph for inflation.

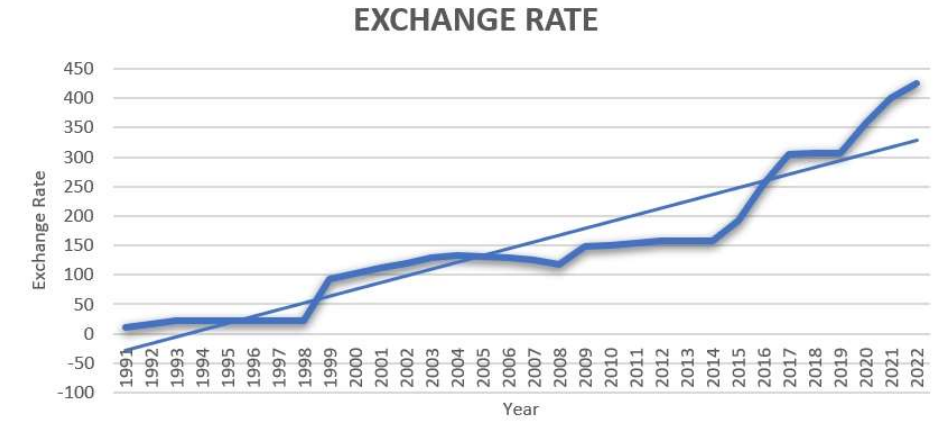

Figure 3. Line graph for official exchange rate.

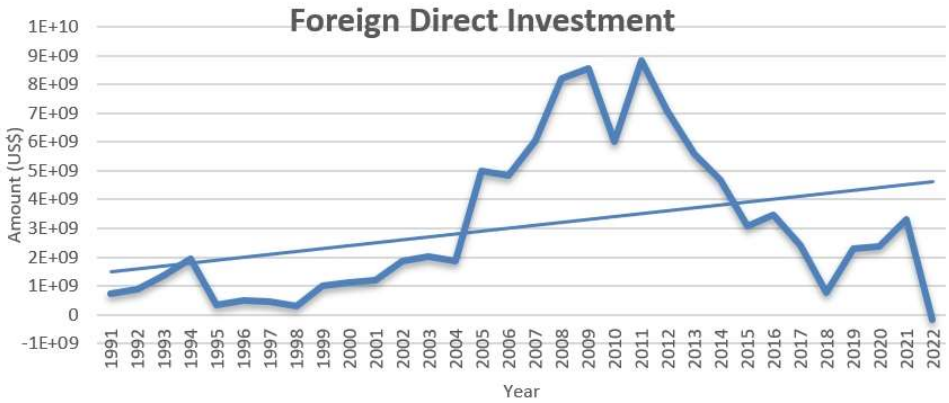

Figure 4. Line graph for foreign direct investment.

Table 1 displays the descriptive overview of different variables, each having 32 observations. It shows the mean, median, variance as well as the lowest and highest values of the selected indicators. From the table, the mean, standard error, kurtosis, and skewness of the inflation rate are 18.42, 2.87, 4.47, and 2.27, respectively. The mean, standard error, kurtosis, and skewness of the exchange rate are 150.88, 20.47, 0.12, and 0.87, respectively. The mean, standard error, kurtosis, and skewness of foreign direct investment are 30,60,824,339, 465,519,213.4, −0.33472763, and

0.876396493, respectively. The mean, standard error, kurtosis, and skewness of gross domestic product are $2.72 \times 10^{+11}$, 2,982,5528,540, −1.49, and 0.11, respectively.

4.2. Unit root test

The following shows the stationarity result for the factors of this study (see **Tables 2–9**)

Table 2. Unit root test on exchange rate.

Variable	Coefficient	Std. Error	*t*-Statistic	Prob.
C	−27.40068	14.74372	−1.858464	0.0729
@TREND	11.50196	0.817206	14.07473	0.0000

Table 3. Unit root test on exchange rate after first difference.

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		−4.253124	0.0111
Test critical values:	1% level	−4.296729	
	5% level	−3.568379	
	10% level	−3.218382	

Table 4. Unit root test on foreign direct investment.

Variable	Coefficient	Std. Error	*t*-Statistic	Prob.
C	$1.51 \times 10^{+09}$	$8.64 \times 10^{+08}$	1.748933	0.0905
@TREND	99,979,668	47,891,205	2.087642	0.0454

Table 5. Unit root test on foreign direct investment after first difference.

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		−6.082224	0.0001
Test critical values:	1% level	−4.296729	
	5% level	−3.568379	
	10% level	−3.218382	

Table 6. Unit root test on inflation rate.

Variable	Coefficient	Std. Error	*t*-Statistic	Prob.
C	31.42735	4.991015	6.296785	0.0000
@TREND	−0.839205	0.276639	−3.033574	0.0050

Table 7. Unit root test on inflation rate after first difference.

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		−5.235890	0.0014
Test critical values:	1% level	−4.356068	
	5% level	−3.595026	
	10% level	−3.233456	

Table 8. Unit root test on gross domestic product.

Variable	Coefficient	Std. Error	*t*-Statistic	Prob.
C	$2.52 \times 10^{+10}$	$2.74 \times 10^{+10}$	0.919093	0.3654
@TREND	$1.59 \times 10^{+10}$	$1.52 \times 10^{+09}$	10.48796	0.0000

Table 9. Unit root test on GDP after first difference.

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		−4.331182	0.0092
Test critical values:	1% level	−4.296729	
	5% level	−3.568379	
	10% level	−3.218382	

The exchange rate is only statistically important on trend at the 5% degree of significance when it is regressed on both constant and trend, as indicated in **Table 2**. Exchange rates are statistically significant ($p < 0.05$) at order 1, as **Table 3** demonstrates. It is found that foreign direct investment is statistically significant on trend only at the 5% level of significance when it is regressed on both constant and trend, as indicated in **Table 4.** Foreign direct investment at order 1 is statistically significant ($p < 0.05$), as **Table 5** demonstrates. Both the constant and trend inflation rates, as seen in **Table 6**, are found to be statistically significant when regressed. The statistical significance of the inflation rate ($p < 0.05$) at order 1 is shown by **Table 7**. Only at the 5% level of significance is GDP growth found to be statistically significant when it is regressed on both constant and trend, as indicated in **Table 8**. The GDP growth rate at order 1 is statistically significant ($p < 0.05$), as **Table 9** reveals.

4.3. Cointegration test

In order to build a lasting relationship, a cointegration test must be conducted if the series are integrated into distinct orders. The bounds test, which was proposed by Kim and Song [20], is a suitable cointegration test. The Johansen cointegration test is no longer appropriate for usage. The hypothesis is expressed as follows: H0: no cointegrating equation, and H1: H0 is false. Bounds Test decision criteria: Rejection at 10%, 5%, or 1% significance levels. We can determine that cointegration exists if the computed F-statistic exceeds the upper bound I(1) criteria value. In other words, the relationship is long-term. Don't accept the null hypothesis. Calculate the error correction model (ECM), which is the long-term model. We infer that there is no cointegration and, thus, no long-run relationship if the computed. The F-statistic for the lower bound I(0) is less than the critical value. Keep accepting the null hypothesis. Calculate the autoregressive distributed lag (ARDL) model, which is the short-run model. Should the F statistic lie between I(0), the lower bound, and I(1), the upper bound? The test yields inconclusive results in **Table 10**.

Table 10. Bounds test.

F-Bounds Test		**Null Hypothesis: No levels of relationship**		
Test Statistic	**Value**	**Signif.**	**I(0)**	**I(1)**
			Asymptotic: $n = 1000$	
F-statistic	5.004387	10%	2.25	2.8
k	3	5%	2.57	3.79
		2.5%	3.09	3.98
		1%	3.53	4.47
Actual Sample Size	28		Finite Sample: $n = 35$	
		10%	2.532	3.443
		5%	3.213	4.232
		1%	4.312	5.734

We reject the null hypothesis that there is no long-run connection in this instance because the F-statistic is 5.00, which is more than the I(1) bound value at a 5% level of significance. There is hence cointegration between the logs of an increased rate of GDP, inflation rate, exchange rate, and foreign direct investment. Consequently, it is necessary to test both short-term and long-term connections.

From these p-values, the variables that are statistically significant at the 5% significance level ($p < 0.05$) are GDP (−3) (lagged GDP), EXR (current exchange rate), EXR (−1) (lagged exchange rate), and EXR (−3) (exchange rate three periods ago). These are the variables to be considered including in the short-run ARDL model, as they have statistically significant relationships with the dependent variable. Based on the significant variables identified from the regression results, the ARDL model would include only the statistically significant variables. In this case, the significant variables incorporating the coefficient estimates from your regression results, the model can be specified as:

$$\Delta GDP = -1.49 \times 1010 + 0.6459\Delta GDP_{t-3} - 2.45 \times 109\Delta EXR_t + 1.68 \times 109\Delta EXR_{t-1} + 1.87 \times 109\Delta EXR_{t-3} + ut$$

This model suggests that changes in GDP three periods ago and changes in the current, lagged, and three periods ago exchange rates have significant effects on the dependent factors. With an R-squared of 0.996782, the self-sustaining factors in the model take into consideration roughly 99.68% of the variance in the dependent variable. It's a high value, suggesting strong explanatory power of the model. An adjusted R-squared of 0.992102 suggests that approximately 99.21% of the variance in the dependent parameter is understood in terms of the self-sustaining variables, adjusted for the number of predictors. The Durbin-Watson statistic tests for the presence of autocorrelation in the residuals (errors). The values span from 0 to 4, with 2 indicating the absence of autocorrelation. Values closer to 2 are preferred. Here, the Durbin-Watson statistic is 1.985634, suggesting no significant autocorrelation. Overall, the regression model seems to have a high explanatory power, good fit, and statistical significance, as indicated by these statistics in **Table 11**.

Table 11. ARDL model.

Variable	Coefficient	Std. Error	*t*-Statistic	Prob.*
GDP(−1)	0.308896	0.263216	1.173547	0.2654
GDP(−2)	−0.124254	0.274928	−0.451953	0.6601
GDP(−3)	0.645942	0.298618	2.163102	0.0534
FDI	−2.080298	2.850402	−0.729826	0.4807
FDI(−1)	3.194763	2.874298	1.111493	0.2901
FDI(−2)	3.348029	3.469275	0.965052	0.3553
FDI(−3)	6.781183	3.692321	1.836564	0.0934
EXR	$-2.45 \times 10^{+09}$	$3.29 \times 10^{+08}$	−7.448342	0.0000
EXR(−1)	$1.68 \times 10^{+09}$	$6.02 \times 10^{+08}$	2.785575	0.0177
EXR(−2)	$-4.61 \times 10^{+08}$	$7.41 \times 10^{+08}$	−0.621679	0.5468
EXR(−3)	$1.87 \times 10^{+09}$	$7.83 \times 10^{+08}$	2.393305	0.0357
INF	$2.41 \times 10^{+08}$	$4.37 \times 10^{+08}$	0.551651	0.5922
INF(−1)	$3.27 \times 10^{+08}$	$4.42 \times 10^{+08}$	0.738085	0.4759
INF(−2)	$2.06 \times 10^{+08}$	$4.34 \times 10^{+08}$	0.474939	0.6441
INF(−3)	$6.09 \times 10^{+08}$	$4.86 \times 10^{+08}$	1.253430	0.2360
INF(−4)	$5.46 \times 10^{+08}$	$4.86 \times 10^{+08}$	1.123977	0.2850
C	$-1.49 \times 10^{+10}$	$1.64 \times 10^{+10}$	−0.907317	0.3837
R-squared	0.996782		Mean dependent var	$3.02 \times 10^{+11}$
Adjusted *R*-squared	0.992102		S.D. dependent var	$1.59 \times 10^{+11}$
S.E. of regression	$1.41 \times 10^{+10}$		Akaike info criterion	49.85739
Sum squared resid	$2.19 \times 10^{+21}$		Schwarz criterion	50.66622
Log-likelihood	−681.0034		Hannan-Quinn criteria.	50.10466
F-statistic	212.9810		Durbin-Watson stat	1.985634

4.4. Long-run (error correction model)

Approximately 97.25% within the variance of the reliant factor can be explained by the self-sustaining factors in the model, according to the *R*-squared value of 0.972485. Given the high value, the technique appears to have a significant explanatory capacity. A little less than the *R*-squared number, 0.950474, is the adjusted *R*-squared value. The model's modified *R*-squared considers the total count of forecasters and penalizes the overuse of several factors that do not necessarily increase the ability to explain the model. The mean shows how far apart on average the shown values are from the values that the regression model predicted. There is a 1.96 Durbin-Watson statistic. This examines whether the residuals have autocorrelation. There is no discernible autocorrelation when the value is near 2. In general, these statistical data offer insights about the model's explanatory capacity, autocorrelation in the residuals, and goodness of fit in **Table 12**.

Table 12. Autocorrelation verification.

Variable	Coefficient	Std. Error	*t*-Statistic	Prob.
C	$6.75 \times 10^{+10}$	$5.50 \times 10^{+10}$	1.225993	0.2304
INF	$-5.52 \times 10^{+08}$	$1.32 \times 10^{+09}$	−0.417801	0.6793
FDI	23.54488	7.642400	3.080823	0.0046
EXR	$9.47 \times 10^{+08}$	$1.75 \times 10^{+08}$	5.402133	0.0000
R-squared	0.647152	Mean dependent var		$2.72 \times 10^{+11}$
Adjusted *R*-squared	0.609347	S.D. dependent var		$1.69 \times 10^{+11}$
S.E. of regression	$1.05 \times 10^{+11}$	Akaike info criterion		53.71741
Sum squared resid	$3.11 \times 10^{+23}$	Schwarz criterion		53.90062
Log likelihood	−855.4785	Hannan-Quinn criter.		53.77814
F-statistic	17.11808	Durbin-Watson stat		0.585062
Prob(F-statistic)	0.000002			

The positive model's autocorrelation is evident, as indicated using the Durbin-Watson estimate of 0.59. The rationale is that Durbin-Watson's value needs to be between 1.5 and 2.0 in order for it to be considered acceptable and autocorrelation-free. 1.38 is outside of the range, indicating the existence of autocorrelation. Additionally, it is discovered that the model contains indications of serial autocorrelation (see **Table 13**).

Table 13. Autocorrelation removal.

Variable	Coefficient	Std. Error	*t*-Statistic	Prob.
C	$-2.41 \times 10^{+09}$	$2.99 \times 10^{+10}$	−0.080555	0.9364
INF	$4.75 \times 10^{+08}$	$6.69 \times 10^{+08}$	0.710323	0.4838
EXR	91642616	$1.25 \times 10^{+08}$	0.732702	0.4703
FDI	7.657523	4.137579	1.850726	0.0756
GDP(−1)	0.881993	0.092223	9.563738	0.0000
R-squared	0.917755	Mean dependent var		$2.79 \times 10^{+11}$
Adjusted *R*-squared	0.905102	S.D. dependent var		$1.67 \times 10^{+11}$
S.E. of regression	$5.14 \times 10^{+10}$	Akaike info criterion		52.31098
Sum squared resid	$6.87 \times 10^{+22}$	Schwarz criterion		52.54227
Log likelihood	−805.8202	Hannan-Quinn criter		52.38637
F-statistic	72.53249	Durbin-Watson stat		1.887246
Prob(F-statistic)	0.000000			

In the table above, the autocorrelation problem has been resolved by adding a lag of the reliant factor in the regression as a self-sustaining factor. Durbin-Watson test statistic of 1.89 shows this in **Table 13**.

4.5. Granger causality test

The outcome of the pairwise Granger Causality test of the variables is displayed in the **Table 14** below.

Table 14. Granger causality test between GDP and FDI.

Null Hypothesis:	Obs	F-Statistic	Prob.
FDI does not Granger Cause GDP	31	5.24891	0.0297
GDP does not Granger Cause FDI		0.95874	0.3359

Table 15 indicates that neither the GDP growth nor the exchange rate granger causes each other. **Table 16** indicates that neither the GDP growth nor the inflation rate granger causes each other.

Table 15. Granger causality test between GDP and EXR.

Null Hypothesis:	Obs	F-Statistic	Prob.
EXR does not Granger Cause GDP	31	1.85197	0.1844
GDP does not Granger Cause EXR		2.33626	0.1376

Table 16. Granger causality test between GDP and INF.

Null Hypothesis:	Obs	F-Statistic	Prob.
INF does not Granger Cause GDP	31	0.71896	0.4037
GDP does not Granger Cause INF		2.04281	0.1640

Table 14 above indicates that the FDI granger causes the GDP growth, but on the other hand, the GDP growth fails to provide the amount of foreign direct investment at the 5% level of significance.

4.6. Discussion of study

The values of *R* square, standard error, adjusted *R* square, and multiple *R* were displayed when the regression analysis and model modification of the variables were undertaken. The chosen variables' coefficient, standard error, and *P*-value. The logs of increase in GDP, inflation rate, currency rate, and foreign direct investment cointegrate; however, tests of the short- and long-term links are necessary. Only the statistically significant variables are included within the ARDL model built from the based regression findings. These data in a short-run connection suggest that the regression model appears to have strong explanatory power, a good fit, and statistical significance. The long-term relationship's goodness of fit, explanatory power, and autocorrelation in the residuals are all indicated by *R* squared, modified *R* squared, the dependent variable's mean and its standard deviation of the dependent variables, Durbin-Watson statistic, and regression standard error. Additionally, it was shown that the model contains indications of serial autocorrelation. By incorporating a lag of the dependent factor in the regression as a self-sustaining factor, the autocorrelation issue was handled.

5. Conclusion

In conclusion, the result of this research shows the existence of a long-term association involving capital market expansion together with Nigeria's economic expansion. The autoregressive distributed lag limits test indicated that the financial

market's development includes a positive and considerable impact on the country's financial expansion. This proves that enhancing the financial system's efficiency as well as depth intends to help Nigeria's economy expand. The findings show that a well-developed capital market can serve as a catalyst for economic growth by allocating resources efficiently and encouraging investment. This demonstrates the significance of improving the operation and efficiency of Nigeria's financial market to boost financial expansion. To fully harness the benefits of capital sector development for long-term economic growth in Nigeria, regulatory frameworks must be strengthened, market transparency promoted, and investor trust built. As a result, policymakers should prioritize policies that encourage the advancement of the capital sector to fuel the nation's economic growth and progress. More research is needed to determine the particular routes via which the financial market influences economic expansion in Nigeria. Future investigation can be done using machine learning models to establish relationships between the financial system and GDP expansion in Nigeria [26–31].

Conflict of interest: The author declares no conflict of interest.

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