Is the impact of the Economic Diversification on Economic Growth Symmetric or Asymmetric? Evidence from Saudi Arabia

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Abstract

This paper presents our investigation of the impact of economic diversification on economic growth in Saudi Arabia for the 1990-2018 period. To this end, we used linear and nonlinear error-correction models (i.e., the ARDL, Pesaran et al. (2001), and NARDL, Shin et al. (2014), models) that are suited to capture the symmetric and asymmetric effects of economic diversification on economic growth based on the Solow model. As a measure of economic diversification, we used the Herfindahl index. In the linear and the nonlinear specifications, our results show that, economic diversification has a positive effect on the economic growth only in the long term. Furthermore, using the Wald test, the symmetric hypothesis in this relationship is not rejected, indicating that economic growth responds symmetrically to positive and negative changes in economic diversification. Our results also reveal that Saudi Arabia had relative success in achieving its goal of attaining a degree of economic diversification and enhancing its economic growth.

Keywords: economic diversification, economic growth, ARDL, NARDL, cointegration

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1. Introduction

The Kingdom of Saudi Arabia presented its 'Vision 2030' initiative, which is based on three main axes: a vibrant society, a thriving economy and an ambitious nation. These axes, which are complementary and consistent with each other, are aimed at achieving the goals and maximizing the benefits to be accrued from the foundations of the initiative. A thriving economy is the second most important objective laid down in Saudi Arabia's vision, especially in view of the decline in global prices of oil, which is the main source of the Kingdom's finances. This second axis also branches into several sub-axes: a thriving economy - a fruitful opportunity, a thriving economy - its attractive competitiveness, a thriving economy - an active investment, and finally a thriving economy - its exploited location. The focus of our study on the axis of a thriving economy - active investment sub-axis and on utilizing and investing the country's resources in diversifying its economy.

In order to achieve a thriving economy, Saudi Arabia intends to diversify it and to create dynamic job opportunities for its citizens. The roadmap to the achievement of this goal involves: committing to education, entrepreneurship, and innovation; unlocking underdeveloped industries such as manufacturing, renewable energy, and tourism; and refocusing on small and medium-sized enterprises (SMEs) by encouraging financial assistance, thus increasing the contribution made to the GDP by these companies by 20% to 35% by 2030 (Vision 2030).

In light of this Vision 2030 aim, it is clear that the diversification of the Saudi economy is the most important component of the country's goal of achieving sustainable development. Therefore, the topic of economic diversification of and how to benefit from it, was a basic pillar of our study and the starting point from which to analyze and understand the degree of economic diversification currently found in the Kingdom and how it will have evolved by 2030. The theoretical framework of this study was focused on clarifying the two basic concepts for the success of the Kingdom's Vision 2030 initiative: economic diversification and growth.

The existing empirical literature has highlighted the existence of a definite nexus between economic diversification and growth, and has analyzed the effect of economic diversification through linear models. Our study is unique because it investigated both symmetric and asymmetric relationships by applying both the newly developed linear and nonlinear autoregressive distributed lag (ARDL and NARDL) bounds testing (Pesaran et al.,

2001; Shin et al., 2014) to cover a wide range of time series data ranging from 1990 to 2018. To our knowledge, asymmetry had not hitherto been applied to the study of the relationship between economic diversification and growth in the Saudi Arabian context. In this context, the results yielded by our study can help policy-makers better understand how any positive and negative changes in economic diversification can affect economic growth.

The rest of the paper is organized as follows. In Section 3, having cited the definitions of the economic diversification and growth concepts, which were the basic variables of our work, we present a literature review on the relationship between the two concepts. In Section 4, we outline our research methodology, whereby we set out to investigate this relationship in the context of Saudi Arabia over the 1990-2018 period by applying the ARDL/NARDL approach. In Section 5, we present the results and discussion. The concluding remarks and policy implications regarding the economic diversification process undertaken in Saudi Arabia are presented in section 6.

2. Economic Diversification/ Economic Growth

Economic diversification is an important concept from both the economic and administrative standpoints. Multiple definitions of this concept are found in the literature. According to these definitions, it can be said, in general, that the aim of diversification is to reduce dependency on a single source of income (in the case of Saudi Arabia, oil) and to shift toward the creation of a production based on areas of multiple activities.

Economic growth is defined as the increase in the gross domestic product (GDP), which is defined as the sum of the market value of the goods and services produced in a certain period; as the GDP is sourced from several sectors, economic growth is the outcome of the sum of the increases that occur in all such sectors.

In Saudi Arabia, the oil sector has dominated the economy from the beginning of the '70s until the present day, with the average contribution made by oil to the GDP being about 48% during the period 2000-2018, and the average oil revenues having reached around 90% of the country's total. This means that Saudi Arabia's dependency to oil may yield some degree of economic growth, but no economic development. Therefore, the country has identified economic diversification as the way it can avoid instability and disruptions in its economy.

3. Literature Review

The effect of economic diversification on economic growth is discussed in various ways in the related literature.

In 2018, using a descriptive analysis, Banafea and Ibnrubbian (2018) emphasized the efforts made by the Saudi government to diversify its economy through nine development plans covering the 45 years from 1970 to 2014. They found that the Saudi government had achieved some success in moving towards diversification only in its last two development plans (from 2005 to 2014) and that, in any case, the process of diversification was slow-paced.

According to Albassam (2015), despite the nine development plans issued since 1970 to diversify the economy, oil remains the main driver of the economy. In view of this lack of success, the author pointed at the urgent need to review the mechanisms used to diversify the Saudi economy.

Moreover, Algowear Almestneer (2018) investigated several factors that might be suited to bring about a reduction of Saudi Arabia's dependency from crude oil as its main source of income, and thus engender economic diversification. The author also developed a model, tailored to the diversification of the Saudi economy, which provides a better rationale for designing the kingdom's trade policies and taking a step toward diversifying the Saudi economy by stimulating non-oil sectors through trade openness.

Alghamedi (2014) reiterated Saudi Arabia's high dependency on oil revenues, which, by excluding other sectors that could boost the national revenue, threatens the economic development of not only Saudi Arabia, but also that of other Gulf States. The many attempts made to diversify the country's sources of income appear to have failed to bring about any important change. This lack of diversification may be due to several reasons: government red tape, high entrance barriers for new businesses, and a lack of commitment by the government. As a result, Saudi Arabia is recording high unemployment rates.

Khorsheed (2015) also showed that, despite the numerous attempts made to diversify the Saudi economy, it remains heavily dependent on the oil and petroleum-related industries.

These studies were conducted based on linear models; to our knowledge, no study has hitherto addressed this topic from a non-linear perspective i.e., taking into account the non-linearity of macroeconomic series.

3.1 Measuring Indicators of Diversification

There are many statistical indicators suited to measure economic diversification—e.g., the Gini, Herfindahl,

Entropy, and coefficient of variation ones—which may vary in terms of their measuring efficiency and purpose. Some of them measure dispersion, others diversification. Following Algowear et al. (2018), the Normalized Herfindahl-Hirschman Index—which is considered to be the most popular indicator and was therefore used in our study—measures the extent to which a particular economy is dominated by a small number of sectors.

The Normalized Herfindahl-Hirschman index is calculated by the following formula (Haouas & Heshmati, 2014):

$$H = \frac{\sum_{i=1}^{N} \left(\frac{x_i}{X}\right)^2 - \sqrt{\frac{1}{N}}}{1 - \sqrt{\frac{1}{N}}}$$

In which N is the total number of economic sectors and X is the target country's GDP. So, (xi/X) is the ith sector's value added share of the country's total added value for all sectors. The value of the index ranges from 0 (full diversification) to 1 (no diversification).

The sectors that were included in our study to construct the Normalized Herfindahl-Hirschman Index are as follows (following Algowear & Raed, 2018):

-Agriculture, Forestry, and Fishing,

-Construction

- Manufacturing—Other than Petroleum Refining,

-Electricity, Gas, and Water,

-Mining and Quarrying—Other than Petroleum and Natural Gas,

-Wholesale and Retail Trade, Restaurants and hotels,

-Transport, Storage, and Communication,

-Finance, Insurance, Real Estate and Business Services—Ownership of Real Estate,

-Community, Social, and Personal Services,

-Providers of Government Services,

-Finance, Insurance,

- Oil and related sectors.

We present the Normalized Herfindahl-Hirschman Index (H) calculated for Saudi Arabia in Figure (1):

Figure 1. Saudi diversification index (H)

The choice of this period (from 1990 to 2018) is justified by the fact that it covers all the development plans carried out in Saudi Arabia. An examination of the trend of the economic diversification index highlights its clear decrease during the study period, which indicates Saudi Arabia's relative success in achieving its goal of increasing its level of economic diversification. This achievement must however be followed by that of economic growth. Hence, should Saudi Arabia succeed in reducing its economic diversification index, would this

be associated with higher economic growth? Answering this question was the goal of our empirical study, which is presented in the remainder of the paper. Figure 2 presents the association between the Normalized Herfindahl-Hirschman Index and economic growth in Saudi Arabia.
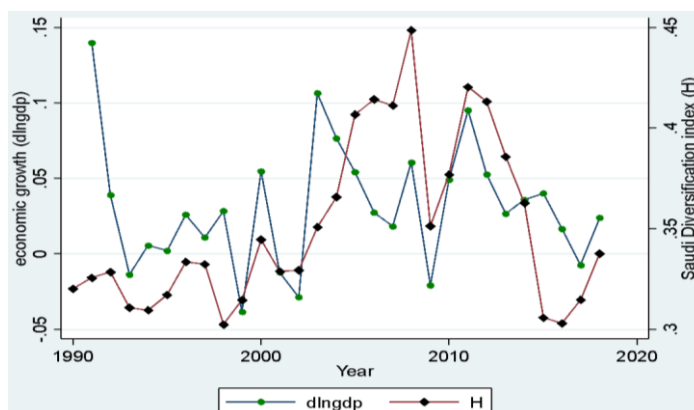

Figure 2. Evolution of economic growth and economic diversification index in Saudi Arabia

4. Data and Methodology

Two models of economic growth are commonly found in the literature: the Solow (Solow, 1957), and Romer models (Romer, 1986). The Solow model, which was used in our study, predicts that, in the long term, economies converge to a steady state equilibrium and that growth is not affected by any actions taken by policy makers, but by external variables like technology and divergence from stability. The Romer model was not suited to our case—specifically to the Saudi economy, which depends heavily on oil revenues and not on the high technology and high quality of education that are the focus of the Romer model.

According to AlKhatib (2014), Keller et al. (2002), and Makdisi et al. (2002), technological development has a limited effect on the growth of the Gulf countries because they import technology and high quality workers, investing little on research and development.

Therefore, to study the effect of diversification on economic growth, we used the expanded neoclassic model based on the production function:

$$Y_t = AL_t^{\alpha 1}K_t^{\alpha 2}F_t^{\alpha 3} \tag{1}$$

Where Y is the real GDP, L is labor and K is capital. F is included as the oil production in real prices.

By transforming equation (1) into its linear form and including the diversification measure H, the model can be reformulated as:

$$LnY_t = \alpha_0 + \alpha_1 LnL_t + \alpha_2 LnK_t + \alpha_3 LnF_t + \alpha_4 H_t + \varepsilon_t \tag{2}$$

Where LnY_t is the natural log of the real GDP, LnL is the natural log of labor force, LnK is the natural log of domestic capital and LnF is the natural log of oil production.

Our sample was made up of 1990-2018 annual data for Saudi Arabia taken from the International Energy Agency's statistics (2018) and from the World Development Indicators (World Bank, 2018). See Table 1 for an explanation of the construction and metrics of the variables used in the analysis.

Table 1. Definition of the variables

Variable	Metric
Real GDP (Lrgdp)	Measured at producer's values at constant prices (2010 = 100) in Million Riyals.
Capital (K)	Measured in millions of constant 2005 Riyals
Labor force (L)	Measured in millions.
Oil production (F)	Measured in millions of barrels.
Diversification measure (H)	Author's calculations

Given the importance of economic diversification in achieving the Vision 2030 initiative, in this study, we first applied the error correction Autoregressive Distributive Lag model (ARDL) to test the short and long-term

relationship between economic diversification and economic growth and the other explanatory variables in Saudi Arabia.

We then used the nonlinear ARDL model (NARDL) (Shin et al., 2014) to investigate the existence of asymmetry in the short and long-term relationship.

As stated by Shin et al. (2014), the ARDL model is one of the simplest error correction models, and it has the advantage of being estimated by the ordinary least squares method, as it is linear in its parameters. In addition, the ARDL model presents several advantages, including the fact that it is not restricted to integrating variables of interest of the same order. The ARDL model can be used when the variables are a mix of order zero I(0) and one I(1) integrated or partially integrated ones.

Therefore, the specification of the ARDL model was as follows:

$$\Delta LnY_t = \beta_0 + \sum_{k=1}^{n1} \beta_{1k}\Delta LnY_{t-k} + \sum_{k=0}^{n2} \beta_{2k}\Delta LnL_{t-k} + \sum_{k=0}^{n3} \beta_{3k}\Delta LnK_{t-k} + \sum_{k=0}^{n4} \beta_{4k}\Delta LnF_{t-k} + \sum_{k=0}^{n5} \beta_{5k}\Delta H_{t-k} + \lambda(LnY_{t-1} - \theta_1 LnL_{t-1} - \theta_2 LnK_{t-1} - \theta_3 LnF_{t-1} - \theta_4 H_{t-1}) + \varepsilon_t \qquad (3)$$

Equation (3) is equivalent to:

$$\Delta LnY_t = \beta_0 + \sum_{k=1}^{n1} \beta_1\Delta LnY_{t-k} + \sum_{k=0}^{n2} \beta_2\Delta LnL_{t-k} + \sum_{k=0}^{n3} \beta_3\Delta LnK_{t-k} + \sum_{k=0}^{n4} \beta_4\Delta LnF_{t-k} + \sum_{k=0}^{n5} \beta_5\Delta H_{t-k} + \lambda ECT + \varepsilon_t \qquad (4)$$

Where, $ECT = LnY_{t-1} - \theta_1 LnL_{t-1} - \theta_2 LnK_{t-1} - \theta_3 LnF_{t-1} - \theta_4 H_{t-1}$

Where, ε_t is an error term, which should be white noise and Δ represents the first difference. ECT is the error correction term. The estimated coefficient λ must be negative and statistically significant, as it represents the speed of adjustment whereby the dynamics converge back to a point of equilibrium, which would confirm the system's stability.

Then, we modified Equation (3) to analyze the asymmetric effects of economic diversification on economic growth. To accomplish this task, we inserted the HPOS and HNEG variables, which—following Shin et al. (2014)—are defined as the positive and negative partial sum decompositions of the diversification variable (H):

$$\Delta LnY_t = \beta_0 + \sum_{k=1}^{n1} \beta_1\Delta LnY_{t-k} + \sum_{k=0}^{n2} \beta_2\Delta LnL_{t-k} + \sum_{k=0}^{n3} \beta_3\Delta LnK_{t-k} + \sum_{k=0}^{n4} \beta_4\Delta LnF_{t-k} + \sum_{k=0}^{n5} \beta_5\Delta HPOS_{t-k}$$
$$+ \sum_{k=0}^{n6} \beta_6\Delta HNEG_{t-k} + \lambda(LnY_{t-1} - \theta_1 LnL_{t-1} - \theta_2 LnK_{t-1} - \theta_3 LnF_{t-1} - \theta_4 HPOS_{t-1} - \theta_5 HNEG_{t-1}) + \varepsilon_t \quad (5)$$
$$HPOS_t = \sum_{j=1}^{t} DHPOS_j = \sum_{j=1}^{t} max(DH_j, 0)$$
$$HNEG_t = \sum_{j=1}^{t} DHNEG_j = \sum_{j=1}^{t} min(DH_j, 0)$$

According to Pesaran et al. (2001) and Shin et al. (2014), the ARDL/NARDL approach requires two steps. First, the existence of any long term relationship among the variables of interest must be determined by performing of an F-test. The estimated value of the F-statistics is matched with the two sets of critical values classified as upper- and lower-bounds: *I*(1) and *I*(0), respectively. The null hypothesis of no co-integration is rejected when the value of the F-statistic exceeds the upper critical bound value, while it is accepted if the F-statistic is lower than the lower bound value. For other values, the result of the co-integration test is considered to be inconclusive. The second step of the analysis involves estimating the coefficients of the short and long term relationship and determining their values.

5. Empirical Results and Analysis

5.1 Unit Root Tests for Stationarity

Various unit root tests can be performed to check for stationarity and to determine the order of integration of the time series data. Enders (1995) recommended the use of more than one such test to determine the correct order of integration of the variables. The ADF (Augmented Dickey and Fuller, 1981), PP (Phillips and Perron, 1988) and KPSS (Kwiatkowski–Phillips–Schmidt–Shin, 1992) tests are widely performed unit root tests, as reported by numerous studies. The correct order of integration for the estimated variables can only be trusted if two unit root tests yield the same results.

The results of the ADF, PP, and KPSS tests are reported in Table 2. Pesaran and Shin (1998) recommended using the Schwarz information criteria for the selection of the optimum lag to conduct these tests.

Table 2. Unit root tests

Panel A	At level						
	ADF		**PP**		**KPSS**		**Order of integration**
variables	With Intercept	With Intercept and Trend	With Intercept	With Intercept and Trend	With Intercept	With Intercept and Trend	
Lngdp	-0.390	-1.736	-0.390	-1.853	0.671	0.147	I(1)
H	-1.978	-1.901	-2.03	-1.947	0.255	0.128	I(1)
Lnk	-0.452	-2.596	-1.027	-1.516	0.646	0.101	I(1)
Lnl	-0.893	-2.747	1.184	-2.038	0.676	0.166	I(1)
lnf	-2.563	-3.962	-2.657	-4.092	0.632	0.101	I(0)
Panel B	**At first Difference**						
	ADF		**PP**		**KPSS**		
variables	With Intercept	With Intercept and Trend	With Intercept	With Intercept and Trend	With Intercept	With Intercept and Trend	
dlngdp	-5.467	-5.493	-5.468	-5.632	0.077	0.077	
dH	-5.398	-5.334	-5.519	-5.504	0.122	0.114	
dlnk	-3.579	-3.475	-3.613	-3.512	0.140	0.126	
dlnl	-1.406	-0.876	-1.488	-0.963	0.289	0.132	
dlnF	-6.784	-3.672	-9.742	-13.565	0.110	0.098	

ADF, PP and KPSS tests were performed both at level (panel A) and first differenced (panel B), with (intercept, and both trend and intercept).

Table 2 clearly shows that some of the variables are stationary at level I(0), while others were found to be stationary at first difference I(1). Therefore, the bounds test of co-integration can be applied to Equation (3) to determine the long term relationship among the estimated variables.

5.2 Bounds Test of Co-Integration and ARDL Estimation Results

The results of the ARDL bounds testing approach (Pesaran, Shin, & Smith, 2001) are shown in Table 3.

Table 3. ARDL bounds test for cointegration

Variables	F– Statistics	Cointegration
Lngdp, H, LnF, LnK, LnL	62.78***	Cointegration
Critical value	Lower Bound	Upper Bound
1%	4.977	6.833
5%	3.425	4.844
10%	2.792	4.029

Note. *** Statistical significance at 1% level; ** Statistical significance at 5% level; * Statistical significance at 10% level. The lag length k=1 was selected based on the Schwarz criterion (SC). Critical values are obtained from Kripfganz and Schneider (2018). The number of regressors is 4.

The empirical findings lead to the conclusion that there is a long term relationship between economic growth, economic diversification, oil production, labor force, and capital. The value of the calculated F-statistic (62.78) was found to be higher than the upper bound critical values at all levels of significance, implying the existence of co-integration. The next step involved examining the marginal effect of economic diversification and of the other explanatory variables on economic growth. The estimation's results are reported in Table 4.

Table 4. Estimated long run coefficients

Dependent variable: dlngdp		
Variables	Coefficients	p-value
Adjusted error term	-0.950	0.000
H	-0.177	0.036
LnF	0.466	0.000
LnK	0.095	0.000
LnL	0.420	0.000
Adj R-squared = 0.9196, ARDL(1,0,0,0,0) regression		

We found no evidence of a short term significant relationship between economic growth and the other explanatory variables. However, our empirical evidence does reveal a negative and significant impact of the Herfindahl index (a positive impact of the degree of economic diversification) on Saudi Arabia's economic growth, which is consistent with Hvidt (2013). The estimated oil production, capital, and labor force long term coefficients are statistically significant at 1%. The results for the estimated long term coefficients show that a 1% increase in oil production, capital, and labor force would lead to economic growth increases of about 0.46%, 0.09%, and 0.42%, respectively. Furthermore, a 1% decrease in the diversification measure (H) would lead to an economic growth increase of about 0.17%. This indicates that economic diversification would have a positive effect on the Saudi economy. We can say that the country has achieved relative success in achieving its goal of increasing its degree of economic diversification and economic growth. However, the results of these increases are weak due to other factors, like the diversity of subsidized commodities (fuel), as well as the grants provided to citizens, which are not related to their productivity.

5.3 Diagnostic Tests

After estimating the ARDL model, we performed some diagnostic tests to assess the adequacy of the dynamic model. The results of these tests, which are reported in Table 5, were quite satisfactory. In terms of serial correlation and heteroscedasticity, the null hypotheses were rejected for the estimated ARDL model (the results of both the LM and Reset tests were found to be insignificant at the 5% level, which implies the absence of serial correlation issues and heteroscedasticity). In addition, the results presented in Figure 3 show that the CUSUM (cumulative sum of recursive residuals) and CUSUM squared (cumulative sum of squares of recursive residuals) are between the upper and lower critical bounds, confirming the stability of the ARDL estimates.

Table 5. Diagnostic tests of the ARDL model

F-Bounds test	ECM	LM test	Reset test	Cusum test
62.78	-0.95 (0.000)	2.304 (0.125)	2.214 (0.151)	Stable**

Note. Numbers inside the parentheses are the p-values. The upper bound critical value of the F-statistic at the 5% significance level is 4.844 (when there are four exogenous variables). The lower bound critical value of the t-statistic at the 5% significance level is 3.425 when there are four exogenous variables. These values come from Pesaran et al. (2001) and they usually used to judge the significance of ECM.
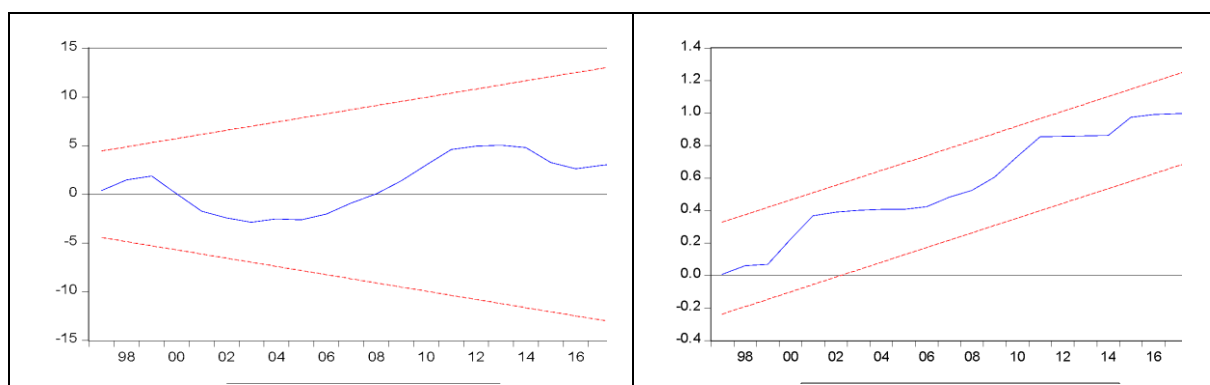

Figure 3. Cusum and Cusum squared tests

5.4 Nonlinear ARDL Estimation

In a second step, we turned to examine the asymmetric impact of economic diversification on economic growth. The NARDL bound test results reported in Table 6 show that the F-statistic (94.99) was found to be significant, indicating that economic growth is nonlinearly co-integrated with economic diversification.

Table 6. Diagnostic tests of the nonlinear ARDL model

F-Bounds test	LM test	Reset test	Cusum test
94.99	0.419 (0.663)	1.175 (0.291)	Stable**

Following Shin et al. (2014) and accounting for the nonlinearity of the relationship between economic growth

and economic diversification, we turned to estimate the nonlinear ARDL model presented above in equation (5), in which we decomposed the diversification measure (H) into its partial sums of negative and positive changes. We therefore were able to assess whether the negative and positive changes in economic diversification had had symmetric or asymmetric effects on economic growth. The NARDL estimation results are presented in Table 7.

Table 7. NARDL model estimation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNGDP(-1)*	-0.919	0.059	-15.415	0.000
Variable	Coefficient	Std. Error	t-Statistic	Prob.
H_POS	0.338	0.218	1.549	0.136
H_NEG	-0.362	0.099	-3.652	0.001
LNF	0.499	0.045	11.03	0.000
LNK	0.079	0.014	5.371	0.000
LNL	0.242	0.077	3.144	0.004
C	2.940	1.068	2.753	0.011

EC = LNGDP - (0.3389*H_POS -0.3627*H_NEG + 0.4993*LNF + 0.0793*LNK+ 0.2429*LNL + 2.9408)

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
		Asymptotic: n=1000		
F-statistic	94.990	10%	2.08	3
k	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15

As in the ARDL model, the estimated results for the NARDL model revealed the absence of a short term relationship between economic growth and economic diversification. The estimated long term coefficient associated with H_pos was found to be 0.33 and non-significant, while the coefficient of H_neg was found to be -0.36 and significant. This implies the existence of a significant long term negative relationship between economic growth and H_neg, thereby indicating that a decrease of 1% in H (the economic diversification measure) would result in a 0.36% increase in economic growth. Finally, we found a significant long term positive relationship between economic growth and the other explanatory variables. This indicates that a 1% increase in oil production, capital, and labor force would lead to 0.499%, 0.079%, and 0.242% increases in economic growth, respectively.

We also report some other diagnostics. We found the LM test (0.663) (Note 1) to be insignificant at the 5% level, which implied the absence of serial correlation problems. We tested Ramsey's RESET statistic to assess misspecification. With a p-value of 0.291, the RESET statistic was found to be insignificant, indicating that the model's functional form was well established. Depending on the CUSUM test (Figure 4), we obtained stable estimates. To conclude, we note that economic diversification would have a long term effect on economic growth in Saudi Arabia.
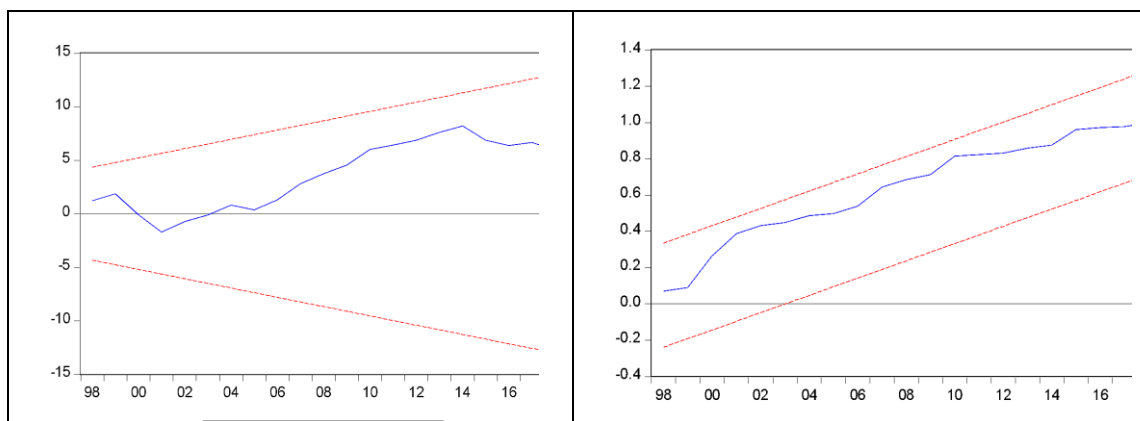

Figure 4. Cusum and Cusum squared tests (NARDL results)

The long term asymmetric effect of economic diversification on economic growth was assessed by means of the Wald test; the results are shown in Table 8.

For the long term, the null hypothesis regarding the existence of a symmetric relationship between economic growth and economic diversification was thus not rejected, as the p-value was found to be greater than 10%. These findings suggest the existence of a symmetric relationship between economic growth and economic diversification in Saudi Arabia.

Table 8. Wald test

Test Statistic	Value	df	Probability
t-statistic	-1.306101	21	0.2056
F-statistic	1.705901	(1, 21)	0.2056
Chi-square	1.705901	1	0.1915
Null Hypothesis: -C(2)/C(1)=-C(3)/C(1)			
Null Hypothesis Summary:			
Normalized Restriction (= 0)		Value	Std. Err.
-C(2)/C(1) + C(3)/C(1)		-8.047096	6.161158

6. Conclusion

Given the objectives laid out in the Vision 2030 initiative, diversification is an economic priority for the economy of Saudi Arabia. In order to achieve a thriving economy, the Kingdom will need to diversify its economy in order to create dynamic job opportunities for its citizens and maintain sustainable real economic growth and development.

For this purpose, we estimated the relationship between economic growth and economic diversification; as measured by the Herfindahl index; on the basis of the Solow model. The effect of economic diversification on GDP growth was analyzed using the ARDL and nonlinear ARDL models using annual time series data over the 1990-2018 period.

Our results highlight the existence of negative linear and nonlinear relationships between economic growth and economic diversification. Indeed, the estimation results of the long term relationship between economic growth and economic diversification show that a decrease of 1% in the Herfindahl index (an increase of the degree of economic diversification) leads to 0.17% and 0.36% increases in economic growth for the ARDL and NARDL models, respectively. In other words, it is clear that economic diversification has a positive effect on Saudi economic growth. However, these results are weak due to other factors, as the wide range of subsidized goods and the grants awarded to Saudi citizens, which are not related to their productivity.

It is difficult to compare the results of this study with the findings of previous ones—e.g., Rahman (2001), Alkhatib (2011, 2014), Coury et al. (2009), Hvidt (2013), Albassam (2015) and Banafea et al. (2018)—due to differences in methodology and periods of analysis. Nevertheless, these studies are almost unanimous in highlighting the limited diversification efforts made in Saudi Arabia, and the country's continued heavy reliance on oil as its main source of income.

The recommendations drawn from this paper are that Saudi Arabia needs to make further efforts to diversify its economy, support more direct and indirect investments, and reduce its volume of grants and subsidized goods.

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Note

Note 1. The number inside the parentheses is the p-value.

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