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Economic Laboratory Transition
Research Podgorica

Montenegrin Journal of Economics

For citation:

Moustafa M., Alomran S., Alwehaibi S. (2026), "Revisiting the link between trade openness and economic growth in Saudi Arabia: a nonlinear ARDL approach", *Montenegrin Journal of Economics*, Vol. 22, No. 4, pp. 209-222.

Revisiting the link between trade openness and economic growth in Saudi Arabia: a nonlinear ARDL approach

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ARTICLE INFO

Received March 28, 2025
Revised from April 26, 2025
Accepted June 02, 2025
Available online October 15, 2026

JEL classification: F43, F14, O53, C32, C5140, M41, M42, M48, M49, M19

DOI: 10.14254/1800-5845/2026.22-4.15

Keywords:

Economic growth,
trade openness,
asymmetric effects,
NARDL

ABSTRACT

This research investigates the effect of trade openness on Saudi Arabia's economic growth from 1970 to 2022. The main goal is to determine whether the relationship between trade openness and growth is nonlinear and how trade liberalization impacts long-term economic performance. To achieve this, the study utilizes the Nonlinear Autoregressive Distributed Lag (NARDL) model, which differentiates between positive and negative shifts in trade openness and their asymmetric influences on GDP growth. The hypothesis being tested suggests that increasing trade openness, particularly through rising exports, boosts economic growth, while trade restrictions can have negative consequences.

The empirical evidence supports a notable long-term nonlinear connection between trade openness and economic growth. In particular, the findings reveal that positive shocks to trade openness affect GDP growth more strongly and persistently than negative shocks. Additionally, the research indicates that gross capital formation positively and significantly influences economic development, underscoring the importance of domestic investment. In contrast, foreign direct investment and higher education enrollment exhibit a negative correlation with growth, pointing to structural challenges linked to labor market issues and the alignment of the educational system.

These findings highlight the critical importance of trade liberalization in promoting economic growth in Saudi Arabia and endorse policy suggestions designed to further minimize trade barriers. The study also emphasizes the need to reform educational outcomes to better match labor market needs, especially in technical and professional fields. Addressing these discrepancies is essential for improving human capital productivity and realizing the goals outlined in Saudi Arabia's Vision 2030.

INTRODUCTION

Trade openness is a crucial driver of economic growth, particularly in developing countries. An increase in trade openness means the ability to access and integrate the latest technologies, thereby improving competitiveness and promoting growth (Hye et al., 2022; Iamsiraroj, 2015; Jouini, 2014; Lawal et al., 2016; Madsen, 2009; Makki & Somwaru, 2004; Musila & Yiheyis, 2015; Nannicini & Billmeier, 2011; Singh, 2010; Wacziarg & Welch, 2008). Additionally, a higher volume of trade generates capital formation, a crucial step in the production process within the economy (Sriyana & Afandi, 2020). As the world economy becomes more integrated, the global trading system evolves into a more progressive and competitive one. International trade promotes economic growth through some channels. First, introducing new technological innovations will increase productivity, as it will increase demand for outputs, leading to higher levels of income per capita. Second, it generates capital formation as a crucial step in the production process of the economy (Sriyana & Afandi, 2020).

This finding aligns with the views of Neoclassical economists, who confirm that trade growth is a key driver of economic growth, often referred to as the "engine of growth." They also emphasize the strong relationship between trade and economic growth. Therefore, an open economy has a greater impact on promoting economic growth compared to a closed economy (Raghutla, 2020). The empirical evidence regarding the effect of trade openness on economic growth remains inconclusive and mixed. The prevailing consensus in the literature found a positive and significant relationship between trade openness and economic growth; however, some studies suggest that this positive relationship may be conditional on various factors, including the measurement of trade openness, the quality of exports, human capital accumulation, income level, and the level of development, among other institutional factors (Fetahi-Vehapi et al., 2015; Haddad et al., 2012; Huchet, 2017; Keho, 2017; Kim and Lin (2009); Kim et al., 2011; Yanikkaya, 2003). These conditions mean that some countries may experience a negative impact on economic growth due to the lower quality of their exports. Trade openness subjects the country to an external source of volatility in economic growth, particularly in less-developed countries (Giovanni & Levchenko, 2009).

Studies on the relationship between trade openness and growth employ various econometric approaches and methodologies, which can influence the conclusions. Most studies used panel data analysis utilizing different methodologies such as Generalized Method of Moments (GMM), Autoregressive Distributed Lag (ARDL) cointegration, and instrumental variable threshold regressions (Fatima et al., 2020; Sarkar, 2008; Giovanni and Levchenko (2009); Yanikkaya, 2003; Makki & Somwaru, 2004; Keho, 2017; Kim et al., 2011; Dowrick and Golley, 2004; Kim and Lin, 2009; Fetahi-Vehapi et al., 2015; Lawal et al., 2016; Huchet et al., 2017; Jouini, 2014). Others used time series analysis (Belloumi, 2014; Musila & Yiheyis, 2015) or synthetic control methods (SCMs) (Nannicini & Billmeier, 2011).

This study examines the impact of trade openness and other key economic factors—including foreign direct investment, gross capital formation, and higher education enrollment—on economic growth in Saudi Arabia. Utilizing annual data from 1970 to 2022, this study employs the Nonlinear Autoregressive Distributed Lag (NARDL) model to investigate whether the relationship between trade openness and economic growth is asymmetric. While previous research on Saudi Arabia has predominantly analyzed this relationship under the assumption of symmetry, this study offers a novel contribution by focusing on potential asymmetries. It provides a perspective on the dynamics of trade openness and its differentiated effects on economic growth. The research questions can be summarized as follows:

Q1: What is the nature of the long-term relationship between trade openness and economic growth in Saudi Arabia?

Q2: To what extent does trade openness have an asymmetric impact on long-term economic growth in Saudi Arabia?

This study proposes the following hypotheses to examine the long-term relationship and the potential asymmetric effects of trade openness on economic growth:

- H1: A long-term relationship exists between economic growth and trade openness in Saudi Arabia.
H2: There is an asymmetric effect of trade openness on long-term economic growth in Saudi Arabia

The remainder of this paper is organized as follows. Section 1 reviews the relevant literature. Section 2 provides an overview of Saudi Arabia's economy and trade policy. Section 3 describes the data, defines the variables, and presents the empirical analysis. Section 4 summarizes the main empirical findings. Finally, the study concludes, discusses its limitations, and outlines directions for future research.

1. LITERATURE REVIEW

Developing economies must rely on trade to access international markets, leverage technology, and attract investment. Trade openness provides an incentive for higher productivity levels and competition. Regarding comparative advantage theory, which is based on the work of economist David Ricardo, who demonstrated that countries benefit from trade when they specialize in producing goods in which they have a comparative advantage. This specialization enhances production efficiency, leading to increased GDP. Additionally, trade-opened countries can better allocate resources and specialize in areas where they are most productive, generating a higher level of output and economic growth (Krugman, 2009). Concerning Endogenous Growth Theory, this theory asserts that international trade contributes to the accumulation of human capital, the transfer of technology, and the promotion of innovation by integrating the economy into global markets (Grossman & Helpman, 1993).

Classical neoclassical growth models, such as the Solow-Swan model, have demonstrated that the accumulation of capital, labor, and technology is a key driver of economic growth. International trade enhances this process by providing access to capital goods and advanced technologies, thereby increasing productivity and accelerating economic growth. Trade openness also facilitates the transfer of technology from developed to developing countries, which enhances production efficiency. Through access to advanced technology and capital goods, the productivity of labor and capital increases, resulting in faster economic growth (Barro & Sala-i-Martin, 2004).

In conclusion, the theoretical framework indicates that trade openness can significantly contribute to economic growth by enhancing efficiency, innovation, and access to international capital. However, the benefits depend on complementary factors, such as strong institutions, sound macroeconomic policies, and competitive markets (Frankel & Romer, 2017).

In empirical studies, many have examined the relationship between trade openness and economic growth, yielding conflicting or at best mixed results. Some studies have found a positive relationship, while others have found a negative one. We will review a group of studies that have shown a positive relationship between trade openness and economic growth. For instance, Jabbar et al. (2024) examined the Impact of Financial Development and Trade Openness on economic growth in Luxembourg from 1980 to 2020 using the ARDL model. The study finds that trade openness, financial development, and capital stock have a significant and positive impact on Luxembourg's economic growth. Trade openness is the strongest driver of economic growth, followed by financial development and capital stock. Kurteš et al. (2023) examined the relationship between trade openness and human capital as explanatory variables, and GDP as the dependent variable, in a sample of eight Balkan countries from 2000 to 2019. They collected panel data, testing both a panel model with fixed effects and a panel model with random effects. The results showed a positive impact of trade openness and human capital on GDP. Oppong-Baah et al. (2022) reviewed the impact of trade openness on economic growth in Ghana and Nigeria, using the Pooled OLS, Fixed Effects (FE), Random Effects (RE), and Hausman tests from 1998 to 2017. The Pooled OLS results show that trade openness has a significant impact on economic growth.

Additionally, based on the fixed effects (FE) test, evidence suggests that trade openness has a significant impact on economic growth. Furthermore, trade openness has a positive and significant impact on economic growth, as indicated by the random effects (RE) test. In summary, openness to trade and

economic growth in Ghana and Nigeria have a significantly positive impact. Jalil et al. (2021) revisited the trade-growth nexus using heterogeneous panel methods that account for cross-sectional dependence and endogeneity in 82 countries, which employ different measures of trade openness from 1960 to 2017. The econometric results support the idea that trade openness induces economic growth.

Mallick and Behera (2020) confirm the evidence of asymmetric cointegration between economic growth and trade openness in India from 1960 to 2018. Amna Intisar et al. (2020) investigated the impact of trade openness and human capital on economic growth in Asia for 19 countries from Western Asia and Southern Asia, spanning the period 1985 to 2017. The study employed fully modified ordinary least squares (FMOLS) and dynamic ordinary least squares (DOLS) models. The study revealed a significant and positive relationship between trade openness and human capital, as well as their impact on economic growth. Raghutla (2020) investigated the impact of trade openness on economic growth in a panel of five emerging market economies from 1993 to 2016. The results showed that trade openness plays a positive and substantial role in promoting economic growth while also fostering economic development in these five emerging market economies. Wiredu et al. (2020) reviewed the relationship between Trade openness and foreign direct investment on economic growth for a panel of four countries (Côte d'Ivoire, Ghana, Nigeria, and Senegal) from 1998 to 2017. They concluded that trade openness, investment, and inflation do have a positive and significant impact on economic growth.

Malefane et al. (2018) examined the impact of trade openness on economic growth in South Africa using the autoregressive distributed lag (ARDL) for the period 1975-2014, by using four proxies of trade openness, the first proxy of trade openness is derived from the ratio of trade to gross domestic product, the second proxy is the ratio of exports to GDP, while the third proxy is the ratio of imports to GDP and the last proxy is an index of trade openness. The study concluded that trade openness has a positive and significant impact on economic growth when the ratio of total trade to GDP is used as a proxy; however, this effect is not observed when the three other proxies are employed. However, in the short run, when the first three proxies of openness are used, the study finds that trade openness has a positive impact on economic growth; however, this is not the case when the trade openness index is employed. Yakubu et al. (2018) examined the impact of openness on economic growth in Nigeria, using GDP as the dependent variable and degree of openness, foreign exchange, and per capita income as independent variables for the period 1981-2017. The study concludes that openness had a positive impact on economic growth in Nigeria. Iyoha and Okim (2017) analyzed the impact of trade on economic growth for the 15 ECOWAS countries using panel data regression analysis from 1990 to 2013. The study concluded that trade had a significant positive impact on economic growth in ECOWAS countries.

Some studies have also shown a negative impact of trade openness on economic growth. Ra-soanomenjanahary et al. (2022) examined the relationship between trade Openness and economic growth in Madagascar from 1993 to 2020 using different econometric methods. Studies concluded that trade openness harms economic growth in Madagascar. Additionally, Adu-Gyamfi et al. (2020) examined the impact of trade openness and inflation on GDP growth for nine West African countries, employing pooled Ordinary Least Squares (OLS), Fixed Effects, and Random Effects tests with panel data for the period from 1998 to 2017. The results showed that Trade Openness has a significant and negative impact on GDP, using the pooled OLS, but an insignificant impact using the fixed and Random effects tests. In addition, Bendjelloul et al. (2021) sought to investigate the long-term causal relationship between trade openness and economic growth in Algeria using the TYDL methodology from 1990 to 2018. The study found that Algeria's economic growth does not benefit significantly from trade openness, particularly given its unitary export structure. Additionally, Malefane et al. (2021) investigated the dynamic impact of trade openness on economic growth in Lesotho using the autoregressive distributed lag (ARDL) model from 1979 to 2013. The study found that trade openness has no significant impact on economic growth in both the short and long run.

There are also some studies shown that the relationship between trade openness and economic growth depends on the quality of products as Huchet-Bourdon et al. (2018) studied the links between trade openness and economic growth Based on the estimation of an endogenous growth model on a panel of 169 countries between 1988 and 2014 using a generalized method of moments estimator. The study's results

indicated that trade openness has a positive impact on economic growth when countries specialize in producing high-quality products. In contrast, trade openness hinders economic growth when countries specialize in producing low-quality products. While other studies have shown that the relationship between trade openness and economic growth depends on the progress of countries in adopting technology, Kim et al. (2012) investigated the impact of foreign trade openness on economic growth using panel data for 61 countries from 1960 to 2000. The study revealed that trade openness has a positive impact on economic prosperity in more technologically advanced countries, whereas trade openness hinders growth in countries with the opposite characteristics.

Examining the literature review helps discern the complex relationship between trade openness and economic growth. Although some studies have found a positive association, others have found that the effectiveness of trade openness as a driver of economic growth is affected by contextual factors. There is a need for an improved understanding that takes into account the country's unique economic and export structure. Further research should observe the various pathways through which trade openness affects economic outcomes and the effect of other development variables.

2. THE RELATIONSHIP BETWEEN TRADE OPENNESS AND ECONOMIC GROWTH IN SAUDI ARABIA

Historically, Saudi Arabia has maintained several international trade agreements and embraced a trade openness approach to drive economic growth. This approach means implementing substantial economic reforms and lowering tariffs long before it accedes to the World Trade Organization (WTO) in 2005. During this lengthy accession process, numerous complex economic and geopolitical circumstances had the potential to alter national priorities and disrupt the reform trajectory (Ghulam, 2012). Nevertheless, the Kingdom has progressively adopted economic liberalization, thereby enhancing its access to international markets and attracting foreign investment (Aliedan, 2022).

Saudi Arabia has continued this trajectory; however, it has recently been marked by increasingly ambitious objectives. Since 2016, the Kingdom has initiated the implementation of a comprehensive reform plan titled Saudi Arabia's Vision 2030. This initiative establishes ambitious goals aimed at diversifying the national economy and reducing dependence on crude oil, thereby promoting sustainable growth. As one of the major global producers and exporters of crude oil and petrochemicals, its substantial oil dependency makes the nation particularly susceptible to fluctuations in energy markets (Saudi Arabia, 2024). This vulnerability is one of the main drivers of Saudi Arabia's Vision 2030. This is particularly evident in the goal of increasing the share of non-oil exports in non-oil GDP from 16% in 2016 to 50% by 2030, with a current achievement of 24.1% as of 2023 (Vision 2030, 2016; Vision 2030 (Annual Report, 2023). In addition, the kingdom is actively planning to exploit its distinctive geographic positioning as a vital trade route by implementing advancements in logistics. This initiative is expected to enhance the flow of goods through the kingdom, benefiting from the effects of trade liberalization.

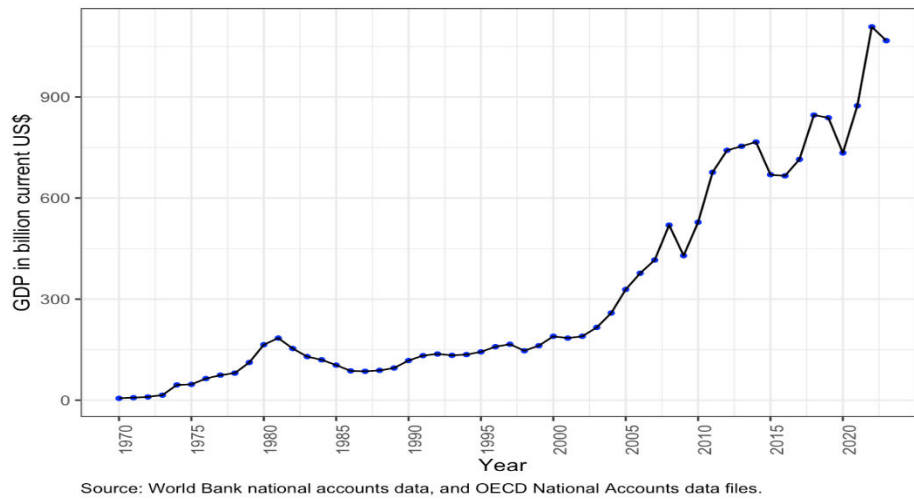


Figure 1. GDP in Billion Current US Dollars from 1970 to 2023



Figure 2. Trade Openness in Saudi Arabia from 1970 to 2023

3. DATA AND METHODOLOGY

3.1 Data description

The study utilizes annual time series data spanning 1970–2022, employing the Nonlinear Auto Regressive Distributed Lag (NARDL) model applied to Saudi Arabia. All data are sourced from the World Development Indicators, published by the World Bank. The primary dependent variable is economic growth, which the study employs a simple production function to analyze, in addition to traditional inputs (capital and labor). The study also incorporates independent variables such as trade openness and foreign direct investment. The study chooses these variables based on previous studies by Mallick & Behera (2020), Syriana & Afandi (2020), and Regula (2020). The data description is presented in Table 1.

Table 1. Data description

Variables	Definition	Abbreviation	Unit
Dependent Variable			
Economic growth	Annual GDP growth	GDPGR	%
Independent Variables and Controls			
Trade openness	The total volume of exports & imports of goods & services	TRADE	% of GDP

Foreign direct investment	Net inflows of foreign direct investment	FDI	% of GDP
Gross capital formation	Gross capital formation	GCF	% of GDP
Enrollment in higher education	Enrollment in higher education	ENR	% of total

Source: Own

Table 2 presents the descriptive statistics for the variables used in the study. The variables generally exhibit normal distributions, supporting the validity of parametric statistical techniques for subsequent empirical analysis.

Table 2. Descriptive statistics of the variables

	LnGDPGR	LnGCF	LnENR	LnFDI	LnTRADE
Mean	1.554799	20.95788	2.952848	-0.123321	4.301838
Median	1.545464	21.21729	2.981126	0.057568	4.313471
Maximum	4.071542	29.99077	4.187729	1.260167	4.565417
Minimum	-0.582106	8.834236	0.464306	-2.111903	4.026929
Std. Dev.	1.070287	4.278270	0.904622	0.978308	0.172326
Skewness	0.189550	-0.577232	-0.820732	-0.511084	-0.077356
Kurtosis	2.966944	3.618117	3.522191	2.309729	1.653396
Jarque-Bera	0.150843	3.786972	3.090717	1.584689	1.913831
Probability	0.927353	0.150546	0.213235	0.452782	0.384076

Source: prepared by authors. Using EViews 12

3.2 Model Specification

This study explores the existence of an asymmetric effect, or nonlinear relationship, between trade openness and economic growth. Analyzing this asymmetric effect enables a distinction between the impacts of increasing and decreasing trade openness on economic growth. Most previous studies utilized the ARDL model to investigate the linear relationship between trade openness and economic growth. However, according to Shin, Yu, and Greenwood-Nimmo (2014), the NARDL model accounts for partial sums of decompositions, thus capturing the long-run relationship between dependent and independent variables. This relationship can be formally expressed as follows:

$$GDPGR = f(ENR, GCF, TRADE, FDI)$$

To understand the relationship between trade openness and economic growth, as shown in Equation 1. The Cobb-Douglas Production function was modified into an expanded trade production function and estimated econometrically using NARDL.

$$GDPGR_t = ENR_t^{\beta_1} GCF_t^{\beta_2} TRADE_t^{\beta_3} FDI_t^{\beta_4} \quad (1)$$

Taking the natural logarithm of all variables in Equation (1) yields Equation (2):

$$\ln GDPGR_t = \beta_1 \ln ENR_t + \beta_2 \ln GCF_t + \beta_3 \ln TRADE_t + \beta_4 \ln FDI_t + U \quad (2)$$

For applying NARDL many Steps were performed, first, determine the stationarity of the series based on augmented Dicky- Fuller (ADF) and Philips Perron (PP), the hypothesis of this test:

$$H0: \sigma = 0 \text{ (unit root /not stationery)}$$

$$H1: \sigma \neq 0 \text{ (no unit root / stationery)}$$

If the null hypothesis is not rejected, the series is deemed non-stationary; if it is rejected, the series is deemed stationary. If a series is non-stationary at the level, first differencing is applied to convert it to a stationary series (Shaari, 2014). The NARDL model is suitable when the variables are integrated in

different orders, specifically a combination of I(0) and I(1) series. If any variable is integrated of order I(2), the NARDL model cannot be applied. One of the primary advantages of the NARDL model is its ability to handle variables of different integration orders, as long as none are I(2).

After checking for stationarity, we must decompose the Independent Variable, LnTRADE , into its positive and negative partial sums to capture the asymmetric effects of increases and decreases in trade openness on economic growth.

Positive partial sum of LnTRADE :

$$\begin{aligned}\text{LnTRADE}^+ &= \text{Sum of all positive changes in } \text{LnTRADE} \\ \text{LnTRADE}^+ &= \max \sum (\Delta \text{LnTRADE}, 0)\end{aligned}$$

This explores the cumulative effect of increases in LnTRADE [insert relevant variable].

Negative partial sum of LnTRADE :

$$\begin{aligned}\text{LnTRADE}^- &= \text{Sum of all negative changes in } \text{LnTRADE} \\ \text{LnTRADE}^- &= \min \sum (\Delta \text{LnTRADE}, 0)\end{aligned}$$

This explores the cumulative effect of a decrease in LnTRADE . A positive change may have a different magnitude of impact than a negative change, by splitting the trade openness variable into two components—one that indicates positive changes and the other that expresses negative changes (Ghazouani, 2021; Turay et al., 2022). The previous connection can be represented in its non-linear form as shown in equation (3).

$$\begin{aligned}\Delta \text{LnGDPGR}_t &= C_0 + \sum_{i=1}^p \gamma_{1i} \Delta \text{LnGDPGR}_{t-i} + \sum_{i=1}^{q1} \gamma_{2i} \Delta \text{LnENR}_{t-i} + \sum_{i=1}^{q2} \gamma_{3i} \Delta \text{LnGCF}_{t-i} \\ &+ \sum_{i=1}^{q3} \gamma_{4i} \Delta \text{LnFDI}_{t-i} + \sum_{i=1}^{q4} \gamma_{5i} \Delta \text{LnTRADE}_{t-i}^+ + \sum_{i=1}^{q5} \gamma_{6i} \Delta \text{LnTRADE}_{t-i}^- \\ &+ \beta_1 \text{LnGDPGR}_{t-i} + \beta_1 \text{LnENR}_{t-i} + \beta_2 \text{LnGCF}_{t-i} + \beta_3 \text{LnFDI}_{t-i} \\ &+ \beta_4^+ \text{LnTRADE}_{t-i}^+ + \beta_5^- \text{LnTRADE}_{t-i}^- + U \quad (3)\end{aligned}$$

Where Δ denotes the first difference operator, γ_{1i} to γ_{5i} represent the short-term dynamic coefficients of the corresponding variables with lag lengths p , q_1 , q_4 , respectively. The coefficients β_1 to β_5 capture the long-term relationship among the variables in the cointegrating set, while U denotes the error term (Cahyono, 2025).

A NARDL model is divided into long-run and short-run equations (Degu et al, 2023). To examine the existence of a cointegration relationship, the bounds test is used to capture the short-run dynamics. We will estimate a restricted Error Correction Model (ECM):

$$\begin{aligned}\sum_{i=1}^p \gamma_{1i} \Delta \text{LnGDPGR}_{t-i} + \sum_{i=1}^{q1} \gamma_{2i} \Delta \text{LnENR}_{t-i} + \sum_{i=1}^{q2} \gamma_{3i} \Delta \text{LnGCF}_{t-i} + \sum_{i=1}^{q3} \gamma_{4i} \Delta \text{LnFDI}_{t-i} + \\ \sum_{i=1}^{q4} \gamma_{5i} \Delta \text{LnTRADE}_{t-i}^+ + \sum_{i=1}^{q5} \gamma_{6i} \Delta \text{LnTRADE}_{t-i}^- + \psi \text{EC}_{t-1} + \mu_t\end{aligned} \quad (4)$$

The Wald test verifies the presence of an asymmetric (nonlinear) relationship between the variables (Hossain et al., 2021).

The null hypothesis for the Wald test:

$$H_0: 0^+ = 0^- \quad (\text{No asymmetry})$$

If the null hypothesis is rejected, it indicates that the impact of trade openness on economic growth is asymmetric.

Several diagnostic tests are performed to ensure the robustness and reliability of the estimated model, including LM test, the Breusch-Pagan-Godfrey heterogeneity test, as well as the Jarque-Bera Test for the normal distribution of the residuals, and the Ramsey test finally CUSUM test to examine the stability of the model (Wadström, et al, 2023)

4. EMPIRICAL RESULTS AND DISCUSSION

4.1 Unit root test

After taking the first difference, the Unit Root test results show that the GDP growth rate (GDPGR), trade openness (TRADE), and energy (ENR) become stationary. The findings of the ADF and PP tests in Table 3, on the other hand, demonstrate that gross capital formation (GCF) and foreign direct investment (FDI) are stationary at the level.

Table 3. Unit root test

Variables	ADF		PP	
	Intercept	At level (0)	At level (0)	At first difference (I)
LnGDPGR		0.1969	0.4297	0.0000
LnTRADE		0.1116	0.1354	0.0000
LnFDI		0.0001	0.0001	-----
LnGCF		0.0000	0.0000	-----
LnENR		0.4430	0.4238	0.0000
trend & Intercept				
LnGDPGR		0.8219	0.5632	0.0002
LnTRADE		0.1417	0.1632	0.0000
LnFDI		0.0002	0.0002	-----
LnGCF		0.0397	0.0001	-----
ENR		0.0010	0.0002	-----
None				
LnGDPGR		0.6861	0.6799	0.0000
LnTRADE		0.5932	0.5850	0.0000
LnFDI		0.0000	0.0000	-----
LnGCF		0.7729	0.3525	0.0000
LnENR		0.4629	0.4629	0.0000

Source: Author using EViews 12

4.2 NARDL Estimates

Table 4. NARDL Estimates

Panel A: Short-run estimates					
Variable	0	1	2		
GCF		-0.0008	-0.0085***		
LENR	-0.0047				
FDI	-0.0074	0.0255***	0.0207***		
Panel B: Long-run estimates					
C	GCF	LENR	LTRADE_POS	LTRADE_NEG	FDI

10.85***	0.031***	-0.252***	0.708***	0.378**	-0.197***
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Panel C: Diagnostics						
F bounds	ECt	Serial correlation	Jarque-Bera	Heteroskedasticity	Ramsey Test	Adj. R2
9.20***	-0.2784***	0.93	0.672	0.95	0.90	0.70
AIC criteria	(1,2,1,0,0,3)					

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

Source: Own

The optimal lag times for the NARDL model are 1, 2, 1, 0, 0, 3, as indicated in Table 4. The (AIC) criteria were used to choose this model. The computed F-statistic is greater than the crucial value of the upper limit at the 1% level of significance, based on the results of the cointegration test using the Bound test. As a result, the null hypothesis that there is no cointegration between the variables under consideration is rejected. This implies a long-term equilibrium relationship between the variables, allowing for the estimation of long-term relationships between them.

According to Panel B in Table 4, there exists a long-term relationship between trade openness and economic growth. This supports the acceptance of the study's first hypothesis. Furthermore, the findings provide evidence of an asymmetric long-run relationship between trade openness and economic growth, thereby confirming the second hypothesis. Specifically, positive shifts in trade openness significantly boost economic growth, suggesting that increased trade liberalization contributes to sustained economic expansion in Saudi Arabia. This is particularly evident as rising exports are associated with rising income levels, aligning with the findings of Akuffo (2012). Conversely, negative changes in trade openness exert a significant adverse effect on economic growth, which is consistent with Udeagha & Ngepah (2021). The analysis also reveals a significant negative long-term relationship between foreign direct investment (FDI) and economic growth, indicating that FDI inflows in Saudi Arabia have not effectively facilitated technology transfer or the development of productive sectors. This finding concurs with Akuffo (2012).

In addition, there is a negative and statistically significant relationship between higher education enrollment and long-run economic growth, consistent with Kamal (2020). Prior research, including Hanushek (2016), suggests that disparities in cognitive skills—or a nation's knowledge capital—account for much of the variation in economic growth across countries. Merely increasing schooling years, without enhancing cognitive capabilities, has historically shown a limited impact on growth outcomes.

On a more positive note, gross capital formation is positively and significantly linked to economic growth, highlighting the critical role of domestic investment in supporting economic expansion. This finding is in line with traditional neoclassical growth theory, which emphasizes investment as a primary engine of growth. As capital accumulation increases, so does a nation's production capacity, which in turn drives higher output levels (Sriyana & Afandi, 2020).

Diagnostic tests of the NARDL model (Panel C) support the validity of the estimation. The Jarque-Bera test yields a p-value of 0.672, indicating normally distributed residuals. The LM test fails to reject the null hypothesis, suggesting no serial correlation. Similarly, the Breusch-Pagan test produces a p-value of 0.9473, exceeding the 5% threshold, indicating no heteroskedasticity. Finally, the Ramsey RESET test confirms that the functional form of the model is correctly specified.

4.3 Wald test & multiplier graph

As reported in Table 5, the results of the Wald test for asymmetry confirm the presence of a significant long-term asymmetric relationship between trade openness and economic growth.

Table 5. Testing for Asymmetry

Test Statistic	Value	df	Probability
F-statistic	4.574715	(2, 37)	0.0168
Chi-square	9.149429	2	0.0103

Source: Author using EViews 12

Figure 3 reinforces the findings of the Wald test, illustrating an asymmetric relationship between trade openness and long-term economic growth, as depicted in the dynamic multiplier graph.

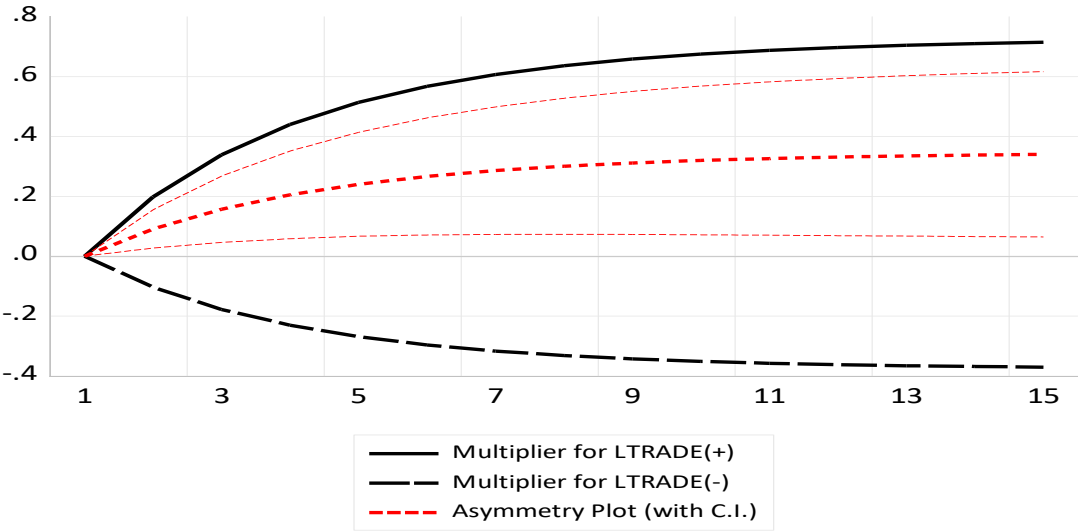


Figure 3. multiplier graph
Source: Author using EViews 12

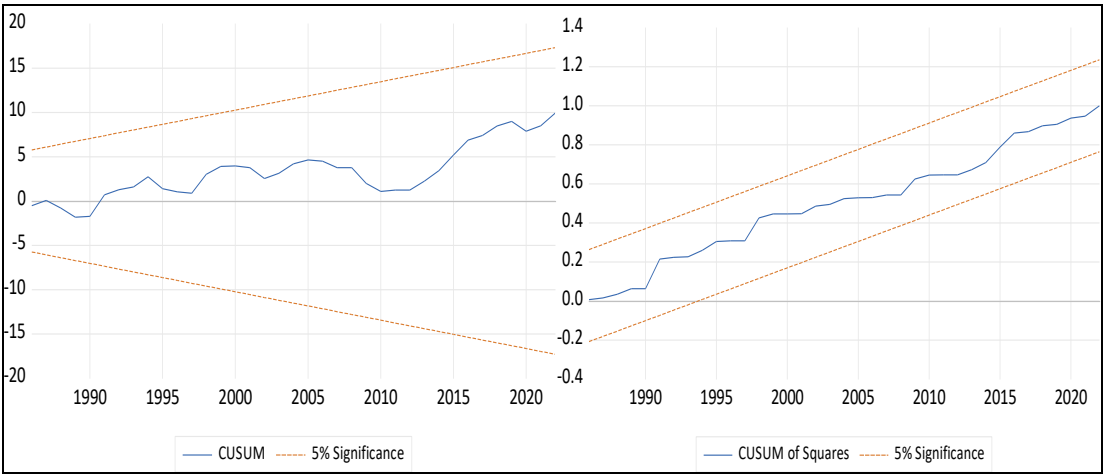


Figure 4. Cumulative Sum and Sum of Squares of Recursive Residuals
Source: Author using EViews 12

CONCLUSION

This study investigates the influence of trade openness on economic growth in Saudi Arabia over the period 1970 to 2022, utilizing the Nonlinear Autoregressive Distributed Lag (NARDL) model. The findings underscore the significant role of domestic investment and export expansion in driving economic growth within the country. Empirical evidence reveals the presence of a long-run asymmetric relationship between trade openness and economic growth. In light of these results, the study recommends strengthening Saudi Arabia's integration into the global economy as a strategic path to stimulate economic activity and boost growth performance. The positive effect of trade openness is primarily attributed to its ability to enhance trade flows, enable technology transfer, and improve productivity. Therefore, the study advocates for the adoption of open trade policies that encourage export growth, manage imports effectively, and support investment in high-value-added, export-driven industries.

Moreover, the research highlights the importance of attracting foreign direct investment (FDI), particularly through the development of skilled human capital and by channeling FDI into sectors that create tangible economic value. The success of FDI in contributing to growth depends not only on capital inflows but also on aligning investments with national development goals.

To enhance future analysis, the study recommends improving data collection on qualitative aspects of trade openness, including tariff structures, non-tariff measures, and trade- restrictive regulations. This would allow for more accurate assessments of openness and its economic impact.

Finally, the study encourages future research to expand the scope of analysis by incorporating a wider array of trade openness indicators or by exploring both linear and non-linear dynamics using alternative econometric approaches. These could include time series models for individual countries or panel data techniques applied to a group of countries. Further research is also needed to explore how trade openness influences sustainable development and contributes to poverty reduction.

REFERENCES

Adu-Gyamfi, G., Nketiah, E., Obuobi, B., Adjei, M. (2020), "Trade openness, inflation and GDP growth: Panel data evidence from nine (9) West African countries", *Open Journal of Business and Management*, Vol. 8, pp. 314-328.

Akuffo, A. (2012), "The effect of trade openness on economic growth: The case of African countries", Master's thesis [No. 92], North Carolina Agricultural and Technical State University, USA.

Amna Intisar, R., Yaseen, M. R., Kousar, R., Usman, M., Makhdum, M. S. A. (2020), "Impact of trade openness and human capital on economic growth: A comparative investigation of Asian countries", *Sustainability*, Vol. 12, No. 7, pp. 2930.

Barro, R., Sala-i-Martin, X. (2004), *Economic growth* (2nd ed.), MIT Press, Cambridge, MA.

Belloumi, M. (2014), "The relationship between trade, FDI and economic growth in Tunisia: An application of the autoregressive distributed lag model", *Economic Systems*, Vol. 38, No. 2, pp. 269–287.

Bendjelloul, K., Hamza, B., Benkhalifa, A. (2021), "The causal relationship between trade openness and economic growth of Algeria in the period 1990–2018 using causality Toda Yamamoto (TYDL)", *Dirasat Journal Economic Issue*, Vol. 12, No. 2, pp. 103–120.

Cahyono, E. F., Mazlan, N. S., Ahmad, M. N. N., Ngah, W. A. S. W., Mohammed, A. (2025), "Evaluating asymmetric impacts of Islamic bank financing on employment in Indonesia", *Etikonomi*, Vol. 24, No. 1.

Degu, A. A., Bekele, D. T., Ayenew, B. B., Abate, C. A. (2022), "The asymmetric effect of trade openness on output volatility: Empirical evidence from Ethiopia", *Working paper*.

Dowrick, S., Golley, J. (2004), "Trade openness and growth: Who benefits?", *Oxford Review of Economic Policy*, Vol. 20, No. 1, pp. 38–56.

Fatima, S. T., Ahmed, A. M., Rehman, W. (2020), "Trade openness and economic growth: A panel data analysis of selected South Asian countries", *Journal of Economic Structures*, Vol. 9, No. 1, pp. 1–16.

Fetahi-Vehapi, M., Sadiku, L., Petkovski, M. (2015), "Empirical analysis of the effects of trade openness on economic growth: An evidence for South East European countries", *Procedia Economics and Finance*, Vol. 19, pp. 17–26.

Frankel, J. A., Romer, D. (2017), "Does trade cause growth?", in: *Global Trade*, Routledge, London, pp. 255–276.

Ghazouani, T. (2021), "Impact of FDI inflow, crude oil prices, and economic growth on CO₂ emission in Tunisia: Symmetric and asymmetric analysis through ARDL and NARDL approach", *Environmental Economics*, Vol. 12, No. 1, pp. 1–14.

Giovanni, J., Levchenko, A. A. (2009), "Trade openness and volatility", *The Review of Economics and Statistics*, Vol. 91, No. 3, pp. 558–585.

Grossman, G. M., Helpman, E. (1993), *Innovation and growth in the global economy*, MIT Press, Cambridge, MA.

Haddad, M., Lim, J. J., Saborowski, C. (2012), "Trade openness reduces growth volatility when countries are well diversified", *The World Bank Economic Review*, Vol. 27, No. 1, pp. 1–28.

Hanushek, E. A. (2016), "Will more higher education improve economic growth?", *Oxford Review of Economic Policy*, Vol. 32, No. 4, pp. 538–552.

Hossain, A., Acet, H., Ahmed, Z., Majumder, A. (2021), "Revisiting inflation and growth nexus in Bangladesh: An asymmetric cointegration based on non-linear ARDL approach", *Revista Finanzas y Política Económica*, Vol. 13, No. 2, pp. 371–402.

Huchet-Bourdon, M., Le Mouél, C., Vijil, M. (2018), "The relationship between trade openness and economic growth: Some new insights on the openness measurement issue", *The World Economy*, Vol. 41, No. 1, pp. 59–76.

Huchet, M. (2017), "Trade openness and growth: Revisiting the evidence using panel data", *Applied Economics*, Vol. 49, No. 54, pp. 5534–5550.

Hye, Q. M. A., Wizarat, S., Lau, W. Y. (2022), "Trade openness and economic growth: A time series analysis for Pakistan", *The Journal of International Trade & Economic Development*, Vol. 31, No. 1, pp. 56–72.

Iamsiraroj, S. (2015), "The foreign direct investment–economic growth nexus", *International Review of Economics & Finance*, Vol. 42, pp. 116–133.

Jabbar, A., Ahmad, I., Sultan, A., Iqbal, J. (2024), "The impact of financial development and trade openness on economic growth: time series evidence from Luxembourg", *Bulletin of Business and Economics (BBE)*, Vol. 13, No. 1.

Jalil, A., Rauf, A. (2021), "Revisiting the link between trade openness and economic growth using panel methods", *The Journal of International Trade & Economic Development*, Vol. 30, No. 8, pp. 1168–1187.

Jouini, J. (2014), "Economic growth and trade openness: Evidence from MENA countries", *The International Journal of Business and Finance Research*, Vol. 8, No. 5, pp. 93–103.

Kamal, N. (2020), "Expenditure on university education and its impact on economic growth in the Kingdom of Saudi Arabia", King Abdulaziz University. Retrieved from https://kau.edu.sa/Files/306/Researches/73375_46544.pdf.

Keho, Y. (2017), "The impact of trade openness on economic growth: The case of Côte d'Ivoire", *Cogent Economics & Finance*, Vol. 5, No. 1, pp. 1–14.

Kim, D.-H., Lin, S.-C. (2009), "Trade and growth at different stages of economic development", *Journal of Development Studies*, Vol. 45, No. 8, pp. 1211–1224.

Kim, D.-H., Lin, S.-C., Suen, Y.-B. (2011), "Nonlinearity between trade openness and economic development", *Review of Development Economics*, Vol. 15, No. 2, pp. 279–292.

Krugman, P. (2009), *International economics: Theory and policy*, Prentice Hall, New York.

Kurteš, S., Amidžić, S., Kurušić, D. (2023), "Impact of trade openness, human capital through innovations on economic growth: Case of the Balkan Countries", *Economics- Innovative and Economics Research Journal*, Vol. 11, No. 2, pp. 199–208.

Lawal, A. I., Nwanji, T. I., Asaleye, A. J., Ahmed, V. (2016), "Economic growth, financial development and trade openness in Nigeria: An application of the ARDL bound testing approach", *Cogent Economics & Finance*, Vol. 4, No. 1, pp. 1–15.

Iyoha, M., Okim, A. (2017), "The impact of trade on economic growth in ECOWAS countries: Evidence from panel data", *CBN Journal of Applied Statistics*, Vol. 8, No. 1, pp. 23–49.

Madsen, J. B. (2009), "Trade barriers and the collapse of world trade during the Great Depression", *Southern Economic Journal*, Vol. 76, No. 3, pp. 849–868.

Makki, S. S., Somwaru, A. (2004), "Impact of foreign direct investment and trade on economic growth: Evidence from developing countries", *American Journal of Agricultural Economics*, Vol. 86, No. 3, pp. 795–801.

Malefane, M. R., Odhiambo, N. M. (2021), "Trade openness and economic growth: empirical evidence from Lesotho", *Global Business Review*, Vol. 22, No. 5, pp. 1103–1119.

Malefane, M. R., Odhiambo, N. M. (2018), "Impact of trade openness on economic growth: Empirical evidence from South Africa", *International Economics/Economia Internazionale*, Vol. 71, No. 4.

Mallick, L., Behera, S. (2020), "Does trade openness affect economic growth in India? Evidence from threshold cointegration with asymmetric adjustment", *Cogent Economics & Finance*, Vol. 8, No. 1, pp. 1782659.

Musila, J. W., Yiheyis, Z. (2015), "The impact of trade openness on growth: The case of Kenya", *Journal of Policy Modeling*, Vol. 37, No. 2, pp. 342–354.

Nannicini, T., Billmeier, A. (2011), "Economies in transition: How important is trade openness for growth?", *Oxford Bulletin of Economics and Statistics*, Vol. 73, No. 3, pp. 287–314.

- Oppong-Baah, T., Bo, Y., Twi-Brempong, C., Amoah, E. O., Prempeh, N. A., Addai, M. (2022), "The impact of trade openness on economic growth: The case of Ghana and Nigeria", *Journal of Human Resource and Sustainability Studies*, Vol. 10, No. 1, pp. 142–160.
- Raghutla, C. (2020), "The effect of trade openness on economic growth: Some empirical evidence from emerging market economies", *Journal of Public Affairs*, Vol. 20, No. 3, e2081.
- Rasoanomenjanahary, M. A., Cao, L., Xi, Y. (2022), "The impact of trade openness on economic growth: Empirical evidence from Madagascar", *Modern Economy*, Vol. 13, No. 5, pp. 629–650.
- Sarkar, P. (2008), "Trade openness and growth: Is there any link?", *Journal of Economic Issues*, Vol. 42, No. 3, pp. 763–775.
- Shaari, M. (2014), "Education-led economic growth in Malaysia", *SOP Transactions on Economic Research*, Vol. 1, No. 1, pp. 27–33.
- Shin, Y., Yu, B., Greenwood-Nimmo, M. (2014), "Modelling asymmetric cointegration and dynamic multipliers in a nonlinear ARDL framework", *Festschrift in honor of Peter Schmidt: Econometric Methods and Applications*, pp. 281–314.
- Singh, T. (2010), "Does international trade cause economic growth? A survey", *The World Economy*, Vol. 33, No. 11, pp. 1517–1564.
- Sriyana, J., Afandi, A. (2020), "Asymmetric effects of trade openness on economic growth in selected ASEAN countries".
- Turay, A., Seraj, M., Ozdeser, H. (2022), "The degree of responsiveness of fiscal and monetary policy in Sierra Leone", *African Journal of Economic and Management Studies*, Vol. 14, No. 1, pp. 18–33.
- Wacziarg, R., Welch, K. H. (2008), "Trade liberalization and growth: New evidence", *The World Bank Economic Review*, Vol. 22, No. 2, pp. 187–213.
- Wadström, C., Johansson, M., Uddin, G. (2023), "Navigating uncertainty: Exploring electricity demand dynamics in Swedish industrial sectors amid global shocks and instability", *Energy Efficiency*, Vol. 16, No. 8, article 95.
- Wiredu, J., Nketiah, E., Adjei, M. (2020), "The relationship between trade openness, foreign direct investment and economic growth in West Africa: Static panel data model", *Journal of Human Resource and Sustainability Studies*, Vol. 8, No. 1, pp. 18.
- Udeagha, C., Ngepah, N. (2021), "The asymmetric effect of trade openness on economic growth in South Africa: A nonlinear ARDL approach", *Economic Change and Restructuring*, Vol. 54, No. 2, pp. 491–540.
- Yakubu, M. M., Akanegbu, B. N. (2018), "Trade openness and economic growth: Evidence from Nigeria", *European Journal of Business, Economics and Accountancy*, Vol. 6, No. 4, pp. 30–44.
- Yanikkaya, H. (2003), "Trade openness and economic growth: A cross-country empirical investigation", *Journal of Development Economics*, Vol. 72, No. 1, pp. 57–89.