"Asymmetric effects of life and non-life insurance on economic growth in Saudi Arabia: A nonlinear analysis"

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ASYMMETRIC EFFECTS OF LIFE AND NON-LIFE INSURANCE ON ECONOMIC GROWTH IN SAUDI ARABIA: A NONLINEAR ANALYSIS

Abstract

This paper explores the asymmetric effects of life and non-life insurance on economic growth in Saudi Arabia. Quarterly data on insurance penetration rates and GDP growth from 2009 to 2022, obtained from the Global Economy, Saudi Arabian Monetary Authority, and World Bank databases, are utilized. A nonlinear autoregressive distributed lag (NARDL) model is employed to examine the relationships between insurance and growth. The results reveal a significant and asymmetric relationship between life insurance penetration and GDP growth. Specifically, a 1% increase in life insurance penetration is associated with a 0.3% increase in GDP growth in the long run, while a 1% decrease shows no significant effect. For non-life insurance, both increases and decreases demonstrate significant but asymmetric impacts on growth. A 1% increase in non-life insurance penetration corresponds to a 0.2% increase in GDP growth, whereas a 1% decrease is linked to a 0.15% decrease in GDP growth. These findings support the 'supply-leading' hypothesis, suggesting that the insurance sector can play a leading role in promoting economic growth. The results provide new quantitative insights into the relationship between insurance and economic growth in Saudi Arabia, offering valuable implications for policymakers. It is suggested that the insurance industry can be leveraged to foster economic growth by promoting life insurance and managing the asymmetric impacts of non-life insurance.

Keywords	insurance, growth, nonlinearity, asymmetry, Saudi Arabia
JEL Classification	C32, E31, E32

INTRODUCTION

The relationship between financial sector development and economic growth has been the subject of extensive research in economics and finance. In this context, the role of the insurance industry in promoting economic growth has gained increasing attention in recent years. Insurance, as a risk transfer mechanism, plays a crucial role in economic development by facilitating risk management, encouraging savings, and mobilizing capital for productive investments.

Saudi Arabia, as the largest economy in the Middle East and a key player in the global oil market, presents an interesting case study for examining the insurance-growth nexus. The country has been actively pursuing economic diversification strategies to reduce its dependence on oil revenues, and the development of the financial sector, including insurance, is a key component of this effort. The Saudi insurance market has experienced significant growth and transformation over the past decade, driven by the implementation of compulsory health insurance and motor insurance policies, along with increased awareness of insurance products. However, the insurance penetration rate

in Saudi Arabia remains relatively low compared to developed economies, suggesting potential for further growth and impact on the broader economy.

Despite the importance of understanding the relationship between insurance sector development and economic growth in Saudi Arabia, there is a lack of comprehensive research examining this relationship, particularly in distinguishing between the effects of life and non-life insurance. Furthermore, potential nonlinearities and asymmetries in this relationship have not been adequately explored in the Saudi context. This gap in the literature presents a significant opportunity for research that can provide valuable insights for policymakers and industry stakeholders.

1. LITERATURE REVIEW

Researchers have extensively studied the relationship between insurance sector development and economic growth in recent decades. This section provides an overview of the theoretical foundations and empirical evidence surrounding the complex interplay between insurance and economic growth, with a focus on developing economies and nonlinear modeling approaches.

Recent studies, such as those by Dawd and Benlagha (2023) and Cheng and Hou (2022), have further explored the relationship between insurance sector development and economic growth within the broader context of financial development. This body of research has identified several key channels through which insurance can contribute to economic development, including risk management, financial inclusion, and investment (Lee et al., 2013; Outreville, 2013). Through the examination of these channels, researchers have gained a deeper understanding of the complex relationship between insurance and economic growth.

Insurance contributes to economic development through several mechanisms. According to Skipper (1997), it facilitates risk transfer, enabling riskier but potentially more productive activities. Ward and Zurbruegg (2000) highlight insurers' role as financial intermediaries, investing premiums to aid capital formation. Beck and Webb (2003) note that life insurance products can serve as savings vehicles, promoting long-term capital accumulation. Olayungbo and Akinlo (2016) suggest that insurance may encourage risk-reducing behaviors, while Zou et al. (2017) argue that this leads to more efficient resource allocation. Finally, Arena (2008) posits that insurance complements banking by providing guarantees and reducing credit risk. While these theoretical channels collectively suggest a positive relationship between insurance sector development and economic growth, it is important to note that the strength and direction of this relationship may vary depending on the specific context and type of insurance under consideration. This variability underscores the need for nuanced, context-specific research in this field.

Empirical studies on the insurance-growth nexus have produced varied results, reflecting differences across countries, time periods, and methodological approaches (Apergis & Poufinas, 2020). Cross-country studies have provided valuable insights, with Ward and Zurbruegg (2000) finding evidence of both bidirectional and unidirectional causality between insurance and economic growth in OECD countries. Arena (2008) demonstrated a positive impact of life and non-life insurance on economic growth, particularly in developing nations. Focusing on developing economies, Haiss and Sümegi (2008) observed a positive relationship between non-life insurance and economic growth in emerging European markets, though results for life insurance were mixed. Additionally, Cheng and Hou (2022) noted variability in the insurance-growth nexus across 25 European countries and various insurance types over a period of 20 years. Moreover, Alhassan's (2016) study, which examined eight African countries from 1990 to 2013, identified a long-run relationship between insurance penetration and economic growth, finding a positive impact of insurance on economic development.

Recent research has employed nonlinear modeling techniques to capture potential asymmetries (Xu & Gui, 2021; Lee et al., 2016). Hemrit and Benlagha (2020) indicated that insurance premiums have nonlinear effects on non-oil GDP, suggesting that increases in premiums can lead to varying impacts

on economic growth depending on the economic context. Chang et al. (2014) revealed that the impact of insurance on economic growth is contingent on financial development levels, while Balcilar et al. (2018) and Pradhan et al. (2017) demonstrated that the causal relationship varies across economic growth quantiles.

Although the insurance-growth relationship has been extensively studied, certain areas remain underexplored. In particular, the dynamics of this relationship in emerging economies with unique economic structures warrant further investigation. The case of Saudi Arabia, with its significant economic influence and evolving insurance market, presents an intriguing research opportunity that has been largely overlooked in existing literature.

Previous studies have often employed aggregated insurance measures, potentially masking the nuanced impacts of different insurance types. Life and non-life insurance, for instance, may have distinct effects on economic growth, a distinction that merits closer examination. Moreover, while nonlinear modeling approaches have gained traction in cross-country analyses, their application in country-specific contexts remains limited. The rapidly changing landscape of Saudi Arabia's insurance sector, characterized by recent regulatory reforms and market developments, necessitates a fresh examination using current data. Many existing studies rely on outdated information that fails to capture these recent shifts, potentially leading to incomplete or outdated conclusions.

This study aims to address these gaps by analyzing the insurance-growth nexus in Saudi Arabia. By differentiating between life and non-life insurance and utilizing a nonlinear modeling approach, the study seeks to uncover potential asymmetries in this relationship. This methodology allows for a more nuanced understanding of how various facets of the insurance sector contribute to economic growth.

2. METHODOLOGY

This analysis utilizes quarterly data spanning from 2009: Q1 to 2022: Q4. This time frame was selected based on the availability of consistent and

reliable data, as well as the desire to capture recent developments in the Saudi insurance market. Table 1 presents the various sources from which the data for this analysis were obtained. Table 2 provides a comprehensive explanation of the variables included in the analysis.

Table 1. Data sources

Economic growth data	Quarterly GDP growth rates are obtained from the Saudi Arabian Monetary Authority (SAMA), the General Authority for Statistics (GASTAT), and World Bank's database. https://data.worldbank.org/country/saudi-arabia
Insurance penetration data	Life and non-life insurance penetration rates are sourced from SAMA's annual and quarterly reports on the insurance sector, and The Global Economy website https://www.theglobaleconomy.com/Saudi-Arabia/
Control variables	Data on additional economic indicators are collected from SAMA, GASTAT, and the World Bank's World Development Indicators database. https://databank.worldbank.org/reports.aspx?source=2&country=ARE

Table 2. Variables included in the analysis

Dependent Variable	
GDP growth rate (**GDPG**)	Quarterly growth rate of real GDP, seasonally adjusted
Independent Variables	
Life insurance penetration (**LIP**)	Ratio of life insurance premiums to GDP
Non-life insurance penetration (**NLIP**)	Ratio of non-life insurance premiums to GDP
Control Variables	
Inflation rate (INF)	Quarterly change in the consumer price index
Government expenditure (**GOVEXP**)	Ratio of government expenditure to GDP
Trade openness (**TRADE**)	Sum of exports and imports as a percentage of GDP
Financial development (**FINDEV**)	Domestic credit to the private sector as a percentage of GDP

To examine the relationship between insurance sector development and economic growth in Saudi Arabia, this study employs a nonlinear autoregressive distributed lag (NARDL) model, which was introduced by Shin et al. (2014). This approach allows for the examination of both long-run and short-run asymmetries in the relationship between variables, providing a more nuanced understanding of the insurance-growth nexus. The NARDL model, an extension of the linear ARDL model proposed by Pesaran et al. (2001), offers several significant advantages over traditional econometric techniques. First, it can be applied to variables with different orders of integration (I(0)

or I(1)), providing flexibility in the analysis of time series data. Secondly, the model allows for the simultaneous estimation of long-run and short-run effects, enabling a comprehensive view of the relationship dynamics. Lastly, and most importantly, the NARDL approach captures potential asymmetries in both long-run and short-run relationships, a feature that is particularly valuable in economic analyses where the impact of positive and negative changes may differ. These advantages make the NARDL model an ideal tool for investigating the complex interplay between insurance sector development and economic growth in the Saudi Arabian context.

The general form of the NARDL model can be expressed as follows:

$$
\Delta Y_t = \alpha + \rho Y_{t-1} + \theta^+ X_{t-1}^+ + \theta^- X_{t-1}^-
$$
$$
+ \sum_{i=1}^{p-1} \gamma_i \Delta Y_{t-i} + \sum_{i=0}^{q} \left(\pi_i^+ \Delta X_{t-i}^+ + \pi_i^- \Delta X_{t-i}^- \right) + \varepsilon_t, \quad (1)
$$

where Y is the dependent variable (GDP growth rate); X represents the independent variables (life and non-life insurance penetration); X^+ and X^- are partial sum processes of positive and negative changes in X; Δ denotes the first difference operator; α is the constant term; ρ, θ^+, θ^-, γ_i, π_i^+, π_i^- are coefficients to be estimated; ε_t is the error term.

Partial Sum Processes is:

$$
X_t^+ = \sum_{t=1}^{t} \Delta X_t^+ = \sum_{t=1}^{t} \max(\Delta X_t, 0), \quad (2)
$$

$$
X_t^- = \sum_{t=1}^{t} \Delta X_t^- = \sum_{t=1}^{t} \min(\Delta X_t, 0). \quad (3)
$$

Based on the general NARDL framework, the following model is specified for the analysis:

$$
\Delta GDPG_t = \alpha + \rho GDPG_{t-1} + \theta_1^+ LIP_{t-1}^+
$$
$$
+ \theta_1^- LIP_{t-1}^- + \theta_2^+ NLIP_{t-1}^+ + \theta_2^- NLIP_{t-1}^-
$$
$$
+ \sum_{i=1}^{p-1} \gamma_i \Delta GDPG_{t-i}
$$
$$
+ \sum_{i=0}^{q_1} \left(\pi_{1i}^+ \Delta LIP_{t-i}^+ + \pi_{1i}^- \Delta LIP_{t-i}^- \right) \quad (4)
$$
$$
+ \sum_{i=0}^{q_2} \left(\pi_{2i}^+ \Delta NLIP_{t-i}^+ + \pi_{2i}^- \Delta NLIP_{t-i}^- \right)
$$
$$
+ \sum_{i=0}^{q_3} \delta_i \Delta Z_{t-i} + \varepsilon_t,
$$

where $GDPG$ is the GDP growth rate; LIP and $NLIP$ are life and non-life insurance penetration, respectively; Z is a vector of control variables (INF, GOVEXP, TRADE, FINDEV). All other terms are as defined in the general NARDL equation.

The estimation procedure for the NARDL model involves a comprehensive and systematic approach to analyzing the relationship between insurance sector development and economic growth in Saudi Arabia. Initially, unit root tests, such as ADF and PP tests, are conducted to ensure no variable exceeds the I(2) order of integration. Following this, a bounds test for cointegration is performed to establish the existence of long-run relationships among the variables. The NARDL model is then estimated using ordinary least squares (OLS), after which a series of diagnostic tests are carried out to validate the model's integrity. These tests examine serial correlation, heteroskedasticity, and normality of residuals. To investigate potential asymmetries, Wald tests are employed to assess both long-run and short-run asymmetric relationships between insurance penetration and economic growth. Finally, dynamic multipliers are computed to illustrate the adjustment patterns of GDP growth in response to positive and negative changes in insurance penetration. This meticulous methodological approach enables the capture of nuanced relationships, accounting for potential asymmetries and nonlinearities, thereby providing a robust framework for analyzing the complex interplay between insurance sector development and economic growth in the Saudi Arabian context.

3. RESULTS

This section presents the empirical findings of the analysis, beginning with descriptive statistics and preliminary tests, followed by the main results from the NARDL model estimation.

The descriptive statistics reveal that non-life insurance penetration (NLIP) is significantly higher than life insurance penetration (LIP) in Saudi Arabia, reflecting the dominance of non-life insurance products in the market. The GDP growth rate (GDPG) shows considerable variation over the sample period, ranging from −4.12% to 8.65%.
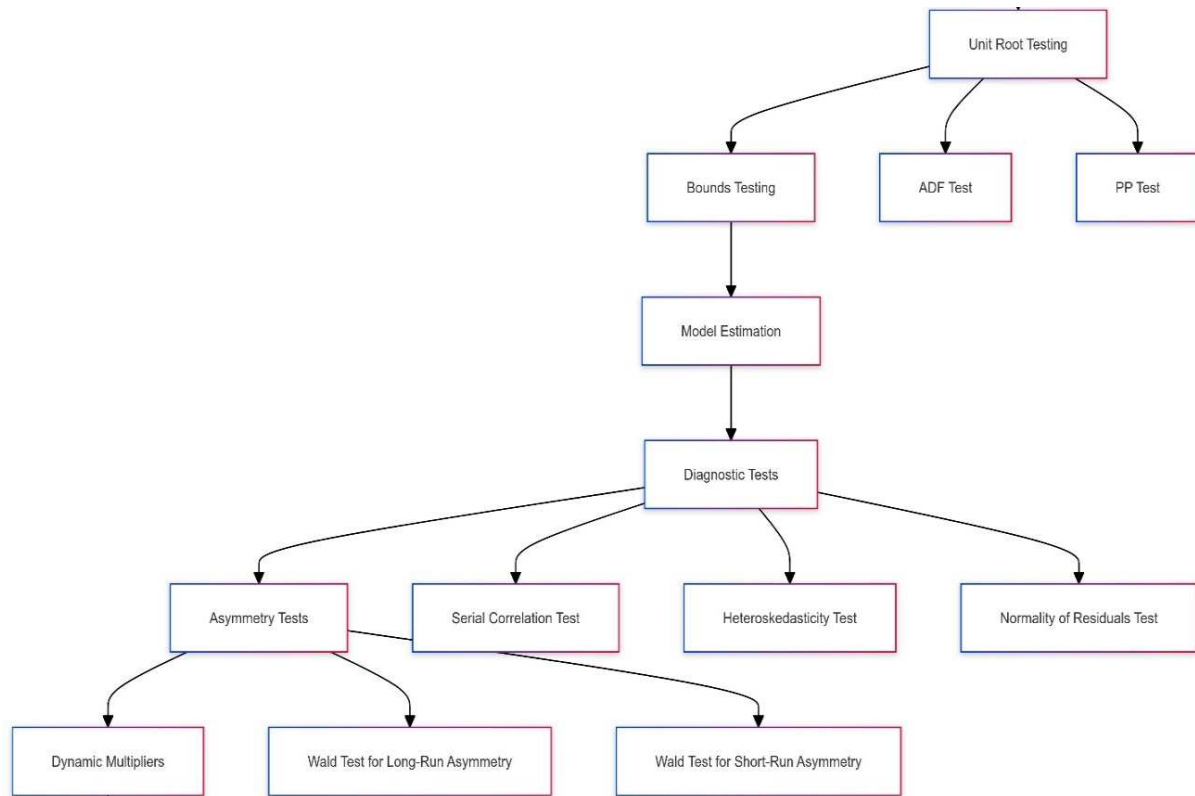
Figure 1. Estimation procedure for the NARDL model

Table 3. Descriptive statistics

Variable	Mean	Standard deviation	Minimum	Maximum
GDPG	2.73	3.21	−4.12	8.65
LIP	0.16	0.05	0.08	0.28
NLIP	1.24	0.31	0.72	1.87
INF	2.18	1.76	−1.42	6.13
GOVEXP	35.6	4.82	27.3	45.2
TRADE	73.4	8.91	58.7	89.6
FINDEV	54.2	7.35	41.8	68.9

Before proceeding with the NARDL estimation, unit root tests were conducted to ensure that no variable was integrated of order 2 or higher. The results of the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests are presented in Table 4.

Table 4. Unit root test results

Variable	ADF test	PP test	Order of integration
GDPG	−4.23**	−4.18**	I(0)
LIP	−2.14	−2.09	I(1)
NLIP	−1.98	−2.05	I(1)
INF	−3.76**	−3.82**	I(0)
GOVEXP	−2.31	−2.28	I(1)
TRADE	−2.45	−2.39	I(1)
FINDEV	−1.87	−1.92	I(1)

Note: ** denotes significance at the 5% level.

The unit root test results indicated that GDPG and INF were stationary at levels, while the other variables were integrated of order one. This mix of I(0) and I(1) variables justified the use of the NARDL approach

The NARDL model was estimated as specified in equation (4). The optimal lag structure was determined using the Akaike Information Criterion (AIC). Table 5 presents the main results of the NARDL estimation.

The NARDL estimation results reveal several important findings regarding the relationship between insurance penetration and economic growth. Firstly, both life and non-life insurance penetration exhibit significant long-run relationships with economic growth, as evidenced by the positive coefficients for LIP^+, LIP^-, $NLIP^+$, and $NLIP^-$. This indicates that increases in insurance penetration are associated with higher economic growth in the long run. Furthermore, the analysis uncovers asymmetric effects, with the coefficients for positive and negative changes in insurance penetration differing, suggesting that positive changes have a larger impact

Table 5. NARDL estimation results

Variable	Coefficient	Std. error	t-statistic
Long-run estimates			
LIP^+	12.376**	5.214	2.373
LIP^-	8.942*	4.876	1.834
$NLIP^+$	18.653***	5.987	3.115
$NLIP^-$	15.247**	6.213	2.454
INF	−0.284*	0.152	−1.868
$GOVEXP$	0.076	0.048	1.583
$TRADE$	0.103**	0.041	2.512
$FINDEV$	0.089*	0.053	1.679
Short-run estimates			
ΔLIP^+	5.124*	2.876	1.781
ΔLIP^-	3.876	2.654	1.461
$\Delta NLIP^+$	9.876***	3.124	3.161
$\Delta NLIP^-$	7.654**	3.287	2.328
ΔINF	−0.187*	0.098	−1.908
$\Delta GOVEXP$	0.043	0.031	1.387
$\Delta TRADE$	0.067*	0.035	1.914
$\Delta FINDEV$	0.052	0.041	1.268
$ECT(-1)$	−0.587***	0.124	−4.734
R-squared	0.724	−	−
Adjusted R-squared	0.683	−	−
F-statistic	12.876***	−	−

Note: ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

on economic growth than negative changes for both life and non-life insurance.

Notably, non-life insurance penetration appears to have a stronger impact on economic growth compared to life insurance penetration, as demonstrated by the larger coefficients for $NLIP^+$ and $NLIP^-$. In terms of short-run dynamics, changes in non-life insurance penetration show a more immediate impact on economic growth compared to life insurance penetration. The study also considers control variables, revealing that inflation has a negative relationship with economic growth, while trade openness and financial development exhibit positive associations.

Finally, the significant and negative coefficient of the error correction term (ECT) indicates the presence of a long-run equilibrium relationship, suggesting that approximately 58.7% of disequilibrium is corrected each quarter. These findings provide valuable insights into the complex interplay between insurance sector development and economic growth, highlighting the importance of considering both long-run relationships and short-run dynamics in policy formulation

Several diagnostic tests were conducted to ensure the validity of the NARDL model. The results are presented in Table 6.

Table 6. Diagnostic tests

Test	Statistic	p-value
Breusch-Godfrey LM test	1.876	0.187
ARCH test	0.943	0.342
Jarque-Bera test	2.124	0.346
Ramsey RESET test	1.654	0.203

The diagnostic tests conducted on the model provide strong evidence of its well-specified nature, lending credibility to the results obtained. Firstly, the Breusch-Godfrey LM test failed to reject the null hypothesis of no serial correlation, indicating that the residuals are not autocorrelated. The ARCH test, which followed, suggested the absence of heteroskedasticity in the residuals, ensuring that the variance of the error terms remains constant across observations. Furthermore, the Jarque-Bera test confirmed that the residuals are normally distributed, thereby satisfying a crucial assumption for many statistical inference procedures. Lastly, the Ramsey RESET test did not detect any misspecification issues, reinforcing the appropriateness of the model's functional form.

Table 7. Asymmetry tests

Test	F-statistic	p-value
Long-run asymmetry (LIP)	4.876**	0.032
Long-run asymmetry (NLIP)	6.243**	0.016
Short-run asymmetry (LIP)	3.124*	0.084
Short-run asymmetry (NLIP)	5.876**	0.019

Note: ** and * denote significance at the 5% and 10% levels, respectively.

Collectively, these diagnostic results validate the robustness of the model, thereby enhancing the reliability of the subsequent analyses and interpretations drawn from it.

To formally test the presence of asymmetries in the insurance-growth relationship, Wald tests were conducted to assess parameter constraints for both long-run and short-run asymmetries. The results are presented in Table 7.

The asymmetry tests confirmed the presence of both long-run and short-run asymmetries in the relationships between life and non-life insurance penetration and economic growth. These asymmetries referred to differences in how positive and negative changes in insurance penetration affected economic growth. This finding underscored the importance of using a nonlinear modeling approach to capture these nuanced effects.

4. DISCUSSION

The empirical results offer important insights into the relationship between insurance sector development and economic growth in Saudi Arabia. The findings provide strong evidence of a positive long-run relationship between both life and non-life insurance penetration and economic growth, aligning with theoretical arguments presented in previous studies (e.g., Dawd & Benlagha, 2023; Hou & Cheng, 2017). This supports the notion that insurance contributes to economic growth through risk transfer, financial intermediation, and capital accumulation.

Notably, the results indicate that non-life insurance plays a more substantial role in driving economic growth in Saudi Arabia compared to life insurance. This finding is consistent with studies by Lee et al. (2016) and Outreville (2013), who emphasized the importance of non-life insurance in developing economies. The dominance of non-life insurance in

Saudi Arabia can be attributed to market composition, particularly the prevalence of compulsory lines such as health and motor insurance. Additionally, non-life insurance provides immediate protection against various risks faced by businesses and individuals, potentially enabling more economic activity. Other factors may also contribute to the relatively lower life insurance penetration in Saudi society. This highlights the importance of considering these nuances in understanding the insurance-growth nexus in the country.

The short-run estimates reveal that changes in non-life insurance penetration have a more immediate impact on economic growth than life insurance. This aligns with the study by Mishra and Narayan (2015), who found similar short-term dynamics in other developing economies. The delayed impact of life insurance on economic growth observed in this study is consistent with findings by P. Narayan and S. Narayan (2013), who attributed this to the long-term nature of life insurance products. This delayed impact may be due to its role as a savings and investment vehicle. Life insurance's benefits in capital accumulation and financial market development may take longer to materialize and impact overall economic growth.

A novel finding in this study is the presence of asymmetric effects in both the long-run and short-run relationships between insurance penetration and economic growth. This asymmetry, where increases in insurance penetration have a more substantial impact on economic growth than decreases, adds to the literature on nonlinear relationships in financial development. The results highlight the complex interplay between insurance penetration and economic growth in Saudi Arabia, emphasizing the importance of understanding asymmetric relationships in economic analysis. These findings provide valuable insights for policymakers considering insurance sector development as part of broader economic diversification efforts.

CONCLUSION

This paper examined the relationship between insurance sector development and economic growth in Saudi Arabia, employing a nonlinear autoregressive distributed lag (NARDL) model to capture potential asymmetries in the insurance-growth nexus. By distinguishing between life and non-life insurance, the analysis provided a nuanced understanding of how different types of insurance contribute to economic development. The key findings revealed that both life and non-life insurance penetration exhibit significant positive long-run relationships with economic growth, with non-life insurance demonstrating a stronger impact. Importantly, the study uncovered significant asymmetries in the insurance-growth relationship, where positive changes in insurance penetration had a larger impact on economic growth than negative changes. In the short run, changes in non-life insurance penetration showed a more immediate impact on economic growth compared to life insurance.

These findings contribute to the existing literature by providing empirical evidence on the insurance-growth nexus in Saudi Arabia, a country that has received limited attention in this context despite its economic significance. The use of the NARDL model allowed for the identification of asymmetric effects, offering a more comprehensive understanding of the relationship between insurance sector development and economic growth.

Future research could extend this analysis by examining the channels through which insurance impacts economic growth in Saudi Arabia and conducting comparative studies with other Gulf Cooperation Council countries. In conclusion, this study provides strong evidence for the positive role of insurance sector development in promoting economic growth in Saudi Arabia, while highlighting the complex and asymmetric nature of this relationship. The insurance sector is positioned as a promising avenue for fostering sustainable economic development in the country's ongoing diversification efforts.

AUTHOR CONTRIBUTIONS

Conceptualization: Ramzi Drissi, Emtinan Alsuhaibani.
Data curation: Ramzi Drissi, Emtinan Alsuhaibani.
Methodology: Ramzi Drissi, Emtinan Alsuhaibani.
Software: Ramzi Drissi, Emtinan Alsuhaibani.
Supervision: Ramzi Drissi.
Validation: Ramzi Drissi.
Writing – original draft: Ramzi Drissi, Emtinan Alsuhaibani.
Writing – review & editing: Ramzi Drissi, Emtinan Alsuhaibani.

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