Hindawi
Discrete Dynamics in Nature and Society
Volume 2023, Article ID 6692446, 15 pages
https://doi.org/10.1155/2023/6692446

Research Article

Investigating Interaction Dynamics among Nonoil Economic Growth and Its Most Important Determinants: Evidence from Saudi Arabia

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Received 29 December 2022; Revised 6 November 2023; Accepted 13 November 2023; Published 15 December 2023

Academic Editor: Sundarapandian Vaidyanathan

Over the past decades, Saudi Arabia's economic development has strongly depended on oil revenues fueled by the rise of oil prices and the strong global market demands for crude oils. However, the country can no longer depend on oil revenues in the face of the dynamic global market, and hence, the Saudi government's Vision 2030 seeks to reduce this dependence and diversify the economy's sources of income. Motivated by this, this study aims to investigate the impact of growth factors: financial innovation (FI), nonoil trade openness (TO), nonoil gross capital formation (GCF), and human capital (CH) development on the nonoil economic growth in Saudi Arabia. The goal of this investigation is to examine the dynamic symmetrical and nonsymmetrical impact of these growth factors on nonoil economic growth and policymaking in Saudi Arabia. To achieve this, this study utilizes the distributed lag symmetric and asymmetric (ARDL and NARD) approaches to assess the short- and long-term symmetric relationships among these growth variables with nonoil economic growth as well as the stationarity, cointegration, and directionality among variables with the theory of "ceteris paribus" in the error correction model (ECM), and Granger causality framework to analyze time-series data from 1980 to 2020. The findings of this study revealed that the FI, TO, GCF, and CH have an impact on the nonoil economic growth in the short and long terms. Additionally, in the long term, the NARDL technique showed that the positive adjustments of HC, FI, TO, and GCF boost the development, which have very significant effects on the nonoil GDP. They also indicate that negative movements have more influence than positive movements in FI. Meanwhile, mixed directional causation results were observed in the short-run analyses. Overall, the findings of this study provide significant insights, empirical recommendations, and implications for policymakers striving to achieve sustainable nonoil trade economic growth in Saudi Arabia and the region.

1. Introduction

The factors that influence growth differ throughout nations and so do economic performance. Several factors, including investments in human and industrialization, inflation, financial development, physical capital, and foreign direct investment, are closely related to growth in all areas [1, 2]. Theories of gross domestic product (GDP) have consistently emphasized the importance of good human resources, a functioning financial system, and trade openness for long-term sustainability. Sustainable GDP can be achieved with an effective financial sector and the efficient use of economic resources through the build-up of human capital [1]. Financial development supports growth by boosting marginal productivity capital and stimulating its accumulation. Financial innovation (FI) can help attain savings while providing new and enhanced financial assistance [1, 3]. With the development of diverse financial services and assets, innovation allows for financial activities to expand and thereby support strong economic growth and transparency [4]. Financial innovation is essential for sustaining the growth sector and achieving financial integrity, which promotes the institutionalization of the financial system [5]. The important elements for sustainable economic growth are society, financial environment, and economic progress, all of which are positively influenced by the establishment of financial institutions [6, 7]. Financial participation involves effective financial transfers and the efficient deployment of investor capital across borders, which are two examples of how FI promotes the financial sector's effectiveness. In turn, such effectiveness promotes financial intermediation and fosters GDP [8].

Financial efficiency is a prerequisite for sustainable growth but remains an insufficient factor. Human capital is another important factor in the development. Given the disregarded role of human capital, physical capital alone is insufficient to explain long-term economic progress [1, 9]. With the advent of development theory in the 1950s and the creation of the human capital theory [10], human capital became a crucial component of development.

Human capital development (HC) is the total of the skills, knowledge, and innovative talents of the country's population [11, 12]. Clearly, by gaining knowledge and skills, individuals become human capital and then play a significant role in the manufacturing process, particularly in labour-intensive regions [13]. The skilled worker who ensures the productive application of human potential as HC in both developed and poor nations when calculating growth is the key to economic growth apart from production [14]. Policymakers, scholars, and academicians have all noted and recorded the importance of human capital to the development during the past few years [15–17]. Human capital plays an important role in the economic process as a manufacturing factor or as a major accelerator for technological innovation, dissemination, and adoption [1, 15] due to the negative effects of inefficient human capital on economic growth, which include both poor resource allocation and reduced long-term investment. HC, which can be considered as a crucial factor in the growth equation, entails increasing quality and quantity as well as labour force skill development. Numerous empirical investigations in various nations over the last 10 years support the favorable influence on economic growth. For instance, such influence was discovered in Pakistan [18], countries with low incomes, India, and specific Asian countries [19]. As such, progress in the HC is necessary to increase overall economic productivity. Throughout this process, several institutional innovations have been made with an emphasis on the transformation of the populace into human capital through skills and attitude development.

Trade openness is defined as a measure of how open a country is to trade and, sometimes, to incoming and outgoing foreign investment [20, 21]. The measure of trade openness is determined by comparing a country's total exports and imports to its GDP which means the country's openness is commonly computed as the ratio of international trade volume to GDP [22, 23]. Over the past three decades, several empirical studies have investigated the impact of trade openness on GDP globally and have obtained positive findings. Trade openness promotes new technology, ideas, and information in addition to buying and selling products and services [24–27].

The international economic, commercial, and financial developments that the world is witnessing today have prompted most countries and governments to liberalize their foreign trade, open the capital account, and move towards the market, under the idea that openness or economic integration helps increase productivity, transfer knowledge and technology, and obtain new sources of financing investment projects local, in addition to many other privileges [27, 28].

Saudi Arabia's economy has flourished a great deal in recent years, establishing that these countries' remarkable growth trajectory can be attributed to financial innovation, the development of human capital, nonoil gross capital formation, and nonoil trade openness, all of which have significant impacts on its economic growth and policymaking. The 2030 vision's main goals are to diversify the economy and lessen the nation's reliance on oil, thus boosting the nonoil GDP share. The strategic macroeconomic pillars of this program are designed to raise the private sector's share of GDP from 40% to 65% [29]. The plan also aims to lower unemployment from 12% to 7% and grow the nonoil GDP's nonoil export proportion from 16% to 50% [30]. Over the next few years, thirteen initiatives were started under the 2030 vision, such as the "financial sector development program" which is a diverse innovation financial development program that encourages saving, financing, and investment while supporting the growth of the national economy and investment, and the "human capacity development program" to develop and flourish skilled and talented personnel of the country's population [29].

The analysis of economic growth factors not only enables creating strategies for sustainable economic growth but also favors the governments and policymakers in identifying such factors and their importance in improving economic growth. Despite the importance of conducting empirical studies to investigate the interaction between nonoil economic variables in Saudi Arabia, there has been only limited attention, in literature, with mostly concentrating on aggregate investment. Also, previous studies in Saudi Arabia are due to the lack of integration among these dynamics, and only a few studies with limited period coverage have been carried out on the basis of the relationship between Saudi Arabia's economic growth and its financial development [26, 31–33]. Thus, the Kingdom of Saudi Arabia remains a fertile environment for enriching academic literature and statistical research in the field of measuring and investigating the announced programs at Vision 2030 of Saudi Arabia.

This study assumes integration among the programs of the Saudi Arabia's Vision 2030 where the variables of the study are identified as the pillars of the vision; given this background, financial innovation and trade openness can be considered key factors in promoting the effective allocation of capital and vice versa. In addition, financial innovation and trade openness mutually cause each other. Therefore, the question is whether these development determinants impact Saudi Arabia's nonoil economic growth and policymaking symmetrically. The primary objective of this paper is to investigate the dynamic impact of financial innovation, nonoil trade openness, nonoil gross capital formation, and human capital, on nonoil economic growth in Saudi Arabia. To achieve this objective, this study utilizes the ARDL approach which allows for assessing cointegration and the short- and long-run symmetric relationships among variables with the theory of "ceteris paribus," in the (ECM) model and causality framework.

The study contributes to the literature by scope and method. More specifically, empirical studies have failed or offered little evidence individually for investigating the interaction between nonoil economic growth in Saudi Arabia and its most important determinants [29, 34]. Additionally, most of the existing empirical studies measure the human capital index through government spending on education and health only which is insufficient in capturing the amount of capital input for improving work skills and comprehensive capability at the societal general level in the procedure of building the assessment index of human capital [35, 36]. Thus, to circumvent these limitations, this study aims to investigate the dynamic impact of financial innovation, nonoil trade openness, nonoil gross capital formation, and human capital, on nonoil economic growth in Saudi Arabia. This sectoral analysis is particularly important for Saudi Arabia because it can provide policymakers, businesses, and academics with a deeper understanding of potential growth opportunities. Sector-level growth and investment trends have important implications for development strategies. Understanding differences by sector is necessary to choose the most effective policy allocation in the presence of resource constraints.

This paper is organized as follows. Section 2 summarizes the literature on the connections among financial innovation, trade openness, increase of human capital, and economic expansion. Section 3 presents the methodology and proposed hypotheses research, whereas data analysis and interpretation are discussed in Section 4. The conclusions are condensed in Section 5.

2. Review of Theoretical and Empirical Works

2.1. Economic Expansion and Financial Innovation. Financial innovation includes creating new finance institutions and products, new payment methods [37], and more importantly ways to boost profits, lower transaction costs, and implement new rules and regulations. Financial innovation sparks a great deal of interest among academics and politicians worldwide, as seen by foundational literature [38]. Following that, financial innovation is viewed as the catalyst for monetary expansion in the real economy and is crucial to increasing economic activity [39]. Additionally, a greater number of empirical investigations support the relationship between financial expansion and economic growth [40]. Over the past 10 years, several empirical studies have investigated the impact of financial innovation on GDP globally and have obtained positive findings [4, 41].

According to [42], financial innovation is a key strategy to maximize shareholder value innovatively. The implication is that new advanced financial services are directly linked to developing fiscal services that are important and run flawlessly. Financial innovation is the link between sustainability and financial industry [43], encompassing modifications to the products and services provided by financial institutions, such as banks, insurance firms and companies, and providers, in addition to alterations to internal systems and procedures, management techniques, and new methods of communicating with consumers [34, 44]. Financial innovation is a crucial component of the economy, particularly for attempts to bring efficiency to the financial system and to accelerate development by lowering transaction costs and equity investment with diversified financial assets [45, 46].

In turn, financial innovation encompasses not only the creation of new financial aids and institutions but also the evolution of financial rules and regulations to ensure accurate reporting and data reliability for overall betterment, and financial innovation leads to varied financial system development that ensures better services [47]. As a result, financial innovation serves as a catalyst for the economy's transformation from a static to a dynamic state by ensuring increased efficiency with quickened capital formation and technological advancement for the expansion of human capital and sustainable financial growth [48]. Consequently, financial innovation is viewed as an engine of economic progress [49]. Innovation alters the financial system, but its impacts may not always generate the expected results. Innovation has both good and bad aspects, including a positive drive for economic growth [50], and is appropriately referred to as a "double-edged sword." Right financial innovation particularly expands service offerings in the banking industry with new financial assets and efficient payment methods, impacts the use of available capital, and transforms savings into successful investments—eventually promoting economic growth [2, 51, 52]. However, financial innovation increases growth volatility for companies, particularly financial ones with investments in multiple areas while ignoring securitization, to blame for the recent global financial [51]. New financial institutions emerge as a result of companies with innovative business practices, which increase institutional complexity, decrease interdependency, and increase the risk of becoming insolvent [53]. Innovative financial products also exacerbate the information asymmetry problem, leading to booms in credit and asset prices [54]. Financial innovation leads to varied financial system development that ensures better services [55]. As a result, financial innovation serves as a catalyst for the economy's transformation from a static to a dynamic state by ensuring increased efficiency with quickened capital formation and technological advancement for the expansion of human capital and sustainable financial growth [48]. Consequently, financial innovation is viewed as an engine of economic

progress [49]. One of the purposes of this study is to investigate the influence of financial innovation on nonoil economic growth in Saudi Arabia, with emphasis on causality in a multivariate framework including nonoil gross capital formation, human capital, and nonoil trade openness, for investigating interaction dynamics among all variables.

2.2. Economic Growth and the Development of Human Capital. Regardless of the health of the economy, economists continue to argue that the most important component of the growth equation is human capital (see [56]) [57]. With the advent of new development theories, HC has emerged as a crucial component for encouraging technical development and adaptation to promote economic prosperity [58, 59]. The knowledge and skills of the population convert them into labour as a crucial component of the industrial process, having a significant impact on manpower productivity [60]. However, skilled labour also adds vitality to economic operations via increasing productivity [61]. Therefore, a fundamental component of economic growth is human capital [2, 62]. Increasing the quality of education and capacity building by putting skilled development into practice programs is necessary for the growth of human capital [63]. Given that investments in the growth of humanity reduce societal economic disparity and ensure better-quality labour [64], they have a positive impact on the development of physical capital and, as a result, promote long-term sustainable economic growth. Thus, human capital is regarded as a key factor in the economic success of emerging nations [1, 14]. Numerous empirical studies have examined the link between the growth of human capital and economic advancement in the last few years [4, 65].

The comprehensive investment in education ensures the optimum use of both physical and financial resources while considering multiplier impacts on the overall output level [66]. By insuring competent labour in productive investments with a greater return, investments in human development create benefits over the long term [67]. Advancement of technology and human capital are the two main factors that determine the real output function [41]. With technological advancement, the contribution from human capital can grow several times with the same amount of work [1, 14]. In addition to spending funds on human development, extensive research suggests that increasing the number of students in various educational levels can boost the nation's productivity [67]. According to Pahlvani et al. [68], more investments in education increase individual production and wages while also having a considerable positive social rate of return. Hanushek [69] stated that developing economies may have difficulties in attaining long-term economic performance without an increase in enrolment rates and improved educational standards. Therefore, an economy with a higher proportion of competent workers undoubtedly benefits from cooperative advantages over another economy as the production innovates, adapts to technology, and disseminates information [70]. Therefore, building up human capital is essential to achieving sustainable economic growth. However, empirical studies continue to support divergent viewpoints regarding the relationship between HC and nonoil-GDP.

One of the purposes of this study is to investigate the influence of human capital on nonoil economic growth in Saudi Arabia, with emphasis on causality in a multivariate framework including nonoil gross capital formation, financial innovation, and nonoil trade openness, for investigating interaction dynamics among all those variables.

2.3. Economic Expansion with Trade Openness and Gross Capital Formation. In this age of globalization, trade openness is a common topic of debate. Trade openness and gross capital formation are two of the most important factors contributing to the growth of the economy [71]. All emerging and developed nations want high economic growth to enhance lives. Developing nations struggle to sustain quick economic development [72]. Trade openness is now regarded as a fundamental factor in economic growth and policymaking in developing nations. The measure of trade openness is determined by comparing a country's total exports and imports to its GDP [71]. That means the country's openness is commonly computed as the ratio of international trade volume to GDP [73]. Over the past three decades, several empirical studies have investigated the impact of trade openness on GDP globally and have obtained positive findings [27–78]. Trade openness promotes new technology, ideas, and information in addition to buying and selling products and services [71]. Aside from the individual link between export, import, and economic development, there are four major contending ideas regarding trade openness. First, the trade-led growth (TLG) theory states that international trade openness causes economic growth [76, 77]. The second theory is growth-led trade (GLT), which states that economic growth causes trade openness [76, 77]. The third is the feedback hypothesis states that trade openness and economic development can mutually cause each other [24, 71]. Fourth, the neutrality hypothesis holds that trade openness and economic development are unrelated. One of the purposes of this study is to investigate the impact of nonoil trade openness on nonoil GDP growth in Saudi Arabia, with emphasis on causality in a multivariate framework including nonoil gross capital formation, financial innovation, and human capital development, for investigating interaction dynamics among all those variables.

3. Empirical Methods

To explore the interaction among variables of this study, there are several steps in the methodology of this study. Figure 1 illustrates the methodology road map of this study which first aimed at investigating the stationary variables using two-point root tests, specifically Phillips and Perron tests and the enhanced Dickey–Fuller test as well as a check of the lag-length criteria for the variables. Subsequently, this investigation used bounds testing to determine whether cointegration was present. Finally, the ARDL and NARL

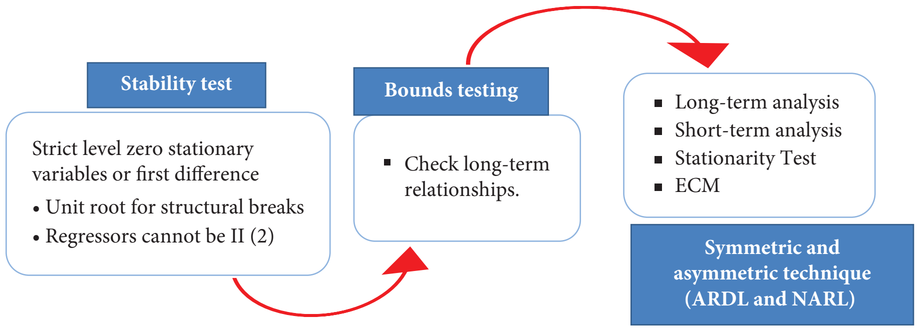

Figure 1: Study methodology diagram.

methods were used to investigate the dynamic impacts and interaction of financial innovation, nonoil gross capital formation, nonoil trade openness, human capital, and nonoil GDP in the long and short terms for the period of 1980 until 2020. The datasets were obtained from the Saudi Arabia Statistics Center bank website and the World Development Indicator Database by the World Bank.

3.1. Symmetric Estimate ARDL Approach. The ARDL approach was employed based on 1980–2020 time series data. This novel approach lets users assess cointegration and short-run and long-run symmetric relationships among variables, with the theory of "ceteris paribus," in the ECM model and causality framework. Over the past 10 years, various approaches have been used to investigate both long- and short-term relationships among research variables. Large empirical studies support the recently created ARDL model, which was first put forth by Pesaran et al. (1998) and then expanded by Pesaran et al. [62] and Narayan's methodology [78]. Bodel (ARDL) has the following advantages. First, irrespective of sample size, which can range from 30 to 80 observations and be small, the autoregressive model is preferable [62]. Second, this strategy performs better when variables integrate differently, such as when several variables are I (0) and others are I (1). Third, both the cointegration and the c problem can be solved by modelling ARDL with the proper lags. Fourth, in simultaneously estimating short- and long-term cointegrating relations, the ARDL model may offer unbiased estimates for the study [62]. By considering empirical studies, we have constructed a linear function for our research variables as follows:

$$\begin{aligned} \text{In nonoilGDP} &= a_0 + \beta_1 \text{InHC}_t + \beta_2 \ln \text{nonoilFI}_t \\ &\quad + \beta_3 \ln \text{nonoilTO}_t + \beta_4 \text{InnonoilGCFt} + \varepsilon_t, \end{aligned} \tag{1}$$

where nonoil GDP stands for the growth rate of the economy per person, FI for financial innovation, non-oil TO for nonoil trade openness, HC for human capital, and nonoil GCF for nonoil gross capital formation.

This study's principal goal is to investigate interaction dynamics among the nonoil economic growth of Saudi Arabia and its most important determinants which are financial innovation, nonoil trade openness, nonoil gross capital formation, and human capital. By analyzing previous empirical studies, we are developing nine hypotheses that are put to the test, as follows:

H_1: $_{A,B}$ Financial innovation has a positive influence on nonoil-GDP and vice versa

H_2: $_{A,B}$ Human capital has a positive influence on nonoil-GDP and vice versa

H_3: $_{A,B}$ Nonoil trade openness and nonoil gross capital formation have positive influences on nonoil GDP and vice versa

H_4: $_{A,B}$ Human capital and financial innovation mutually cause each other

H_5: $_{A,B}$ Nonoil trade openness and nonoil gross capital formation mutually cause each other

H_6: $_{A,B}$ Nonoil trade openness and financial innovation mutually cause each other

H_7: $_{A,B}$ Nonoil gross capital formation and financial innovation mutually cause each other

H_8: $_{A,B}$ Nonoil trade openness and human capital mutually cause each other.

H_9: $_{A,B}$ Nonoil gross capital formation and human capital mutually cause each other.

Equation (1) can be reexpressed in the following form to be estimated econometrically: (the study's generalized ARDL model).

$$\begin{aligned}\Delta \text{In}(\text{nonoilGDP})_t = C_0 &+ \sum_{i=1}^{n}\theta_1\Delta\text{In}(\text{nonoilGDP})_{t-1} + \sum_{i=0}^{n}\theta_2\Delta\text{In}(\text{HC})_{t-1} + \sum_{i=0}^{n}\theta_3\Delta\ln(\text{FI})_{t-1}\\ &+ \sum_{i=0}^{n}\theta_4\Delta\ln(\text{nonoilTO})_{t-1} + \sum_{i=0}^{n}\theta_5\Delta\ln(\text{nonoilGCF})_{t-1} + \lambda_0\text{In}(\text{nonoilGDP})_{t-1}\\ &+ \lambda_1\text{In}(\text{HC})_t + \lambda_2\text{In}(\text{FI})_t + \lambda_3\text{In}(\text{nonoilTO})_t + \lambda_{.4}\text{In.}(\text{nonoilGCF})_{.t} + \varepsilon_t,\end{aligned} \tag{2}$$

where "Δ" denotes variable differentiation, "εt" represents an error term (white noise), "$t-1$" stands for the delayed period, "λ_1 to $\lambda 4$" is abbreviated as long-run coefficients, and ″θ_1 to θ_4" to calculate coefficients in the short term. To investigate the long-term and short-term connection among FI, HC, non-oil-TO, and non-oil GDP, we design a model of unbounded error correction under ARDL, whereas in the analysis, all variables are dependent. The following model equation is expressed as a matrix:

$$\begin{aligned}\begin{bmatrix}\Delta\text{In}(\text{nonoilGDP})_t\\ \Delta\text{In}(\text{HC})_t\\ \Delta\text{In}(\text{FI})_t\\ \Delta\text{In}(\text{nonoilTO})_t\\ \Delta\text{In}(\text{nonoilGCF})_t\end{bmatrix} &= \begin{bmatrix}\delta_1\\ \delta_2\\ \delta_3\\ \delta_4\\ \delta_5\end{bmatrix} + \begin{bmatrix}\theta_{11} & \theta_{12} & \theta_{13} & \theta_{14} & \theta_{15} & \theta_{16}\\ \theta_{21} & \theta_{22} & \theta_{23} & \theta_{24} & \theta_{25} & \theta_{26}\\ \theta_{31} & \theta_{32} & \theta_{33} & \theta_{34} & \theta_{35} & \theta_{36}\\ \theta_{41} & \theta_{42} & \theta_{43} & \theta_{44} & \theta_{45} & \theta_{46}\\ \theta_{51} & \theta_{52} & \theta_{53} & \theta_{54} & \theta_{55} & \end{bmatrix} \times \begin{bmatrix}\Delta\text{In}(\text{nonoilGDP})_{t-1}\\ \Delta\text{In}(\text{HC})_{t-1}\\ \Delta\text{In}(\text{FI})_{t-1}\\ \Delta\text{In}(\text{nonoilTO})_{t-1}\\ \Delta\text{In}(\text{nonoilGCF})_{t-1}\end{bmatrix}\\ &+ \sum_{s=1}^{Q}\begin{bmatrix}\theta_{11m} & \theta_{12m} & \theta_{13m} & \theta_{14m} & \theta_{15m} & \theta_{16m}\\ \theta_{21m} & \theta_{22m} & \theta_{23m} & \theta_{24m} & \theta_{25m} & \theta_{26m}\\ \theta_{31m} & \theta_{32m} & \theta_{33m} & \theta_{34m} & \theta_{35m} & \theta_{36m}\\ \theta_{41m} & \theta_{42m} & \theta_{43m} & \theta_{44m} & \theta_{45m} & \theta_{46m}\\ \theta_{51m} & \theta_{52m} & \theta_{53m} & \theta_{54m} & \theta_{55m} & \end{bmatrix} \times \begin{bmatrix}\Delta\text{In}(\text{nonoilGDP})_{t-s}\\ \Delta\text{In}(\text{HC})_{t-s}\\ \Delta\text{In}(\text{FI})_{t-s}\\ \Delta\text{In}(\text{nonoilTO})_{t-s}\\ \Delta\text{In}(\text{nonoilGCF})_{t-s}\end{bmatrix} + \begin{bmatrix}\varepsilon_{1t}\\ \varepsilon_{2t}\\ \varepsilon_{3t}\\ \varepsilon_{4t}\\ \varepsilon_{5t}\end{bmatrix}.\end{aligned} \tag{3}$$

The initial difference operator is Δ; Δ_1 to Δ_5 symbolizes constant terms; θ_{11} to θ_{55} symbolizes long- and short-run coefficients. F tests can be used to perform the bound test, which examines the long-run connection between variables. In equation (3), the null hypothesis that there is no counteraction between the variables is as follows:

H_0: $\theta_1 = \theta_2 = \theta_3 = \theta_4 = \theta_5 = 0$

H_1: $\theta_1 \neq \theta_2 \neq \theta_3 \neq \theta_4 \neq \theta_5 \neq 0$

The alternative hypothesis is that there is cointegration among the variables, contrary to the null hypothesis. The following technique was suggested by Pesaran et al. [62] for the decision-making criteria about H_0 or H_1; If the critical value's lower bound is exceeded by Fs, conforming variables are not cointegrated. The determination of the variables' cointegration may not be made conclusively if Fs ≥ lower and ≤ upper bound of the crucial value are not known.

After calculating long-term and short-term associations among variables, we extended the study to use error correction (ECM) and Granger causality test to examine directional causality among variables. Thus, the vector error correction model in equation (4) can be used to analyze directional causation among variables as follows:

$$\begin{bmatrix} \Delta\text{In}(\text{nonoilGDP})_t \\ \Delta\text{In}(\text{HC})_t \\ \Delta\text{In}(\text{FI})_t \\ \Delta\text{In}(\text{nonoilTO})_t \\ \Delta\text{In}(\text{nonoilGCF})_t \end{bmatrix} = \begin{bmatrix} \delta_1 \\ \delta_2 \\ \delta_3 \\ \delta_4 \\ \delta_5 \end{bmatrix} + \begin{bmatrix} \Delta\text{In}(\text{nonoilGDP})_{t-1} \\ \Delta\text{In}(\text{HC})_{t-1} \\ \Delta\text{In}(\text{FI})_{t-1} \\ \Delta\text{In}(\text{nonoilTO})_{t-1} \\ \Delta\text{In}(\text{nonoilGCF})_{t-1} \end{bmatrix} \times \begin{bmatrix} \theta_{11} & \theta_{12} & \theta_{13} & \theta_{14} & \theta_{15} & \theta_{16} \\ \theta_{21} & \theta_{22} & \theta_{23} & \theta_{24} & \theta_{25} & \theta_{26} \\ \theta_{31} & \theta_{32} & \theta_{33} & \theta_{34} & \theta_{35} & \theta_{36} \\ \theta_{41} & \theta_{42} & \theta_{43} & \theta_{44} & \theta_{45} & \theta_{46} \\ \theta_{51} & \theta_{52} & \theta_{53} & \theta_{54} & \theta_{55} & \end{bmatrix}$$
$$+ \sum_{s=1}^{Q} \begin{bmatrix} \theta_{11m} & \theta_{12m} & \theta_{13m} & \theta_{14m} & \theta_{15m} & \theta_{16m} \\ \theta_{21m} & \theta_{22m} & \theta_{23m} & \theta_{24m} & \theta_{25m} & \theta_{26m} \\ \theta_{31m} & \theta_{32m} & \theta_{33m} & \theta_{34m} & \theta_{35m} & \theta_{36m} \\ \theta_{41m} & \theta_{42m} & \theta_{43m} & \theta_{44m} & \theta_{45m} & \theta_{46m} \\ \theta_{51m} & \theta_{52m} & \theta_{53m} & \theta_{54m} & \theta_{55m} & \end{bmatrix} \times \begin{bmatrix} \Delta\text{In}(\text{nonoilGDP})_{t-s} \\ \Delta\text{In}(\text{HC})_{t-s} \\ \Delta\text{In}(\text{FI})_{t-s} \\ \Delta\text{In}(\text{nonoilTO})_{t-s} \\ \Delta\text{In}(\text{nonoilGCF})_{t-s} \end{bmatrix} + \begin{bmatrix} \gamma_1 \\ \gamma_2 \\ \gamma_3 \\ \gamma_4 \\ \gamma_5 \end{bmatrix} \text{ECT}_{t-1} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{21t} \\ \varepsilon_{3t} \\ \varepsilon_{4\text{it}} \\ \varepsilon_{5t} \end{bmatrix}. \quad (4)$$

The initial difference operator is Δ; Δ_1 to Δ_5 symbolizes constant terms; θ_{11} to θ_{55} symbolizes long- and short-run coefficients. F tests can be used to perform the bound test, which examines the long-run connection between variables. In equation (4), the null hypothesis states no counteraction among the variables.

3.2. An Asymmetric Estimate Nonlinear (NARDL). The cointegration test estimates long-run correlation using the symmetric assumption that the explanatory variable linearly affects the dependent variable. Variables can move positively or negatively. The recently established nonlinear ARDL technique by [79] Shin et al. (2014) was used to study the asymmetric connection between variables using positive and negative changes in an independent variable. Following [80] Verheyen et al. [80, 81] Bahmani-Oskooee and Mohammadian [81], with additional positive and negative modifications, we can recast equations (2) and (3) to nonlinear ARDL as follows:

$$\begin{aligned} \Delta\text{In}(\text{nonoilGDP})_t = {} & C_0 + \sum_{i=1}^{n} \theta_1 \Delta\text{In}(\text{nonoilGDP})_{t-1} + \sum_{i=0}^{n} \theta_2^{+} \Delta\text{InPOS}(\text{HC})_{t-1} + \sum_{i=0}^{n} \theta_2^{-} \Delta\text{InNEG}(\text{HC})_{t-1} \\ & + \sum_{i=0}^{n} \theta_3^{+} \Delta\text{lnPOS}(\text{FI})_{t-1} + \sum_{i=0}^{n} \theta_3^{-} \Delta\text{lnNEG}(\text{FI})_{t-1} + \sum_{i=0}^{n} \theta_4^{+} \Delta\text{lnPOS}(\text{nonoilTO})_{t-1} + \sum_{i=0}^{n} \theta_4^{-} \Delta\text{lnNEG}(\text{nonoilTO})_{t-1} \\ & + \sum_{i=0}^{n} \theta_5^{+} \Delta\text{lnPOS}(\text{nonoilGCF})_{t-1} + \sum_{i=0}^{n} \theta_5^{-} \Delta\text{lnNEG}(\text{nonoilGCF})_{t-1} + \lambda_0 \text{In}(\text{nonoilGDP})_{t-1} \\ & + \lambda_1^{+} \text{InPOS}(\text{HC})_{t-1} + \lambda_1^{-} \text{InNEG}(\text{HC})_{t-1} + \lambda_2^{+} \text{InPOS}(\text{FI})_{t-1} + \lambda_2^{-} \text{InNEG}(\text{FI})_t + \lambda_3^{+} \text{InPOS.}(\text{nonoilTO})_{t-1} \\ & + \lambda_3^{-} \text{InNEG.}(\text{nonoilTO})_{t-1} + \lambda_4^{+} \text{InPOS}(\text{nonoilGCF})_{t-1} + \lambda_4^{-} \text{InNEG}(\text{nonoilGCF})_{t-1} + \varepsilon_t. \end{aligned} \quad (5)$$

In equation (5), θ_1 to θ_5 represent short-run elasticities, while λ_0 to λ_4 represent long-run elasticities. We used Wald to measure long-term and short-term asymmetries. Nonoil economic growth, financial innovation, trade openness, and gross capital formation are represented by Nonoil-GDP_t, HC_t, IF, nonoil-TO_t, and nonoil-GCF_t. Akaike information calculated optimum lag, *n*. Shin et al. (2014) suggest comparing the F-statistic (Wald test) and the critical value to demonstrate long-run cointegration using the limit test method, as presented by Pesaran et al. [62]. The null hypothesis $\lambda_0 = \lambda_1 + = \lambda_1 - = 0$.

4. Empirical Results Analysis

4.1. Unit Root Test Outcomes. To avoid the erroneous in the regressions and findings, time series analysis begins with the unit root test to determine the integration order. We first establish the order of the variables' integration by using the unit root under the ADF, P-P, KPSS (Kwiatkowski–Phillips–Schmidt–Shin) test statistic, and Zivot–Andrews test (ZA) to control structural breaks. All of the variables (nonoil GDP, FI, HC, and nonoil TO) are incorporated after the first difference I (1) but none are integrated at the second difference (II), according to the study's findings (Tables 1 and 2). These features of the study variables re-necessitates that we utilize the recently developed cointegration approach described, also known as ARDL bound testing, published by Pesaran et al. [62], where this article uses ARDL and its extensions.

4.2. Bound Testing ARDL Results Cointegration. ARDL bound testing method was used to investigate the long-run relationships. Under the symmetric assumption with notes

Table 1: Unit root test.

Level	Augmented Dickey–Fuller	Phillips–Perron	KPSS	First difference	Augmented Dickey–Fuller	Phillips–Perron	KPSS	
In (nonoilGDP)	−2.988	−1.439	0.183	Δ In (nonoilGDP)	−2.842**	−3.213*	0.105***	I (1)
In (HC)	−0.0153	0.267	0.192	Δ In (HC)	−4.418***	−3.937***	0.1275***	I (1)
In (FI)	−2.2989	−1.336	0.178	Δ In (FI)	−4.192**	−4.192***	0.115***	I (1)
In (nonoilTO)	−3.4304*	−3.421*	0.075**	Δ In (nonoilTO)	—	—	—	I (0)
In (nonoilGCF)	−2.6244	−1.738	0.134**	Δ In (nonoilGCF)	—	—	—	I (0)

Note. Nonoil-GDP: sector, HC: development of human capital, FI: financial innovation, nonoil-TO: nonoil trade openness, and non-oil-GCF: gross capital formation, used with an intercept and trend. ***, **, and * 1%, 5%, and 10% significance.

Table 2: Andrews structural break test.

Level	Zivot–Andrews	Break year	First difference	Zivot–Andrews	Break year	
In (nonoilGDP)	−2.757**	1992	Δ In (nonoilGDP)	−3.617**	1986	I (0)
In (HC)	−3.616	2002	Δ In (HC)	−4.885**	1994	I (1)
In (FI)	−3.048*	1997	Δ In (FI)	−5.345***	2016	I (1)
In (nonoilTO)	−8.056***	2005	Δ In (nonoilTO)	−7.719***	1989	I (0)
In (nonoilGCF)	−5.256***	2004	Δ In (nonoilGCF)	−2.810***	2013	I (0)

when estimating F-statistics, each variable in equation (3) acts as the dependent variable as shown in Table 3. When nonoil economic growth (nonoil-GDP) is the dependent variable, F-statistics = 28.25, above the 1% significance level where the current study allows both intercept and trend breaks by test Zivot and Andrew's unit root with lag selection via AIC. According to the empirical literature, the structural breaks impact the results of variables where the time series studies may show structural changes induced by economic or political crises. Structural changes in the series make unit root tests have bias, and thus, we used Zivot and Andrew's unit root tests and then found internal structural breakdowns as shown in Table 2. The study finds that in all outcomes, the F-statistic exceeds the value of the upper bound (5.06) when the other variables in Equation 3 are considered as the dependent variables. The exception is the comparable value HCD, which is lower than the crucial upper bound value, inferring the presence of co-integration between economic development and its determinants rather than the null hypothesis of no counteraction. Thus, clearly, trade openness, gross capital formation, domestic private sector credit, and financial innovation are all related to Saudi Arabia's GDP.

4.3. Estimating Short-Run and Long-Run Coefficients. When nonoil economic growth (nonoil GDP) is the dependent variable, we found long-run cointegration by using equation (4) to estimate long- and short-run elasticities. Table 4 displays estimates. All explanatory factors were statistically significant and positively affected nonoil economic growth in the long term as shown in Table 4, which is supported by previous literature. The model's one phase of shock is represented by the error correction term (ECT), which measures how quickly the long-term equilibrium is reached. According to Pahlavani et al. [68], a stable model error correction term should have the two crucial characteristics of being statistically significant and having a negative sign. Table 4 makes clear that the stated model's error correction term (ECT (−1)) is negative and statistically significant at the 1% level, for nonoil DGP, with speeds of 37%, and it implies that the long-run equilibrium must account for any past period shocks in the model. The outcomes from the long-run investigation elucidate that HC, FI TO, and GCF have coefficients of 0.190, 0.246, 0.174, and 0.318 with statistical values "$p \leq 0.05$" where probability values are 0.0002, 0.0346, 0.0002, and 0.0008, respectively, showing a positive impact on nonoil-economic growth of Saudi Arabia. In principle, a 1% improvement in human capital, financial innovation nonoil trade openness, and gross capital formation rate will produce a correspondence in the nonoil GDP, in the long run by 0.19%, 0.24%, 0.17%, and 0.31%, respectively. Correspondingly, the short-run investigation outcomes demonstrate that all variables can cause nonoil GDP with a positive impact apart from the FI has a negative impact on nonoil GDP, but not significant; the coefficient is −0.036, $p = 0.427$. Our findings support most studies that found a considerably favorable effect of financial innovation on nonoil economic growth in Saudi Arabia [31, 82, 83]. Thus, financial innovation promotes nonoil economic development in the long run by hastening the accumulation of capital, facilitating financial intermediation, and improving payment methods. Moreover, our findings also support most empirical research that found a considerably favorable effect of nonoil trade openness on nonoil [4, 30]. Thus, nonoil trade openness promotes nonoil economic development by importing new technology, ideas, and information in addition to buying and selling products and services. Considering other nations, our findings are similar to those of most past research such as references 84, 85.

Several diagnostic tests were used to validate our model as shown in Table 3. The results show the JB statistic for the normality test, heteroscedasticity error, and serial correlation. These findings showed that the "$p \leq 0.05$" which indicates that the datasets are not autocorrelated; furthermore, the model underestimates are shown by the stable and within the 95% confidence interval as CUSUM and CUSUM-SQ graphs as shown in Figures 2 and 3. In conclusion, the model is suitable for approving policies and making objective

Table 3: Testing for ARDL bound.

Models			F-statistic			Decision
Fin (nonoilGDP) = (In (nonoilGDP)/In (HC), In (FI), In (nonoilTO), In (nonoilGCF))			28.25			Cointegration
Fin (HC) = (In (HC)/In (nonoilGDP), In (FI), In (nonoilTO), In (nonoilGCF))			2.35			No cointegration
Fin (FI) = (In (FI)/In (nonoilGDP), In (HC), In (nonoilTO), In (nonoilGCF))			9.15			Cointegration
Fin (nonoilTO) = (In (nonoilTO)/ In (nonoilGDP), In (HC), In (FI), In (nonoilGCF))			10.63			Cointegration
Fin (nonoilGCF) = (In (nonoilGCF)/In (nonoilGDP), In (HC), In (FI), In (nonoilTO))			6.16			Cointegration
	1%		**5%**		**10%**	
$K = 4$	I, (0)	I, (1)	I, (0)	I, (1)	I, (0)	I, (1)
Value critical	3.74	5.06	2.86	4.01	2.45	3.52

Table 4: The ARDL short-run and long-run coefficients on nonoil GDP from 1980 to 2020.

Variables	Coefficient	Standard error	t-statistic	p
Long-run coefficients on nonoil GDP ARDL AIC (2, 2, 1, 2, 2)				
In (HC)	0.1903**	0.0297	2.883	0.0002
In (FI)	0.2458**	0.0800	6.533	0.0034
In (nonoilTO)	0.17444**	0.0388	2.835	0.0002
In (nonoilGCF)	0.318**	0.0773	2.369	0.0008
Short-run coefficients on nonoil GDP ARDL				
C	0.47006**	0.034775	13.51732	0.0000
@TREND	0.002742**	0.000225	12.16931	0.0000
Δ In (nonoillGDP(1-))	0.72166**	0.042910	16.81813	0.0000
Δ In (HC)	−0.04355*	0.020648	−2.109191	0.0510
Δ In (HC(-1))	0.028268	0.018864	1.498567	0.1535
Δ In (FI)	−0.036769	0.045184	−0.813760	0.4277
Δ In (nonoillTO)	0.037875**	0.006578	5.758128	0.0000
Δ In (nonoillTO(1-))	−0.027295**	0.005060	−5.394567	0.0001
Δ In (nonoillGCF)	0.159759**	0.015536	10.28304	0.0000
Δ In (nonoillGCF(-1))	−0.084919**	0.019440	−4.368155	0.0005
ECT(-1)*	0.298952**	0.022498	−13.28776	0.0000
Residual diagnostic				
R^2_{Squared}	0.987676	$X^2_{\text{Normality}}$	0.986	0.6106
$R^2_{\text{Squared ed}}$	0.976585	$X^2_{\text{Heteroskedasticity}}$	20.94	0.5242
$F_{\text{statistic}}$	89.048(0.000)	CUSUM and CUSUM: SQ		Stables
$X^2_{\text{Autocrrelation}}$	No autocorrelation		0.467	0.4941

Note. * and ** 1% and 5% significance.

decisions. Using the Granger approach, we also examine if the variables are causally related. Finally, the modified R^2 showed that the model could explain variation by 97% of the variation in Saudi Arabia's nonoil GDP.

4.4. An Asymmetric Estimate NARDL. Table 4 illustrates the nonlinear ARDL estimates using equation (5) which indicates that the nonoil TO, FI, GCF, and HC explained up to 99% of nonoil economic growth development in Saudi Arabia and that the error correction term of ECM explained the remainder variation. Meanwhile, the correlation $X^2_{\text{Autocrrelation}}$ showed autocorrelation, the model distribution was normal $X^2_{\text{Normality}}$, and no heteroscedasticity issues were observed in the model $X^2_{\text{Heteroskedasticity}}$ It was also proven by the Ramsey RESET test that the model's functional form was established and the F_{pss} coefficient showed long-term cointegration F-statistics that was attained from the Wald test. This finding is consistent with earlier ARDL tests (see Table 3) where the F-statistic for each model was greater than the upper bound of the critical value at the 1% level of significance according to Pesaran et al. [62]. This means that there is a long-term cointegration among FI, nonoil-TO, nonoil-GCF, and nonoil-GDP development from 1980 to 2020 in Saudi Arabia. Next, we investigated the existence of a symmetric relationship between nonoil economic

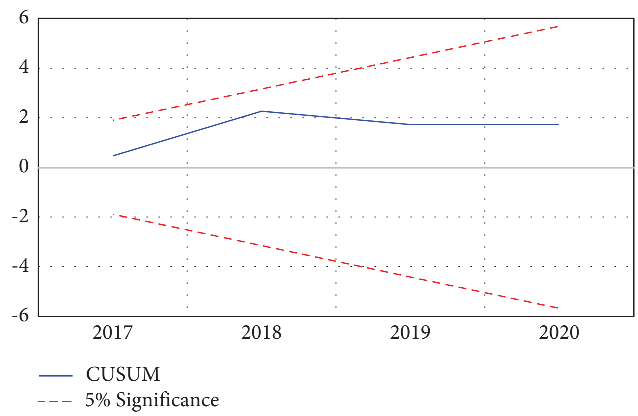

Figure 2: CUSUM plot illustrating the 5% significance among variables.

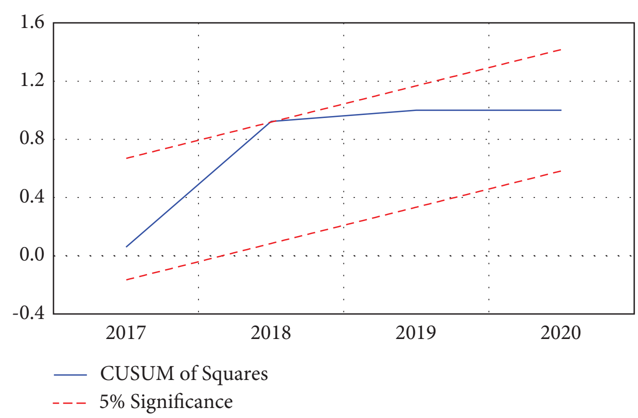

Figure 3: CUSUM-SQ plot illustrating the 5% significance among variables.

growth, and it is determinants which are HC, IF, nonoil-TO, and nonoil-GCF, by applying the Wald test, and the results are shown in Table 5. The results indicated that, in the long term, the null hypothesis of a symmetric relationship was rejected at 1% significance for the HC, TO, and GCF where the Wald statistics are 23.98, 29.46, and 4.625 with statistical values "$p \leq 0.05$," respectively. While the null hypothesis is accepted according to the Wald test for FI, the probability value is greater than 0.05, showing that FI affects nonoil GDP asymmetrically and exclusively the negative changes. Thus, in the long run, a 1% reduction in FI leads to a reduction in the nonoil GDP by 1.5%. Meanwhile, in the short run, the null hypothesis of a symmetric relationship was rejected at 1% significance for the HC, FI, TO, and GCF where the Wald statistics are 33.13, 4.76, 27.60, and 24.49 with statistical values "$p \leq 0.05$," respectively. This finding supports the theory that financial innovation explains long-term causality with GDP. Meanwhile, financial innovation, development of human capital, formation of gross capital, and trade openness can lead to economic growth over time. These results are consistent with the results of previous studies [33, 82, 86]. In addition, the results shown in Table 5 Panel: D showed that in NARDL models by Wald test, the long-run and short-run null hypotheses are accepted according to the Wald test for FI. Meanwhile, the null hypothesis of a symmetric relationship was rejected at 1% significance for the HC, TO, and GCF. This indicates that variables have a positive impact on nonoil economic growth. Our findings support most studies that found a considerably favorable effect of financial innovation on nonoil economic growth in Saudi Arabia [31, 82, 83, 87]. Thus, financial innovation promotes nonoil economic development by hastening the accumulation of capital, facilitating financial intermediation, and improving payment methods. Moreover, the findings of this paper are similar to most empirical studies that found that the non-oil trade has a significant effect on the economic growth and GDP [87, 88]. Thus, nonoil trade openness promotes nonoil economic development by importing new technology, ideas, and information in addition to buying and selling products and services.

4.5. Granger Causality Test. ARDL and NARDL provided proof that cointegration existed in the long run. This implies that there is at least one directional causality either in the short run, long run, or both in the model. Using an error correction model (ECM), the Granger causality test was performed to determine the direction of causality between the set of variables. For long-term causation, the ECT (−1) must be statistically significant and negative. We considered equation (4) for the stated model to represent both long- and short-term causations. At 1% and 5% levels of significance, some of the ECTs (1) were statistically significant and negative. The results of the causality test are

Table 5: Nonlinear NARDL estimation results.

Variable	Coefficient	Std. error	t-statistic	p
A: long-run estimation				
C	7.338708	0.553519	13.25828	0.0000
@TREND	−0.008086	0.002189	−3.693431	0.0035
In (nonoillGDP(−1))	−0.594450	0.045878	−12.95706	0.0000
In (HC^{+}(−1))	0.023919	0.029242	0.817991	0.4307
In (HC_(−1))	0.167835	0.024310	6.903924	0.0000
In (FI^{+}(−1))	0.180338	0.082622	2.182700	0.0516
In (FI_)	−0.940096	0.421485	−2.230439	0.0475
In ($nonoilTO^{+}$)	0.327963	0.041791	7.847701	0.0000
In ($nonoilTO^{-}$)	0.002137	0.009017	0.236977	0.8170
In ($nonoilGCF^{+}$)	−0.017823	0.026869	−0.663350	0.5208
In (nonoilGCF_)	−0.149135	0.076773	−1.942549	0.0781
B: short-run estimation				
Δ In (nonoillGDP(−1))	0.574814	0.059128	9.721477	0.0000
Δ In (HC^{+})	−0.042590	0.022024	−1.933762	0.0793
Δ In (HC^{+}(−1))	0.058850	0.026609	2.211652	0.0491
Δ In (HC_)	0.294558	0.034691	8.490910	0.0000
Δ In (FI^{+})	−0.162383	0.061585	−2.636752	0.0231
Δ In ($nonoilTO^{+}$)	0.197670	0.025025	7.898882	0.0000
Δ In ($nonoilTO^{+}$(−1))	−0.090331	0.025703	−3.514461	0.0048
Δ In ($nonoilTO^{-}$)	0.021372	0.007228	2.957065	0.0130
Δ In ($nonoilGCF^{+}$)	0.018759	0.030991	0.605293	0.5573
Δ In ($nonoilGCF^{+}$(−1))	−0.112308	0.020920	−5.368490	0.0002
Δ In (nonoilGCF_)	0.127492	0.031418	4.057914	0.0019
ECT (−1)*	−0.594450	0.037399	−15.89492	0.0000
C: residual diagnostic test				
R^2_{Squared}	0.989172	$X^2_{\text{Normality}}$	12	0.776
$R^2_{\text{A-Squared}}$	0.963579	$X^2_{\text{Heteroskedasticity}}$	15.77	0.941
$F_{\text{Statistic}}$	38.64(0.00)**			
D: symmetric estimate				
Variables	W_{LR}	W_{SR}	L^{+}_{Xi}	L^{-}_{Xi}
In (HC)	23.98 (0.000)	33.13 (0.000)	0.0402 (0.035)	0.2823 (0.000)
In (FI)	3.607 (0.057)	6.95 (0.008)	0.3033 (0.0056)	−1.5814 (0.001)
In (nonoilTO)	29.46 (0.000)	27.60 (0.000)	0.5517 (0.001)	0.0035 (0.492)
In (nonoilGCF)	4.626 (0.0315)	24.49 (0.0001)	−0.0299 (0.312)	−0.2508 (0.019)

Note. "+" and "−" signs show changes that are positive and negative, respectively. W_{LR} stands for the Wald test of long-term symmetry. W_{SR} is the Wald test of additive short-run symmetry. L^{+}_{Xi} and L^{-}_{Xi} are long-term coefficients of variables positive and negative changes. * and ** the significance of the values at 1% and 5%, respectively. The estimated using unrestricted constant and trend.

Table 6: The causality test using ECM and Granger.

	Short run					Long run
Variables	Δ In $(\text{nonoilGDP})_{t-1}$	Δ In $(\text{HC})_{t-1}$	Δ In $(\text{FI})_{t-1}$	Δ In $(\text{nonoilTO})_{t-1}$	Δ In $(\text{nonoilGCF})_{t}$	ECT − 1
Δ In $(\text{nonoilGDP})_t$		3.16*	2.665*	2.146	4.197*	
Δ In $(\text{HC})_t$	1.763		1.579	1.92	3.07*	0.391*
Δ In $(\text{FI})_t$	13.84**	2.636*		2.786*	2.079	−0.906*
Δ In $(\text{nonoilTO})_t$	0.101*	0.650	0.3447		0.096	−0.444**
Δ In $(\text{nonoilGCF})_t$	4.197*	2.524*	0.843	5.079*		−0.091*

shown in Table 6. The results demonstrated the model contained long-term causation.

Similar to long-run causality, different directional causations between the variables were observed in the short run. This study found a bidirectional causal between financial innovation and nonoil economic growth, FI⟵⟶nonoil-GDP, nonoil-GCF⟵⟶nonoil-GDP, and nonoil-GCF⟵⟶HC. However, the study also revealed unidirectional causality from nonoil-GDP⟶CH, nonoil-TO⟶nonoilGDP, FI⟶HC, FI⟶nonoilTO, and nonoil-GCF⟶nonoil-TO.

5. Conclusion and Recommendations for Policy

This paper investigated the dynamic interactions among nonoil Saudi Arabia's economic growth and its most important determinants which are financial innovation, nonoil trade openness, nonoil gross capital formation, and human capital in the context of long and short term from 1980 to 2020. This study focused on vital Saudi Arabia 2030 vision including the financial sector development program and human capacity development programs. These programs are vital in the 2030 vision of Saudi Arabia and thus worthy of comprehensive investigation. This study used the ARDL and NARDL methods to conduct comprehensive investigations on the impact of economic growth variables, namely, the FI, TO, GCF, and HCL with nonoil trade economic growth in Saudi Arabia. Bound testing confirms all of the investigated variables that have cointegration, except for human capital. In addition, the findings suggest that the influence of all variables is positive with a statistical significance, in the long run. In principle, a 1% improvement in human capital, financial innovation nonoil trade openness, and GCF rate will produce some correspondence in the nonoil GDP in the long run by 0.19%, 0.24%,(0.17%, and 0.31%, respectively. Therefore, human capital, financial innovation, and nonoil trade openness are valuable to the nonoil economy of Saudi Arabia.

The NARDL findings also support the existence of long-run relationships. They also reject the null hypothesis regarding the nonexistence of an asymmetric relationship between nonoil GDP and its determinants (TO, HC, and GCF). Thus, we can infer the symmetric relationship between those variables and nonoil economic growth while there is an asymmetric relationship between financial innovation and nonoil GDP in the long run.

The ECM findings and causality framework, at the 1% and 5% significance levels, showed that some of the ECTs (1) were statistically significant and negative. The results demonstrated the model contained long-term causation. Similar to long-run causality, different directional causation between the variables was observed in the short run. This study also found a bidirectional causal between financial innovation nonoil economic growth (FI⟵⟶nonoil-GDP), (nonoil-GCF⟵⟶nonoil-GDP), and (nonoil-GCF⟵⟶HC). However, the study also revealed unidirectional causality from nonoil-GDP⟶CH, nonoil-TO⟶nonoil-GDP, FI⟶HC, FI⟶nonoil-TO, and nonoil-GCF⟶nonoil-TO. Based on a comprehensive empirical investigation, this paper presents three useful implications for further progress in the nonoil economy.

(i) More expenditure should be encouraged in improving the average years of education and quality of education as well as emphasizing and investing in developing skilled personnel who are essential to facilitating the nonoil economic growth of Saudi Arabia.

(ii) Policymakers and economists should divert their attention to trade regulations and trade policies with dynamic reasoning by further strengthening nonoil trade openness which integrates local economic systems through international commerce and other social and economic variables. The nonoil trade openness promotes the elimination of tariffs and other trade barriers and the manufacturing and marketing globalization.

(iii) The financial industry can also boost economic growth by providing payment services, raising money from multiple investors, obtaining and analyzing the business project and investment information, allocating funds to the most profitable projects, monitoring investments, and implementing corporate governance. Diversification boosts liquidity and reduces time risks. These habits can affect investment and saving decisions and economic growth.

Finally, this study draws some important recommendation ideas which are summarized as follows:

(i) The first idea is to educate, train, and develop Saudi's citizens skills through high-quality education, extensive training programs, and research and development (R&D). Having skilled personnels facilitate the smooth transition from oil dependent country to nonoil and sustainable economic growth society with people being the main driver of such change.

(ii) The second idea is that investments in extending international nonoil trade should be rewarded because trade openness supports nonoil economic structure upgrades.

(iii) The third idea is for the government to promote financial innovation inside the financial system and continue fiscal policies that support its spread and uptake with increased nonoil aggregate capital formation. Therefore, the government and policymakers can definitely use this study as a way to set priorities and encourage important policy changes that will improve Saudi Arabia's economy growth.

Abbreviations

AIC: Akaike Information Criteria
EMP: Employment
ADF: Augmented Dickey–Fuller
ECT: Error correction term
PP: Philipps–Perron
SIC: Schwartz Information Criteria
VAR: Vector autoregressive
ECM: Error correction mechanism
FI: Financial innovation
HC: Human capital
GCF: Gross capital formation
TO: Trade openness.

Data Availability

The data used in this manuscript were secondary data collected from Saudi Central Bank. The data are available on the official web page https://www.sama.gov.sa/en-us/economicreports/pages/report.aspx?cid=123.

Consent

As far as the study is concerned, it is solely based on secondary data that are publicly accessible; no such secret or proprietary material exists that would require permission before being made available to the public.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Authors' Contributions

F.A., the corresponding author, contributed the ideas for this article and wrote the original draft. B.A. supervised the completion of every section of this article and revised the methodology section, with verification. B.A., F.A., and A.B. completed the methodology part and the literature review of the article. T.J. and F.S. reviewed and checked the analysis. B.A. and F.S. edited and reviewed the manuscript and updated the literature section of the paper. All authors read and approved the final manuscript.

Acknowledgments

The authors thank the Deanship of Scientific Research at King Khalid University for funding this work through Larg Groups (project under grant number: RGP.1/371/43).

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