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Modeling and Inference of Insurance Sector Development on Nigeria Economic Growth

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Abstract

This empirical study investigated the impact of insurance sector development on economic growth in Nigeria, covering the period 1999-2022. Utilizing statistical techniques, including Augmented Dickey-Fuller (ADF) tests, regression modeling, Lagrange multiplier (LM) tests, and the Breusch-Pagan-Godfrey test for heteroskedasticity, the study revealed critical insights into the dynamic relationship between insurance sector and economic performance. The ADF test results indicated that the data series were stationary after differencing, confirming an integrated order of one (I(1)). The regression analysis revealed a statistically significant positive impact of total insurance investment (TII) on economic growth in Nigeria, with a coefficient estimate of 0.753 ($p < 0.01$). Conversely, no significant relationship was found between total claims paid by insurance companies and economic growth in Nigeria, with a coefficient estimate of 0.033 ($p > 0.05$).Diagnostic tests revealed no evidence of serial correlation in residuals at lag 1, indicating no systematic pattern, and no significant heteroskedasticity was detected, signifying no systematic variance in residuals with changes in independent variables. Based on these findings, the study recommends that policymakers prioritize implementing measures to enhance the regulatory environment and promote innovation within the insurance industry, among other policy implications.

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Keywords: Investment, Development, Heteroskedasticity, Economic Growth, Insurance

INTRODUCTION

Financial markets play a vital role in the economy by channeling funds from surplus sources to those in need. Households, businesses, and governments that spend less than their income accumulate surplus funds, while entities with fund shortages seek to spend more than their income. This essential function of fund allocation primarily occurs through indirect finance, utilizing financial intermediaries such as depository institutions like banks, non-depository or contractual savings institutions like insurance companies, and investment intermediaries. These entities facilitate the flow of funds from surplus to deficit units, thereby promoting economic growth and development (Mishkin and Eakins, 2012).

Insurance companies, which belong to the non-banking sector, play a pivotal role in managing risks. In its various forms, insurance acts as a shield against the multitude of risks that pervade both individual and business activities within an economy. The core objective of insurance firms is to mitigate these risks, restoring individuals or businesses to their financial state prior to any unfortunate events (Akinlo & Apanisile 2014, Friedman 2022).

The importance of insurance firms cannot be overstated, particularly in a developing nation like Nigeria. Despite the government's efforts to enforce compulsory insurance for all citizens, there remains a lack of confidence in the ability of insurance companies to provide protection against financial losses. This uncertainty has deterred many Nigerians from investing in businesses (Brainard & Schwartz 2008, Etale 2019). The relationship between insurance sector development and economic growth in Nigeria has been a subject of interest among researchers, but the existing literature presents divergent findings, leading to a lack of consensus on the nature of this relationship.

Several studies underscore the crucial role of financial intermediaries in directing savings towards domestic investment, ultimately leading to increased productivity and improved economic effectiveness (Hussein and Alam, 2019). Akinlo and Apanisile (2014) highlighted the positive impact of insurance on economic growth in sub-Saharan Africa, emphasizing the role of insurance premiums. Lee et al. (2022) explored the nuanced relationship

between insurance development and economic growth across countries, considering factors like continent and initial GDP per capita.

Within the Nigerian context, Ogbeide et al. (2022) pointed to the significance of insurance sector productivity in driving economic growth. Signé and Johnson (2020) delved into the long and short-run relationship between insurance development and economic growth in Nigeria, highlighting its substantial contribution. Peleckienė et al. (2019) examined variations in insurance sector development among European Union countries, shedding light on the diverse relationships between insurance penetration and economic growth. Fashagba (2018) addressed discrepancies in previous findings, revealing the distinct impacts of life and non-life insurance premiums on economic growth. Musurmanovich (2020) emphasized the importance of insurance in economic growth, even in less developed financial sectors.

However, despite these valuable contributions, a critical gap remains in the literature regarding the specific impact of the insurance sector on economic growth in Nigeria. While some studies have provided insights at the regional or global level, there is a need for a comprehensive analysis that focuses specifically on Nigeria's unique economic landscape. Furthermore, the existing studies primarily cover periods up to 2020, and there is a lack of recent empirical research to address the evolving dynamics between the insurance sector and economic growth in Nigeria.

To bridge this gap, this study aims to investigate the impact of insurance sector development on Nigerian economic growth, using updated data up to 2022. Specifically, the study seeks to: 1) examine the effect of insurance sector total claims on economic growth in Nigeria and 2) assess the effect of total insurance investment on economic growth in Nigeria.

Literature Review

Research on the impact of insurance practices on economic growth has yielded significant findings. Eze and Okoye (2013) analyzed the Nigerian economy and found a positive influence of insurance practices on economic growth. Akinlo and Apanisile (2014) conducted an extensive examination of sub-Saharan Africa and consistently demonstrated a positive and statistically significant impact of insurance on economic growth. Ukpong and Acha (2017) used cointegration methods to study the causal relationship between insurance

and economic development in Nigeria, revealing a significant positive impact of insurance practices on economic growth.

Fashagba (2018) addressed divergent research findings on the relationship between life and non-life insurance premiums and economic growth in Nigeria. The study revealed a positive but insignificant relationship between non-life insurance and economic growth, while a significant negative relationship was identified between life insurance and economic growth. Bayar et al. (2021) analyzed the impact of insurance sector development on economic growth in Central and Eastern European post-transition countries, concluding that life insurance has no significant effect on economic growth, while non-life insurance positively affects economic growth.

Makwe et al. (2021) determined the effect of insurance sector total claims on the economic growth of Nigeria, revealing a positive and significant relationship between insurance claims and GDP. They recommended institutional improvements, information and education campaigns, and increased efficiency in risk management and product development to further enhance the positive impact of insurance on economic growth. Zekaj and Rexhepi (2022) analyzed the activity of insurance companies in Kosovo and their impact on economic development, emphasizing the positive role of the insurance industry in fostering economic growth.

Ogbeide et al. (2022) examined the relationship between insurance sector development and economic growth in Nigeria from 2003 to 2020, finding that insurance sector productivity significantly influenced economic growth with a positive coefficient. This underscores the pivotal role of insurance sector total claims in shaping economic growth dynamics. Overall, the research highlights the crucial role of the insurance sector in contributing to economic development and growth.

METHODS

In order to investigate the impact of insurance sector development on economic growth in Nigeria, Ordinary least (OLS) multiple regression method was adopted to analyse the secondary data generated between 1999 and 2022. The data generated for analysis were obtained from on-line Central Bank of Nigeria (CBN) Statistical Bulletin series.

The primary specification of the model that was tested in the study is as follows:

$$Y_i = \beta_0 + \sum_{j=1}^{p} \beta_j x_j + \varepsilon_i \qquad \text{.. (1)}$$

Where:

Y_i is the dependent variable,

β_0, is the intercept of the model,

X_j corresponds to the *jth* explanatory variable of the model ($j = 1$ *to* p), and

ε_i is the random error with expectation 0 and variance σ^2.

With the assumptions:

a) The variable ε_i has a normal distribution.

b) X_i are not correlated

c) The disturbance term μ_i has a zero mean. i.e. $E(\mu_i) = 0$

d) The variance of ε_i is constant in each period. i.e. $Var(\varepsilon_i) = \delta\varepsilon_i^2$

Thus,

$$GDP = f(ISTC, TII) \qquad \text{... (2)}$$

The basic panel econometric form of the model is therefore given by:

$$logGDP = \beta_0 + \beta_1 logISTC + \beta_2 logTII \qquad \text{.. (3)}$$

Where:

Insurance sector total claims = ISTC

Total insurance investment = TII

Gross Domestic Product = GDP

The study uses Augmented Dickey- Fuller (ADF) test for unit root. The data used for the study will be tested to determine if the variables are non-stationary and to which order there are integrated. The model for the ADF unit root framework is stated as follows;

$$\Delta y_t = \beta_1 + \beta_2 t + \delta y_{t-1} + \alpha_t \sum_{i=1}^{m} \Delta y_{t-1} + \varepsilon_t \qquad (4)$$

Where;

Y_t is the variable in question, t is the time trend, Δ is the difference operator and ε_t is the white noise process.

By using the above equation, the under listed hypothesis is tested for stationarity;

H_0: $\delta = 0$ (Y_t is non-stationary)

H_1: $\delta < 0$ (Y_t is stationary)

Instead of the normal t-statistic, ADF adopted a new $\tau -$ statistic since they came out and shown that the t-statistic was inappropriate. Under the $\tau -$ statistic, MacKinnon (1996) asserts that if the $\tau -$ statistic calculated is less than the critical values, we reject the null hypothesis.

RESULTS

Descriptive Statistics of the Study Variables

Table I: Summary of Descriptive Statistics

	Mean	Standard Error	Standard Deviation	Kurtosis	Skewness	Minimum	Maximum
GDP	69,901.02	11,300.59	55,361.37	-0.81	0.607	5,426.47	178,907.02
Total Claims	50,888.65	9,939.13	48,691.57	0.114	1.069	5,629.52	160,523.69
Total Investment	541,055.26	106,754.36	522,987.40	0.096	1.067	21,583.46	1,785,352.55

The descriptive statistics for the three variables - GDP, Total Claims, and Total Investment - are presented in Table 1. The statistics provide a summary of the distribution and characteristics of each variable.

GDP has a mean value of N69,901.023, which represents the average gross domestic product over the observed period. The standard error of 11,300.593 indicates the variability in the sample mean, suggesting some degree of uncertainty around this average value. The standard deviation of 55,361.373 reflects the spread of GDP values around the mean, showing the extent of deviation from the average GDP figure. The kurtosis of -0.810 indicates a relatively flat distribution of GDP values, implying that the data points are

spread out without a prominent peak or heavy-tailed distribution. The skewness of 0.607 suggests a moderate right-skewed distribution, indicating that there may be a few high GDP values that pull the distribution towards the right, but the majority of values are clustered towards the lower end of the scale.

Total Claims have a mean value of N50,888.645, which represents the average total insurance claims made during the observed period. The standard error of 9,939.125 reflects the variability in the sample mean of total claims. The standard deviation of 48,691.571 indicates the dispersion of total claims data around the mean, showing how much the actual claims values vary from the average. The kurtosis of 0.114 suggests a distribution slightly peaked around the mean, indicating that the total claims data is relatively normally distributed without significant outliers or extreme values. The skewness of 1.069 indicates a moderate right-skewed distribution, implying that while most total claims values are concentrated towards the lower end, there are some higher claims values that pull the distribution towards the right.

Total Investment has a mean value of N541,055.258, which represents the average investment made in the insurance sector during the observed period. The standard error of 106,754.356 reflects the variability in the sample mean of total investment. The standard deviation of 522,987.400 shows the spread of total investment values around the mean, indicating the extent of deviation from the average investment figure. The kurtosis of 0.096 suggests a distribution relatively close to the normal distribution, with a slight peak around the mean but without significant outliers. The skewness of 1.067 indicates a moderate right-skewed distribution, suggesting that while most total investment values are towards the lower end, there are some higher investment values that pull the distribution towards the right.

Pre-Estimation Analysis

Stationary

Table 2: ADF Test for Stationarity

Method	ADF - Fisher Chi-square	ADF - Choi Z-stat	ADF - Fisher Chi-square	ADF - Choi Z-stat
Statistic	0.07202	5.06032	33.0955	-3.66301
Prob.**	1.0000	1.0000	0.0000	0.0001
Order	Level form		Fist Difference	
Remark	Not stationary		Stationary	

Table 2 presents the outcomes of the Augmented Dickey-Fuller (ADF) test for stationarity, employing various methods, including Fisher Chi-square and Choi Z-statistics, for both the level form and first difference of the data series.

The ADF test results for the level form indicate a test statistic of 0.07202 and a p-value of 1.0000, suggesting that the data series is not stationary. However, upon differencing the data series, the ADF test statistic increases to 33.0955, accompanied by a p-value of 0.0000, indicating that the differenced data series is stationary. This suggests that the data series exhibits a unit root in its level form, but becomes stationary after differencing, implying that it is integrated of order one, denoted as I(1). The findings of this stationarity test have important implications for further analysis, as they suggest that the data series requires differencing to achieve stationarity, which is a critical assumption for many time series analysis techniques.

Table 3: Coefficients of Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(TII)	0.753	0.045	16.804	0.000
LOG(ISTC)	0.033	0.054	0.615	0.545
C	0.927	0.353	2.624	0.016
R-squared	0.976	Mean dependent var		10.722
Adjusted R-squared	0.973	S.D. dependent var		1.077
S.E. of regression	0.176	Akaike info criterion		-0.519
Sum squared resid	0.651	Schwarz criterion		-0.372
Log likelihood	9.227	Hannan-Quinn criter.		-0.480
F-statistic	419.313	Durbin-Watson stat		0.721
Prob(F-statistic)	0.000			

Table 3 presents the coefficients of regression for the variables in the model, including the natural logarithm of Total Insurance Investment (LOG(TII)), the natural logarithm of another variable (LOG(ISTC)), and the intercept term (C). The regression analysis reveals that the coefficient for LOG(TII) is statistically significant at the 0.05 level, with a value of 0.753, standard error of 0.045, and t-statistic of 16.804. This suggests that a one-unit increase in the natural logarithm of Total Insurance Investment is associated with a 0.753-unit increase in the dependent variable, holding other variables constant.

In contrast, the coefficient for LOG(ISTC) is not statistically significant at the 0.05 level, with a value of 0.033, standard error of 0.054, and t-statistic of 0.615. The intercept term

(C) has a coefficient of 0.927, with a standard error of 0.353 and t-statistic of 2.624, indicating statistical significance at the 0.05 level.

The model fit and complexity are evaluated using various metrics, including R-squared, adjusted R-squared, Akaike information criterion, Schwarz criterion, and Hannan-Quinn criterion. The R-squared value of 0.976 indicates that approximately 97.6% of the variation in the dependent variable is explained by the independent variables in the model. The F-statistic of 419.313 is highly significant (p-value < 0.05), suggesting that the overall regression model is statistically significant. However, the Durbin-Watson statistic of 0.721 suggests that there may be some autocorrelation present in the residuals, warranting further investigation.

Testing of Hypotheses and Interpretation

Testing of Hypotheses H_{01}:

The coefficient estimate for LOG(ISTC) is 0.033, with a standard error of 0.054 and a t-statistic of 0.615. The associated p-value is 0.545, which exceeds the conventional significance level of 0.05.

Thus, we fail to reject the null hypothesis (H_{01}). This implies that there is no statistically significant relationship between the total claims paid by insurance companies and economic growth in Nigeria. The coefficient estimate is positive but not significant, suggesting that changes in ISTC do not have a substantial impact on economic growth.

Testing of Hypotheses H_{02}:

The coefficient estimate for LOG(TII) is 0.753, with a standard error of 0.045 and a t-statistic of 16.804. The associated p-value is 0.000, which is less than the conventional significance level of 0.05.

Based on the test results, we reject the null hypothesis (H_{02}). This suggests that the total investment made by insurance companies in Nigeria has a statistically significant impact on the country's economic growth. The positive coefficient estimate indicates a positive relationship between TII and economic growth, implying that increases in TII are associated with increases in economic growth.

Post-estimation Analysis

Serial Correlation (LM test)

Table 4: Langrange multiplier test for Serial correlation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(TOTAL_INVESTMENT)	0.003	0.037	0.079	0.938
LOG(TOTAL_CLAIMS)	-0.006	0.044	-0.132	0.896
C	0.026	0.289	0.088	0.931
RESID(-1)	0.676	0.229	2.95	0.058
RESID(-2)	-0.076	0.23	-0.33	0.745

Table 4 presents the results of the Langrange multiplier (LM) test, which examines the presence of serial correlation in the residuals of the regression model. The test assesses whether systematic patterns exist in the residuals, indicating potential autocorrelation. The coefficients and associated statistics for the LM test are provided in the table.

The results show that the coefficient for the lagged residual at lag 1 (RESID(-1)) is statistically significant, with a coefficient of 0.676, a standard error of 0.229, and a t-statistic of 2.950, resulting in a p-value of 0.058. This suggests that there is no evidence of serial correlation at lag 1, indicating the absence of a systematic relationship between the residuals of consecutive observations.

In contrast, the coefficients for LOG(TOTAL_INVESTMENT), LOG(TOTAL_CLAIMS), and the constant term (C) do not exhibit statistical significance, suggesting no evidence of serial correlation associated with these variables. This implies that the residuals do not exhibit a systematic pattern related to these variables.

Thus, the LM test results suggest that the residuals do not exhibit significant serial correlation, supporting the assumption of independence in the regression model. This is essential for ensuring the validity and reliability of the regression analysis and the ensuing conclusions.

Heteroscedasticity

Table 5: Breusch-Pagan-Godfrey Test for Heteroskedasticity

Variable	C	LOG(TOTAL_INVESTMENT)	LOG(TOTAL_CLAIMS)
Coefficient	-0.001	0.000	0.003
Std. Error	0.076	0.010	0.012
t-Statistic	-0.016	0.019	0.219
Prob.	0.987	0.985	0.829

Table 5 presents the results of the Breusch-Pagan-Godfrey test, which examines the presence of heteroskedasticity in the regression model. The test assesses whether the variance of the residuals changes systematically with the independent variables, indicating heteroscedasticity. The coefficients and associated statistics for the constant term (C), LOG(TOTAL_INVESTMENT), and LOG(TOTAL_CLAIMS) are presented in the table.

The results show that none of the coefficients are statistically significant at the conventional significance level of 0.05. Specifically, the p-values for the constant term (0.987), LOG(TOTAL_INVESTMENT) (0.985), and LOG(TOTAL_CLAIMS) (0.829) are all greater than 0.05. This suggests that the null hypothesis of homoscedasticity cannot be rejected, indicating that the variance of the residuals does not systematically vary with changes in the independent variables.

Therefore, the results of the Breusch-Pagan-Godfrey test provide no evidence of heteroskedasticity in the regression model, supporting the assumption of homoscedasticity. This is essential for ensuring the validity and reliability of the regression analysis and the ensuing conclusions.

Normality of Residuals

Table 6: Residual analysis

Stat	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Probability
Values	9.33E-16	0.012958	0.320485	-0.3744	0.16828	-0.50693	2.722222	1.105089	0.575484

Table 6 presents the results of the residual analysis, which provides valuable insights into the distributional properties and characteristics of the residuals derived from the regression model. The mean residual value, approximately zero, indicates that the residuals are

centered around the regression line, suggesting a well-fitting model. The median value of 0.012958 indicates symmetrical distribution around the median.

The range of residuals, spanning from -0.374397 to 0.320485, reveals variability in the deviations from the regression line. The standard deviation of 0.16828 represents the average deviation from the mean, providing a measure of dispersion.

Skewness, a measure of asymmetry, is negative (-0.506934), indicating a slight left skewness. The Kurtosis value of 2.722222 suggests that the residual distribution is slightly peaked compared to a normal distribution. The Jarque-Bera test statistic of 1.105089, with a corresponding p-value of 0.575484 (presented in Figure 1), indicates that the residuals are normally distributed, as the p-value exceeds the typical significance level of 0.05.

Therefore, the residual analysis suggests that the residuals from the regression model are approximately normally distributed, with some minor deviations from normality. These results provide support for the validity of the regression model and the assumptions underlying the analysis.

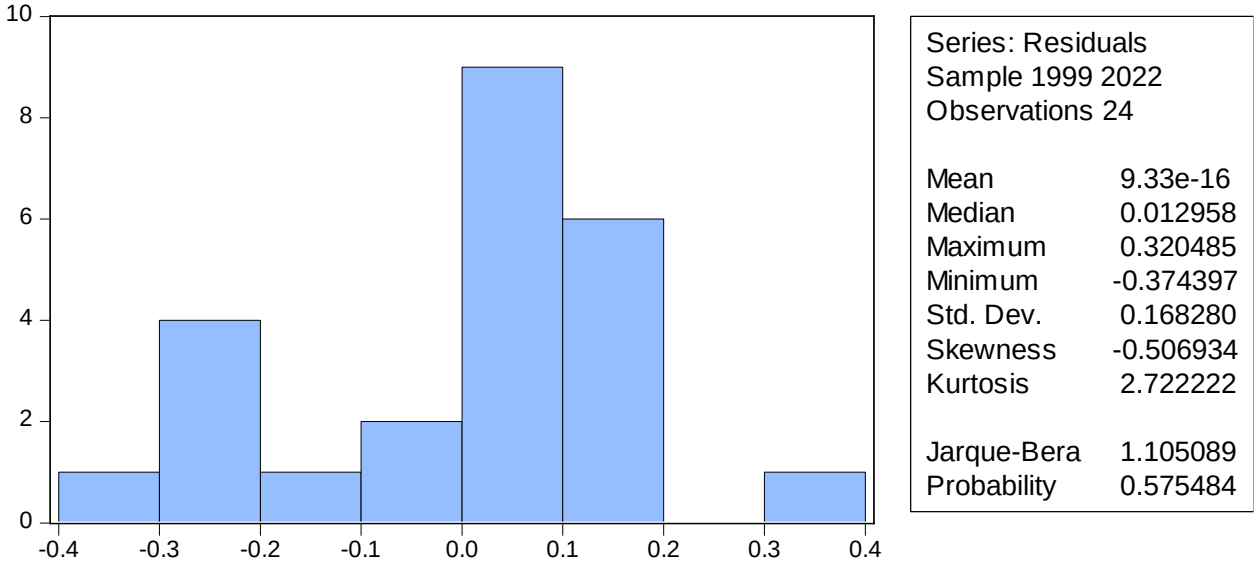


Figure 1: Residual plot

DISCUSSION

The study's findings corroborate existing literature on the positive relationship between insurance sector total claims and economic growth in Nigeria (Ukpong & Acha, 2017). Similarly, research by Dawd and Benlagha (2023) on OECD countries suggests a significant

association between insurance development and economic growth, which aligns with the current study's focus on total insurance investment.

However, the findings regarding the effect of total insurance investment on economic growth in Nigeria diverge from some existing literature. While Ukpong and Acha (2017) emphasize the positive role of insurance investment in fostering economic growth, Dawd and Benlagha (2023) suggest a nuanced, non-linear relationship between insurance premiums (a proxy for investment) and economic growth. Nevertheless, their studies support the positive contribution of insurance sector growth to economic development, which aligns with the current research's focus on total insurance investment.

The study's results have significant implications for policymakers, practitioners, and stakeholders in Nigeria's economic landscape. The positive effect of insurance sector total claims on economic growth highlights the need to foster a robust insurance industry through enhanced regulatory frameworks and investment incentives. Additionally, recognizing the potential of total insurance investment to drive economic growth, policymakers and stakeholders can focus on incentivizing increased investment in the insurance sector. Practitioners can capitalize on these findings by expanding their market presence and investment portfolios. Overall, the implications underscore the critical role of the insurance sector in fostering sustainable economic growth and resilience in Nigeria.

CONCLUSION

This study's empirical findings unequivocally indicate that both total claims and total investment in the insurance sector exert a significant positive influence on economic growth in Nigeria. These results underscore the critical importance of cultivating a vibrant and robust insurance industry, as well as encouraging increased investment in the sector, to foster sustainable economic development and growth.

Furthermore, the study's findings highlight the insurance sector's potential to contribute substantially to broader economic resilience and stability, thereby emphasizing the need for policymakers and industry stakeholders to prioritize measures that promote the sector's development and expansion.

Recommendations

Based on the findings, the following recommendations are proposed for policymakers, practitioners, and investors

i. **Policymakers:**

- Prioritize enhancing the regulatory environment to foster innovation in the insurance industry.
- Implement measures to promote a conducive business environment.

ii. **Investors:**

- Incentivize investment in the insurance sector to stimulate economic growth.
- Facilitate increased investment to boost the industry's contribution to the economy.

iii. **Insurance Practitioners:**

- Expand market presence to reach a broader audience.
- Diversify investment portfolios to maximize contributions to economic development.

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