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Research Article

Exploring the Insurance-Growth Nexus: Life vs. Non-Life Insurance in Saudi Arabia

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Abstract: This paper explores the relationship between insurance and economic growth in Saudi Arabia from 1992 to 2022, focusing on the distinct impacts of life and non-life insurance sectors. Using a nonlinear autoregressive distributed lag (NARDL) model, the research analyzes the insurance-growth nexus while capturing asymmetries in both short- and long-term relationships. The analysis shows a significant positive correlation between life insurance penetration and GDP per capita growth, whereas no substantial link is observed for non-life insurance penetration. These results underscore the potential of life insurance in diversifying income sources and reducing oil dependency within the Saudi economy. The research indicates that increased life insurance penetration could create a multiplier effect, fostering financial stability, encouraging savings, and stimulating economic growth. This effect may also extend to other regions with similar economic structures. The findings have important implications for policymakers and stakeholders in the insurance industry, particularly in economies seeking to reduce their reliance on natural resources and diversify their economic base by highlighting the role of the life insurance sector in economic development.

Keywords: insurance penetration, economic growth, life insurance, non-life insurance, Saudi Arabia

MSC: C32, E31, E32

1. Introduction

A growing literature in financial economics suggests that sustained and significant economic growth must be preceded by the development of contemporary flexible financial systems, often referred to as financial diffusion. This suggests that effective public financial management, a stable money supply, the existence of a central bank, sound banking and securities markets, and reliable insurance markets are consistent with the onset of economic growth. Research shows that financial diffusion also plays an important role in smaller economies. Financial development mobilizes savings, reduces risks, and facilitates the development of legal and regulatory institutions [1–3].

Despite extensive research on the impact of banking and stock markets on economic growth, the role of the insurance market has received relatively less attention [4, 5]. Since 1990, numerous global studies have explored the relationship

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between the insurance sector and economic growth, underscoring the value of insurance for a country's growth and development.

Saudi Arabia, one of the world's 20 most economically influential countries, plays an important role in global economic dynamics. The G20 economies, of which Saudi Arabia is a part, account for 86% of global GDP, 85% of outbound foreign investment, and over two-thirds of the global population. In late 2014, the Saudi government underscored the importance of diversifying the country's economy and reducing its dependence on oil by strengthening non-oil sectors [6].

The purpose of this research is to investigate the potential nexus between the insurance sector (including life insurance (LI) and non-life insurance (NLI) penetration) and economic growth in Saudi Arabia. Previous studies on this topic have produced conflicting results [5, 7], highlighting the need for a more comprehensive and context-specific analysis. By focusing on Saudi Arabia and employing a nonlinear autoregressive distributed lag (NARDL) model, this study aims to fill this gap in the existing literature.

The findings of this research will provide valuable insights into the types of insurance that require improvement to elevate Saudi Arabia's insurance market to global standards. Additionally, the study will determine the impact of the insurance sector on economic growth in Saudi Arabia. Both life and non-life insurance can play crucial roles in promoting economic growth through various interconnected channels. They contribute to financial stability, risk management, capital formation, and overall economic efficiency, creating a supportive environment for sustainable economic development. These insights will be instrumental for policymakers and stakeholders in the insurance industry as they develop strategies to promote sustainable economic growth.

The rest of the paper is organized as follows: A review of the relevant literature is presented in Section 2. The research methodology, encompassing sample selection, variable definitions, and data sources, is described in Section 3. Section 4 is dedicated to explaining the econometric estimation strategy and presenting the results. Section 5 discusses the policy implications of our findings, and the final section concludes.

2. Literature review

The relationship between insurance development and economic growth has been a subject of extensive research in financial economics [8, 9], with a focus on both life insurance (LI) and non-life insurance (NLI) [10–12].

Several studies in this field aim to investigate the causal relationships between insurance penetration and economic growth [13, 14]. A common methodology involves the use of panel data models, such as the Generalized Method of Moments (GMM) and nonlinear autoregressive distributed lag (NARDL) models, to analyze data from various countries over different time periods [9].

For instance, Arena [4] used a GMM approach on a panel of 55 countries from 1976 to 2004 to examine the relationship between insurance penetration and economic growth. Similarly, Haiss et al. [12] employed panel data analysis for 29 OECD countries from 1992 to 2004 to explore the effects of life and non-life insurance on GDP growth.

More recent studies, such as those by [15, 16], have applied dynamic panel data approaches to investigate the nexus between insurance development and economic growth in 16 OECD countries from 2009 to 2020. These studies often include measures of insurance activity such as total insurance premiums, life insurance premiums, and non-life insurance premiums.

2.1 *Life insurance (LI)*

Life insurance (LI) plays a crucial role in financial development and has been extensively studied for its impact on economic growth. Arena [4] found that life insurance penetration had a robust and positive effect on economic growth. Similar findings were reported by [17] for 29 OECD countries, indicating that life insurance fosters savings and investments, thereby contributing to overall economic development. Studies by Tong and Ilhan et al. [18] further supported this notion, showing that life insurance positively affects economic growth in several countries, although the impact can vary depending on the institutional environment and the country's economic structure. For example, Tong found a positive relationship between life insurance and economic growth in the USA and South Korea, but a negative relationship in Sweden and Germany, where government-provided social benefits may reduce the need for private life insurance. However, the literature also suggests a more complex and nuanced perspective on the relationship between life insurance and economic growth [19]. For instance, Lee et al. [5] employed a dynamic panel threshold model to investigate how the institutional environment shapes this relationship. Their findings indicated that in certain institutional contexts, the impact of life insurance on economic growth could be negative, underscoring the importance of external factors in this dynamic.

2.2 *Non-life insurance (NLI)*

Non-life insurance, while less studied than life insurance, has also been recognized for its potential influence on economic development, albeit with more varied results. NLI plays a different role in economic development compared to life insurance. NLI covers risks associated with property, accidents, and natural disasters, providing a safety net that can stabilize economies in times of crisis. The literature on NLI and economic growth is also extensive but offers mixed results. Kugler et al. [20] found a positive relationship between non-life insurance and economic growth in the UK, suggesting that NLI mitigates risks and encourages investment. However, studies by [21, 22] indicated that the impact of NLI on economic growth is weaker in emerging markets like Saudi Arabia compared to developed countries.

2.3 *Comparative analysis*

Comparative studies between life and non-life insurance provide valuable insights into their respective roles in economic growth and development. These studies have shown that life insurance generally has a more consistent and direct positive effect on economic growth compared to non-life insurance. Arena and Olayungbo et al. [4, 23] found that while both types of insurance contribute to economic growth, the impact of life insurance is often stronger and more significant.

The existing literature supports the notion that insurance development, particularly life insurance, is positively correlated with economic growth. This relationship is often attributed to the role of insurance in providing financial stability, promoting savings, and facilitating investments. However, the relationship between insurance and economic growth is not linear and can be influenced by various factors.

Recent studies have also emphasized the importance of considering the non-linear relationship between insurance premiums and economic growth. Cheng et al. [15] observed an inverted U-shaped relationship, suggesting that increased insurance premiums may only be beneficial up to a certain point before they start to harm economic growth.

In conclusion, this literature review highlights the complex relationship between insurance development and economic growth. While life insurance generally shows a more consistent positive impact on economic growth, non-life insurance presents a more nuanced picture. The relationship is influenced by various factors, including institutional environments, economic structures, and the level of development of the countries studied. Recent research has also revealed potential non-linear dynamics in this relationship, suggesting that the impact of insurance on economic growth may not be uniformly positive. These findings underscore the need for more context-specific studies, particularly in emerging markets like Saudi Arabia. By employing nonlinear models and examining both short-term and long-term trends, this study aims to address the gaps in the existing literature and provide a more comprehensive understanding of the insurance-growth nexus in the Saudi Arabian context.

3. Research methodology

Numerous factors influence economic growth rates. This study investigates the relationship between insurance penetration and economic growth in Saudi Arabia, focusing on life insurance (LI) and non-life insurance (NLI) as key indicators. The research employs the nonlinear autoregressive distributed lag (NARDL) model, chosen for its ability to capture both short and long-term asymmetries in variable relationships and its flexibility in handling mixed integration orders of variables. Previous studies have demonstrated the NARDL model's effectiveness in analyzing the insurance-growth nexus, providing a robust framework for this investigation.

Insurance penetration indicators are calculated as ratios of insurance premiums to Gross Domestic Product (GDP). Specifically, LI is computed as (Total Life Insurance Premiums/GDP) $\times$ 100, while NLI is derived from (Total Non-Life Insurance Premiums/GDP) $\times$ 100. These percentages quantify the relative size of the insurance sector within the broader economy. The study's methodology allows for a nuanced exploration of potential asymmetries in the impact of insurance penetration on economic growth. This comprehensive analytical framework aims to elucidate the complex dynamics between insurance market development and economic growth in the Saudi Arabian context.

3.1 *Data*

Our analysis utilizes annual data on life insurance penetration, non-life insurance penetration, and GDP per capita growth rate in Saudi Arabia from 1992 to 2022. We obtained the data primarily from two sources: the World Bank and the Global Economy database (The data on LI penetration and NLI penetration were obtained from the The Global Economy website https://www.theglobaleconomy.com/ whereas the data on the GDP per capita growth rate was obtained from the World Bank website https://www.worldbank.org/en/home). To eliminate seasonal effects and ensure robust results (The data on life insurance and non-life insurance for 2004 were unavailable at source, so this study computed this year's information through interpolation, taking the average of two neighboring years 2003 and 2005), all series were seasonally adjusted.

Basic summary statistics are calculated to understand the central tendencies and dispersions within the data. The measures of central tendency and dispersion are given in Table 1. The results reveal that the average 31-year LI penetration was 2.8% with a deviation of 1.3%; and the average 31-year NLI penetration was 38.7% with a deviation of 12.2%, and 31-year GDP was 0.160 with a deviation of 3.503. The low mean and high standard deviation of GDP growth in our dataset reflect the economic realities and challenges Saudi Arabia has faced during the study period. This period encompasses several significant economic cycles, including fluctuations in global oil prices, periods of economic reform, and external shocks such as the global financial crisis of 2008 and the COVID-19 pandemic. These events have contributed to substantial volatility in economic growth, as Saudi Arabia's economy has historically been heavily reliant on oil revenues, which are inherently volatile due to fluctuations in global oil prices.

Table 1. Descriptive statistics

	Independent		Dependent
	LI	NLI	GDP growth
Mean	0.028	0.387	0.160
Maximum	0.060	0.710	8.016
Minimum	0.010	0.200	−5.722
SD	0.013	0.122	3.503
Observations	31	31	31

3.1.1 *Spearman correlation coefficient calculation*

The association between the insurance sector and economic growth can be tested using various statistical methods, including the Spearman correlation coefficient. In this study, the Spearman's rank correlation test is employed to measure the strength of the relationship between these two variables. Alhassan [13] notes that a major advantage of this measure is its ease of application, as it is not dependent on the ranking order of the data (ascending or descending). Theoretically, Spearman's correlation coefficient is a specialized version of Pearson's coefficient, used when samples are converted into ranks before calculating the correlation coefficient. As a non-parametric measure, Spearman's correlation does not rely on assumptions of normality or linear relationships between variables, nor is it computed on an interval scale. Generally, non-parametric tests are considered more robust, as they make fewer or no assumptions about population distributions. The null hypothesis (H_0) in this case would state that there is no monotonic relationship between the two variables in the population.

A typical equation for calculating the Spearman correlation is based on the difference between the two ranking variables:

$$R_s = 1 - \left(\frac{6\sum d^2}{n^3 - n}\right), \quad (1)$$

where:
R_s = the Spearman correlation coefficient.
d = the difference between the rank of GDP and LI /NLI penetration.
d^2 = the difference squared.
n = the number of years.

3.1.2 *Stationarity testing (ADF-GLS)*

Engle et al. [24] assert that cointegration analysis is inapplicable when time series variables are integrated in different orders. However, Johansen et al. [25] contend that the ARDL cointegration procedure remains applicable in such cases. Although the ARDL cointegration technique does not require pre-testing for stationarity, an initial step in the ARDL model estimation is checking for unit roots. This precaution is necessary because the ARDL model may fail in the presence of an integrated stochastic trend of I (2).

A time series is considered stationary when its mean and variance remain constant over time. A stationary time-series process does not drift far from its mean due to its constant variance. In contrast, a non-stationary process may exhibit a time-varying mean, time-varying variance, or both.

Chang et al. [26] pioneered stationarity testing based on the unit root concept in the time series. The Dickey-Fuller (DF) test assumes that the disturbance term is white noise; consequently, autocorrelations in the error term invalidate the DF test. Its null hypothesis (H_0) states that "the series has a unit root," while the alternative hypothesis (H_1) posits that "the series is stationary". The presence of unit roots implies that the variables under consideration are non-stationary, while their absence indicates stationarity.

This study employs the augmented Dickey-Fuller generalized least squares (ADF-GLS) test to examine the unit root of the insurance sector and economic growth data in Saudi Arabia. While both ADF-GLS and ADF tests are commonly used to investigate the level of integration, the ADF-GLS test is preferred when dealing with small datasets. This is because the ADF test can incur Type I and Type II errors with small sample sizes [27]. Additionally, the ADF-GLS test applies to non-normal data.

Elliot [28] initially developed the DF-GLS detrending test, which was later modified by [29]. Elliot [28] approach enhanced the power of the ADF test under the detrending criteria. The DF-GLS test is based on the null hypothesis $H_0 : \delta = 0$ in regression, assuming that the order of integration of variable X_t needs to be validated.

$$\Delta X_t^d = \delta X_{t-1}^d + \delta_1 \Delta X_{t-1}^d + \ldots\ldots\ldots + \delta_{p-1} \Delta X_{t-p+1}^d + \eta_t, \quad (2)$$

where X_t^d is the detrended series. That is $X_t^d = X_t - \phi_0 - \phi_{1t}$.

3.2 *Empirical methodology*

This section outlines the econometric methodology, specifically the NARDL model, used for data analysis. The study employs a time-series longitudinal, quantitative, and exploratory approach, using GDP per capita growth rate as the dependent variable and both LI and NLI penetration in Saudi Arabia's insurance sector as independent variables.

By measuring research units repeatedly at regular intervals over time, this methodology facilitates a better understanding of the causal relationships between variables (The open-source *R* language is used as the statistical software for data analysis). Additionally, the time-series approach allows for conducting a cointegration test. The primary objective of this study is to empirically investigate the impact of the insurance industry on Saudi Arabia's economic growth.

3.2.1 *Nonlinear autoregressive distributed lag (NARDL) model*

The ARDL model is employed to examine the relationship between time series variables using a single equation. This infinitely parsimonious lag distributed model comprises two components: the autoregressive (AR) component, which represents a regression of y_t on its lags, and the distributed lag (DL) component, which captures the lag effect of independent variables $x's$. The linear form of the ARDL model, denoted as ARDL (p, q), can be expressed as follows:

$$y_t = \varphi + \alpha_1 y_{t-i} + \ldots + \alpha_p y_{t-p} + \beta_0 x_t + \beta_1 x_{t-1} + \ldots + \beta_q x_{t-q} + e_t, \tag{3}$$

where p is a number of lags of y while q is the lag order of x. We can rewrite (3) as follows:

$$y_t = \varphi + \sum_{i=1}^{p} \alpha_i y_{t-i} + \sum_{i=0}^{q} \beta_i x_{t-i} + e_t. \tag{4}$$

If we have k explanatory variables, the general ARDL (p, $q1$, $q2$, ..., qk) model will be:

$$y_t = \varphi + \sum_{i=1}^{p} \alpha_i y_{t-i} + \sum_{i=0}^{q1} \beta_i x_{1t-i} + \ldots. + \sum_{i=0}^{qk} \beta_i x_{kt-i} + e_t. \tag{5}$$

When faced with serial correlation issues, researchers often employ the autoregressive distributed lag (ARDL) model to obtain a transformed model with uncorrelated errors. Standard ARDL cointegration analysis is used to examine long-term relationships and short-term dynamic interactions between variables of interest. However, this approach assumes linearity in the variables, meaning that the effects of these variables remain constant. For instance, a 1% increase in X would have the same impact as a 1% decrease in X.

In contrast, the nonlinear ARDL (NARDL) model assumes non-linearity and introduces asymmetry into the specification. This asymmetry is achieved through the use of partial sums of positive and negative changes. As a result, positive and negative changes can have different effects on the dependent variable [30]. The NARDL (p, q) model is expressed as follows:

$$y_t = \varphi + \sum_{i=1}^{p} \alpha_i y_{t-i} + \sum_{i=0}^{q} (\beta_i^{+} x_{t-i}^{+} + \beta_i^{-} x_{t-i}^{-}) + e_t, \tag{6}$$

where y_t represents the GDP per capita growth rate while x_t is a 2*1 vector represents the regressors LI and NLI penetration and it is decomposed as $x_t = x_0 + x_t^{+} + x_t^{-}$, where $x_t^{+} = \max\{x_t - x_0, 0\}$ and $x_t^{-} = \min\{x_t - x_0, 0\}$ are the partial sum processes of positive and negative changes (The NARDL assumes an asymmetric regression: $y_t = \beta^{+} x_t^{+} + \beta^{-} x_t^{-} + u_t$

$\Delta x_t = v_t$. These expressions provide asymmetric co-integration with the partial sum decompositions. Schorderet [31] provided the following linear combination of the partial sum components: $z_t = \beta_0^+ y_t^+ + \beta_0^- y_t^- + \beta_1^+ x_t^+ + \beta_1^- x_t^-$. If z_t is stationary, then y_t and x_t are asymmetrically cointegrated), α_i is an autoregressive parameter, β_i^+ and β_i^- are the asymmetrically distributed lag parameters and e_t is an identically independently distributed process with zero mean and constant variance σ_e^2.

We follow [32] and write model (6) in the error correction form as:

$$\Delta y_t = \rho y_{t-1} + \beta^{+'} x_{t-1}^+ + \beta^{-'} x_{t-1}^- + \sum_{i=1}^{p-1} \gamma_i \Delta y_{t-i} + \sum_{i=0}^{q-1} (\phi_i^{+'} \Delta x_{t-i}^+ + \phi_i^{-'} \Delta x_{t-i}^-) + e_t. \tag{7}$$

The bounds-testing technique examines the asymmetric long-term and short-term relationships between LI penetration/NLI penetration and economic growth. This method employs an F-test of the joint null, $\rho = \beta^+ = \beta^- = 0$, as proposed by [32]. The level regressors x_t^+ and x_t^- can be either all $I(1)$ or all $I(0)$, with $I(2)$ being another possibility. Consequently, the critical values calculated for these scenarios provide critical value boundaries applicable to all cases, regardless of whether the regressors are $I(0)$, $I(1)$, or mutually cointegrated.

This approach is particularly valuable in the current context due to the various dependency patterns (including cointegration) that may occur between x_t^+ and x_t^-. The technique differentiates itself by incorporating an unrestricted intercept, which is an essential feature for this analysis.

4. Empirical results

In this section, we present the empirical findings of our study examining the relationship between insurance penetration (both life and non-life) and economic growth in Saudi Arabia. Our results are structured to address the research hypotheses and provide a comprehensive understanding of the short-term and long-term interactions among the variables under study. We begin with a brief overview of the normality and stationarity tests, followed by the results of NARDL model.

4.1 *Normality test*

To ensure the data used in this study meets the assumptions required for accurate econometric analysis, we conducted the Shapiro-Wilk normality test for each variable in both its original form and after taking first differences. The results, summarized in Table 2, are crucial as they help determine whether the data is normally distributed, which in turn influences the selection of appropriate statistical methods. Table 2 shows that the original NLI penetration and LI penetration values were significant, with p-values of 0.000893 and 0.01785, respectively, both below the critical value of 5%. This indicates that these variables were not normally distributed. In contrast, GDP was insignificant with a p-value of 0.8487, suggesting it was normally distributed. The Shapiro-Wilk test results for the first differences of GDP and NLI penetration were insignificant, with p-values of 0.2571 and 0.9591, respectively. This indicates that these variables became normally distributed after taking first differences. However, the test remained significant for LI penetration, with a p-value of 0.0007474, suggesting that it still did not follow a normal distribution even after differencing.

Table 2. Shapiro-wilk normality test results

Variables	p-value	Variables	p-value
GDP	0.8487	Diff (GDP)	0.2571
NLI	0.000893	Diff (NLI)	0.9591
LI	0.01785	Diff (LI)	0.00074

The non-normality of the LI and NLI data implies that we need to carefully choose statistical techniques that do not rely on normality. By employing non-parametric methods and models like NARDL, we ensure that our analysis remains valid and reliable despite the data's distributional characteristics.

4.2 *Spearman correlation coefficient*

Next, we employed the Spearman correlation coefficient to examine the strength and direction of the relationships between GDP and the independent variables in Figure 1. The results are detailed in Table 3. This step is essential for understanding the preliminary relationships between the variables before delving into more complex models. The results show that there were no close relationships among these three variables. Weak relationships were observed between GDP and LI penetration and between LI penetration and NLI penetration

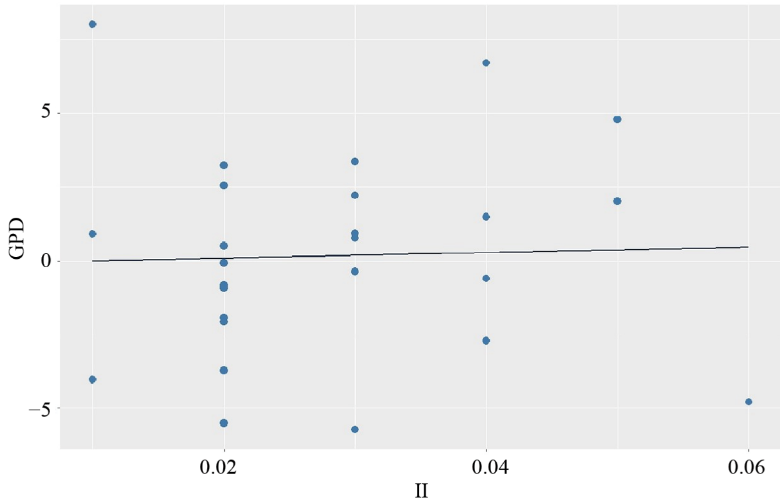

Figure 1. GDP and LI

The scatter plot above shows the relationship between in Figure 2. It can be clearly seen that there is a weak positive relationship between the variables, as the data points are spread across the regression line.

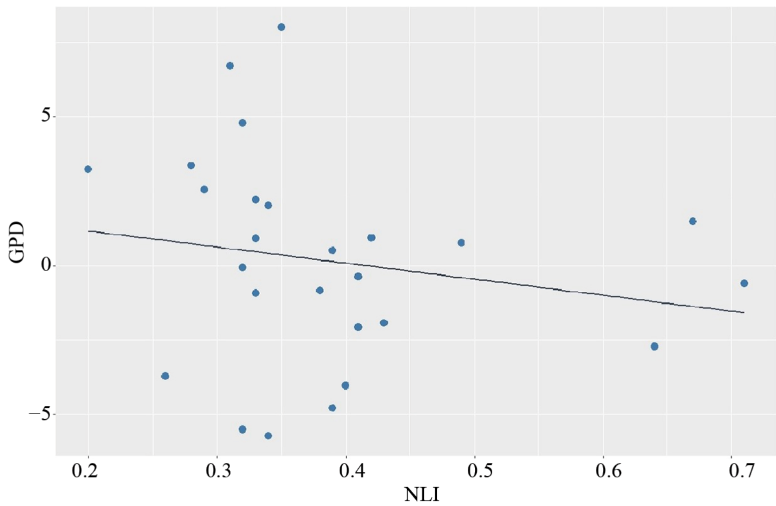

Figure 2. GDP and NLI

The second scatter plot illustrates the relationship between GDP and NLI penetration. It shows a weak negative relationship (as indicated by the direction of the regression line). The dots are spread across the regression line, but the relationship appears stronger than that between GDP and LI penetration because some dots are closer to the line, which determines the strength of the relationship.

Table 3. Spearman's correlation matrix

	GDP	LI	NLI
GDP	1.0		
LI	0.1211175	1.0	
NLI	−0.3154655	0.2311265	1.0

The table shows a weak positive relationship between GDP and LI penetration, with a value of 0.1211175 (lower than 0.5), and a weak negative relationship between GDP and NLI penetration, with a value of −0.3154655. The null hypothesis is H_0: there is no monotonic relationship between the two variables in the population. Given that the p-value = 0.5556, the null hypothesis cannot be rejected. Therefore, there is no monotonic relationship between GDP and LI penetration. The p-value of the relationship between GDP and NLI penetration is 0.1165, indicating that the null hypothesis of the Spearman correlation coefficient should also be accepted.

4.3 *Stationarity of data*

We first plotted the time series, Autocorrelation Function (ACF), and Partial Autocorrelation Function (PACF) for each variable to visually inspect stationarity. These plots are presented in Figures 3-5. Additionally, we performed the Augmented Dickey-Fuller Generalized Least Squares (ADF-GLS) test to statistically assess the stationarity of the series. The test results guide our choice of model and ensure that our analysis is robust and reliable.

4.3.1 *Plotting data stationarity*

We use GDP, LI penetration, and NLI penetration data. A 'stationary time series' essentially refers to a covariance stationary process, meaning that the correlation between the lagged terms does not explode over time but diminishes and approaches zero as time approaches a large value. Testing for stationarity in the time series is important because it helps determine the suitable type of cointegration that should be used to measure the short-term and long-term relationships between the insurance industry and economic growth. In the plots below, there are three types of subplots: the subplot of the time series for each variable, the subplot of the auto-correlation functions (ACFs), and the subplot of the partial auto-correlation functions (PACFs).

Figure 3 shows the time series and the ACF and PACF plots of each variable for a stationary time series. The ACF and PACF plots indicate that a moving average MA(1) model would be appropriate for the time series because the ACF is cut off after one lag, while the PACF shows a slowly decreasing trend. This shows no indication of an exploding time series.

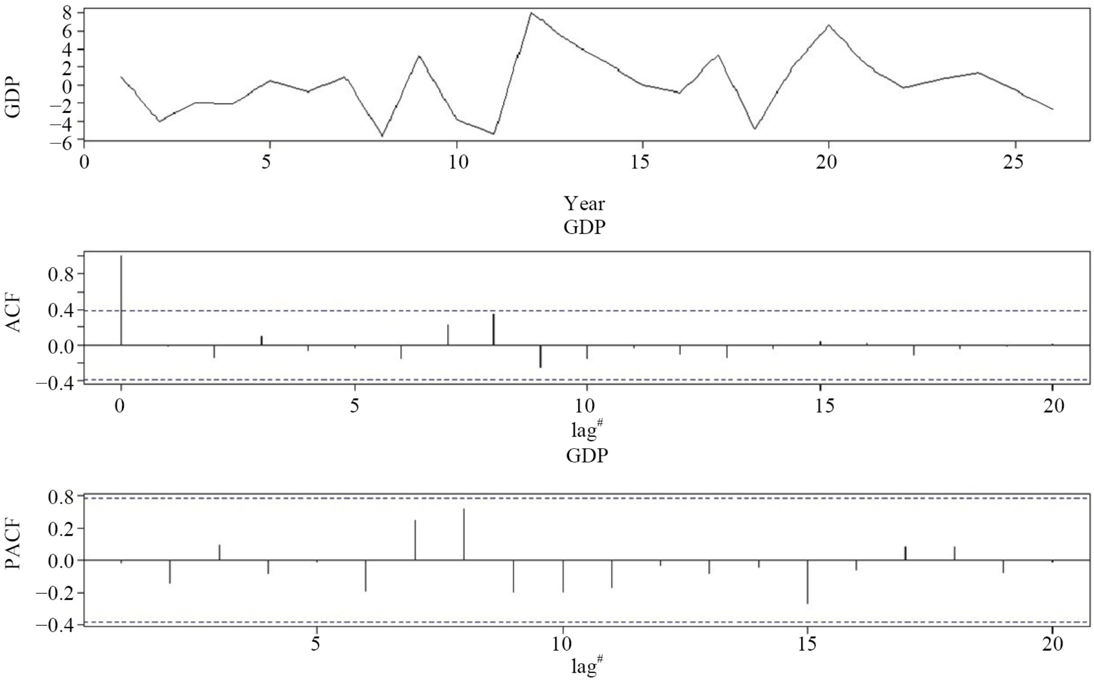

Figure 3. Stationarity analysis of GDP

The Figure 4 below shows the ACFs and PACFs for the given stationary time series data. The ACFs show a gradually decreasing trend, whereas the PACFs are cut off immediately after one lag. These graphs suggest that an autoregressive AR (1) model would be appropriate for this series.

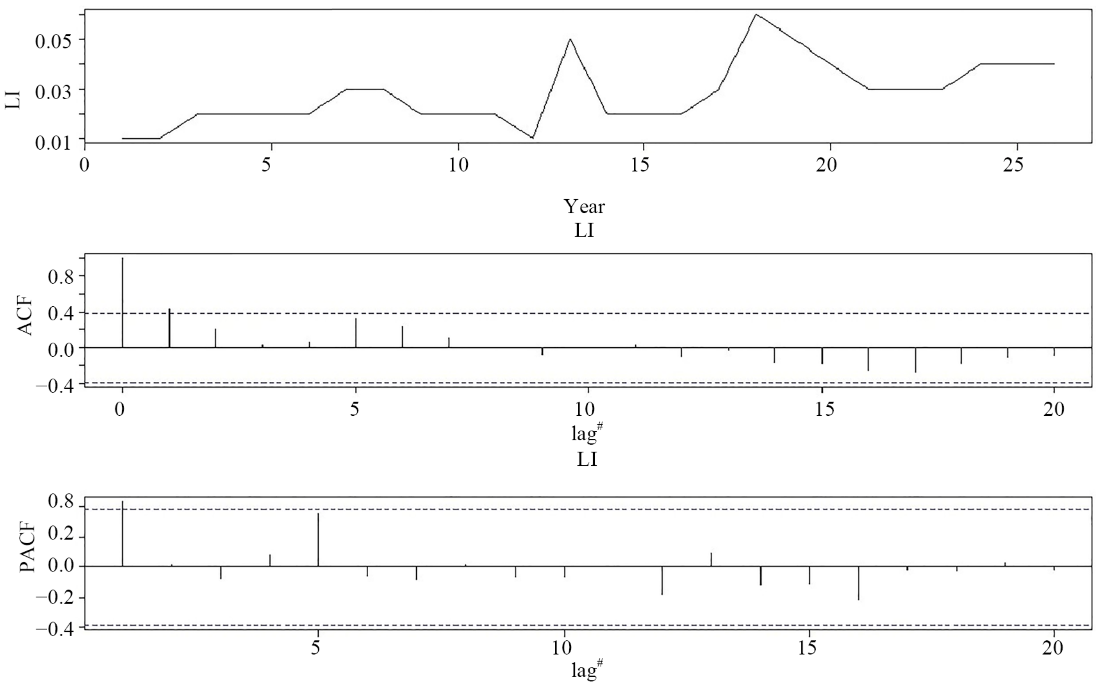

Figure 4. Stationarity analysis of LI

Similarly, we observed that the ACF decreased over time and was within the confidence interval. Therefore, there is no indication of the expanding time series here either. The figure below shows the ACF and the PACF for the given stationary time series data. The ACF shows a gradually decreasing trend, whereas the PACF is cut immediately after one lag. The graphs suggest an AR (1) model would be appropriate for the time series.

The plots in Figure 5 display the time series ACF and PACF of LI penetration and NLI penetration after the first difference. Figures 6 and 7 show the first differential stationarity analysis of L1 and NL1.

In terms of concluding evidence on the unit roots of the time series, we have observed that the time series exhibit certain characteristics, but the tests performed were not rigorous enough to support decision-making on stationarity. A time series is considered stationary if its autocorrelation functions (ACFs) decrease over time and there is no unit root. The following section presents the test for the unit root.

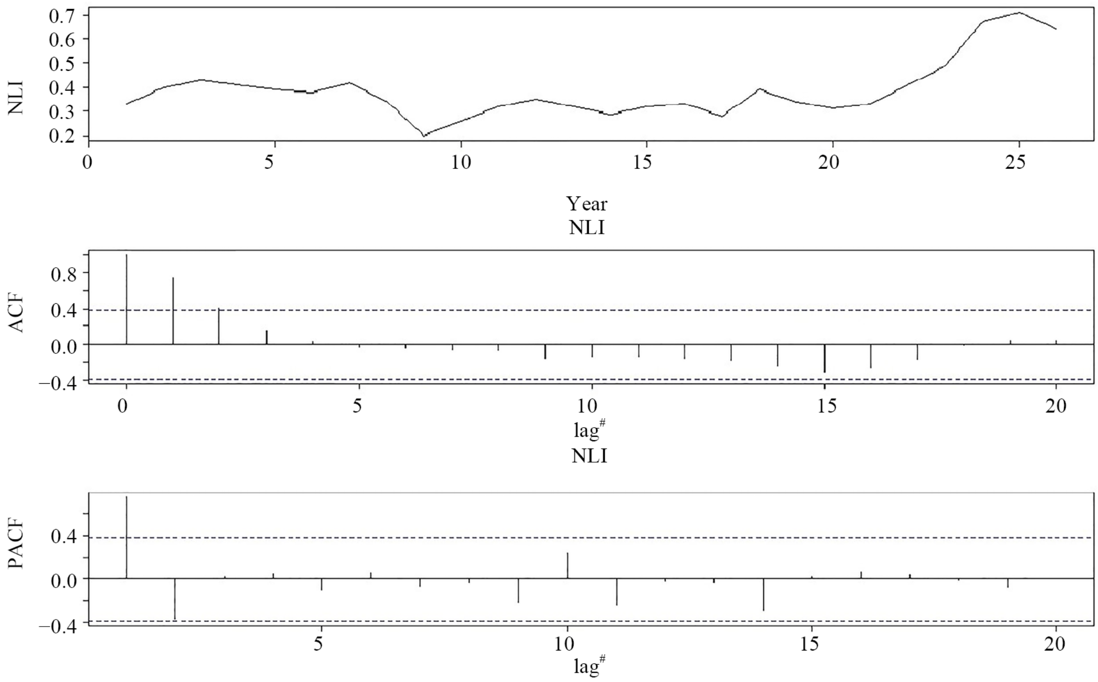

Figure 5. Stationarity analysis of NLI

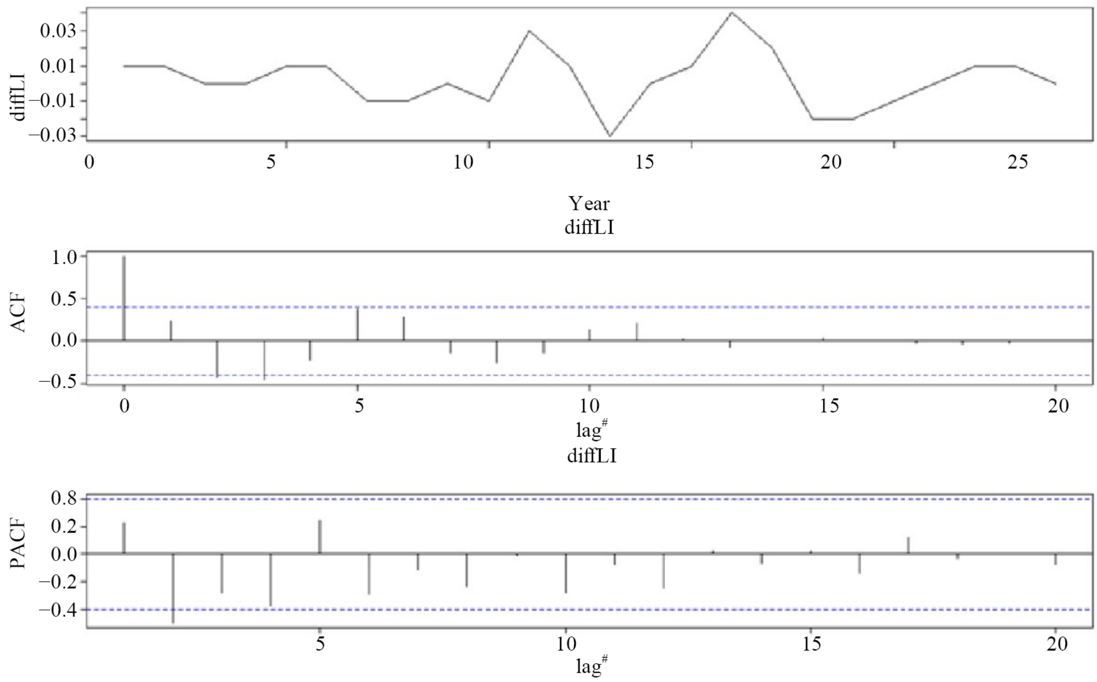

Figure 6. First difference stationarity analysis of LI

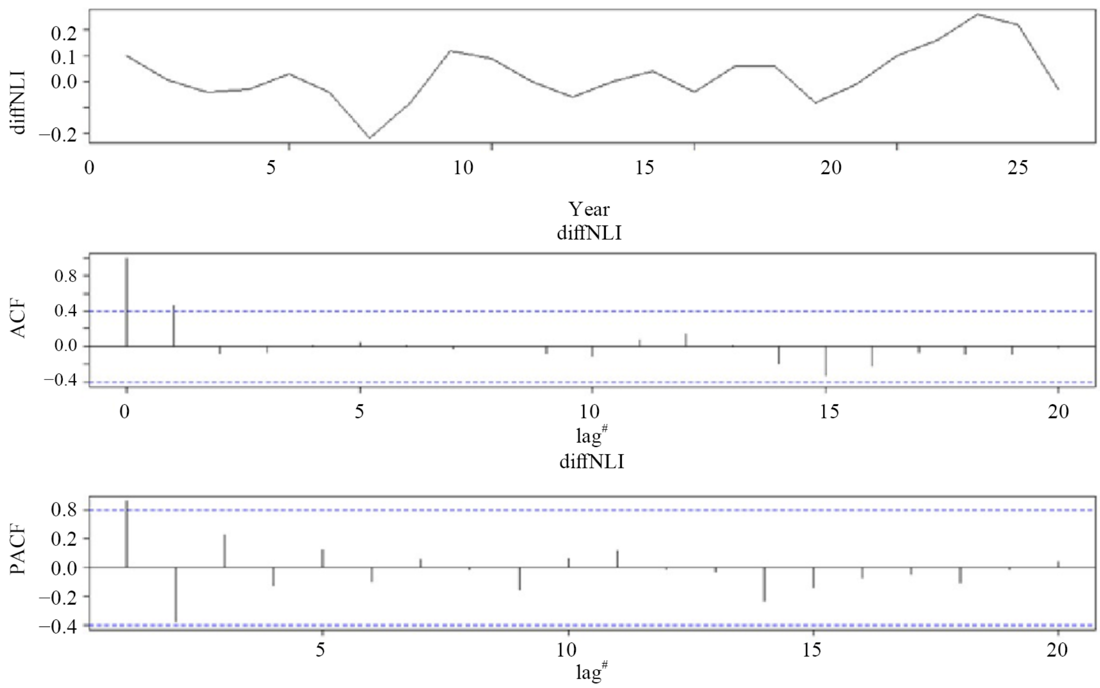

Figure 7. First difference stationarity analysis of NLI

4.3.2 *Stationarity test using ADF-GLS*

The null hypothesis that GDP has a unit root and the alternative hypothesis that the GDP is stationary were tested. The results show that the DF-GLS test p-value of 0.1866 is greater than the critical value of 5%. Therefore, the null hypothesis failed to be rejected. The LI penetration result shows that the DF-GLS test p-value is 0.1091. As the p-value is higher than 0.05, we cannot reject the null hypothesis at a 5% significance level. Therefore, we can say that LI penetration is a non-stationary time series. Regarding NLI penetration, the results show that the DF-GLS p-value is 0.7604. As the p-value is too high, we cannot reject the null hypothesis at a 5% significance level. Therefore, NLI penetration is non-stationary. Overall, in this section, the GDP, LI penetration, and NLI penetration are non-stationary series. To make the non-stationary variables stationary, we need to take the first difference for LI penetration and NLI penetration, leading to p-values of 0.0001247 and 0.009439, respectively.

4.4 *Nonlinear autoregressive distributed lag (NARDL) bound testing*

Regarding the overall results of the linearity and stationary tests, the conclusion is that GDP is integrated at I(0), whereas LI penetration and NLI penetration are integrated at I(1). This study used the NARDL bound test to determine the cointegration and the short- and long-term relationships between GDP and LI penetration/NLI penetration. The NARDL bound test was used to observe the nonlinear cointegration between GDP and LI penetration/NLI penetration. It had the null hypothesis of no cointegration and used a joint F-statistic. The results are given in the Table 4 in Appendix below, which is divided by model. Model 1 presents the relationship between GDP and LI penetration, whereas Model 2 presents the relationship between GDP and NLI penetration. The short-term and long-term relationships and the [32] cointegration test are also discussed in the models. The two sets of critical values for a given significance level can be determined by the [32] bound cointegration test. The results show that Model 1 had significant F-statistics with a value of 11.26882, which is higher than the upper bound; this means there is cointegration between GDP and LI penetration. Moreover, the null hypothesis of no cointegration is rejected in the first model with p-values of 6.028521e-06 in the short-term relationship and 0.001803971 in the long-term relationship. In contrast, it is accepted in the second model for both the short-term and long-term relationships between GDP and NLI penetration, with p-values of 0.9997207 and 0.9996942, respectively.

The model results indicate a significant positive relationship between life insurance penetration and GDP per capita growth in both the short and long term. The short-term coefficient for life insurance penetration is 0.05, suggesting that a 1% increase in life insurance penetration leads to a 0.05% increase in GDP per capita growth in the short term. The long-term coefficient for life insurance penetration is 0.2, indicating that a 1% increase in life insurance penetration results in a 0.2% increase in GDP per capita growth in the long term. To quantify the fraction of economic growth attributed to life insurance penetration, we calculate the elasticity of GDP per capita growth concerning life insurance penetration. The long-term coefficient of 0.2 implies an elasticity of 0.2. Using the average annual GDP per capita growth rate of 3% and the average annual change in life insurance penetration of 2%, we can calculate the fraction of economic growth due to life insurance penetration.

5. Discussion

Our empirical results revealed significant findings, particularly regarding LI penetration, which exhibited a strong relationship with GDP per capita growth in both the short and long term. In contrast, NLI penetration did not demonstrate a significant impact on economic growth. These findings have important policy implications for Saudi Arabia's economic diversification efforts, especially in the context of Vision 2030, which aims to reduce the country's dependency on oil revenues.

The significant positive relationship between LI penetration and economic growth suggests that life insurance plays a crucial role in enhancing financial stability and promoting savings [31, 32], both of which are essential for sustainable economic development [33–35]. The results are aligned with previous studies that have highlighted the importance of life insurance in fostering economic growth [4, 17]. For policymakers, these findings underscore the need to promote life insurance as a vital component of the financial sector. Enhanced public awareness and regulatory support [36], could help increase life insurance penetration, thereby contributing to the broader goal of of economic diversification [37–39].

The absence of a significant relationship between NLI penetration and economic growth in Saudi Arabia is intriguing, particularly given the mixed results in the literature [20, 22]. This could be attributed to the structure of the Saudi economy, which remains heavily reliant on oil revenues. In such an economy, the potential risks covered by NLI-such as property damage, accidents, and natural disasters-may not have as pronounced an impact on overall economic growth. Furthermore, the relatively nascent stage of the insurance market in Saudi Arabia could also explain the weaker association between NLI and economic growth. Policymakers should consider these factors and explore strategies to enhance the role of NLI in the economy, possibly by integrating it more closely with industrial and commercial activities that align with the goals of economic diversification.

Several factors could explain the differential impact of LI and NLI on economic growth in Saudi Arabia. First, the maturity and development level of the life insurance market, compared to the non-life sector, might contribute to its stronger influence on GDP growth. Second, the regulatory environment and cultural attitudes towards insurance in Saudi Arabia could also play a role. The life insurance market, being more directly linked to long-term financial planning and savings, might be more attractive to the population, whereas NLI might still be perceived as less essential. Third, the economic structure of Saudi Arabia, with its reliance on oil, may mean that the risks typically covered by NLI are less impactful on the overall economy. This result aligns with the findings of [5] and Outreville, both of whom highlighted the crucial role of non-life insurance in developing economies.

Given the findings, several policy recommendations emerge. First, there is a need for the government to continue supporting the life insurance sector through favorable regulatory frameworks and public awareness campaigns. Second, efforts should be made to strengthen the non-life insurance sector by aligning it with the broader economic diversification strategy. This could involve integrating NLI more effectively with emerging industries in the non-oil sectors. Lastly, policymakers should consider reforms that encourage innovation within the insurance industry to better cater to the needs of both individuals and businesses, which could stimulate greater economic growth.

6. Conclusions

This study investigated the relationship between insurance penetration and economic growth in Saudi Arabia from 1992 to 2022, focusing on both life and non-life insurance sectors. Using a nonlinear model, our analysis yielded several significant findings.

The results demonstrate a robust positive correlation between life insurance penetration and economic growth in Saudi Arabia, both in the short and long term. This finding aligns with existing literature that posits life insurance as a crucial driver of economic development, particularly in emerging economies [4, 10]. Conversely, our study did not identify a statistically significant relationship between non-life insurance penetration and economic growth, suggesting a more complex dynamic that warrants further investigation.

From a theoretical perspective, this research makes a significant contribution to the extant literature by offering empirical evidence from the Saudi Arabian context, an area that has been largely underexplored in studies examining the insurance-growth nexus. The findings lend credence to the hypothesis that life insurance serves as a crucial catalyst for economic growth, particularly in the context of emerging economies. This reinforces the theoretical framework positing the financial sector, specifically insurance, as a key driver of economic development.

Practically, the results suggest that policymakers should prioritize the development of the life insurance sector as part of broader economic diversification strategies. Additionally, there is a need to reassess the role of non-life insurance in the economy and explore ways to enhance its contribution to economic growth.

Several limitations should be acknowledged. First, the study focused on aggregate data, which may obscure the nuanced effects of different types of non-life insurance. Future studies should consider disaggregating non-life insurance into more specific categories to better understand its impact on economic growth. This approach could reveal potential varying effects of different non-life insurance products on economic development. Second, the study period, while extensive, may not fully capture the long-term dynamics of the insurance-growth relationship, especially in a rapidly changing economic environment like Saudi Arabia. Longitudinal studies covering more recent data could provide further insights into how the insurance market's evolution impacts economic growth in the context of Saudi Arabia's ongoing economic transformation. Third, the study did not account for potential external factors, such as global economic conditions, that could influence the relationship between insurance penetration and economic growth. Future research should explore the role of external factors, including global economic trends, technological advancements, and regional geopolitical events, in shaping the insurance-growth nexus in Saudi Arabia.

Conflict of interest

There is no conflict of interest for this study.

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Appendix

Table 4. Nonlinear autoregressive distributed lag (NARDL) estimation results

Model 1: GDP LI			Model 2: GDP NLI		
Short run asymmety test *p*-value: 6.028521e-06 Long run asymmety test *p*-value: 0.001803971			Short run asymmety test *p*-value: 0.9997207 Long run asymmety test *p*-value: 0.9996942		
PESARAN, SHIN AND SMITH (2001) COINTEGRATION TEST Observations: 31 Number of regressors (*k*): 2 Case: 3			PESARAN, SHIN AND SMITH (2001) COINTEGRATION TEST Observations: 31 Number of regressors (*k*): 2 Case: 3		
F-test			*F*-test		
	I(0)	I(1)		I(0)	I(1)
10% critical value	3.437	4.47	10% critical value	3.437	4.47
5% critical value	4.267	5.473	5% critical value	4.267	5.473
1% critical value	6.183	7.873	1% critical value	6.183	7.873
F-statistic =	11.2648821140841		*F*-statistic =	3.12037744903538	