

Article

Globalization, Fiscal Policy, and Economic Diversification in Saudi Arabia: An ARDL Approach

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Abstract

Economic diversification has become a central policy objective for resource-dependent economies seeking to reduce vulnerability to external shocks. In the case of Saudi Arabia, diversification has gained particular importance within the framework of Vision 2030, which aims to broaden the productive base beyond the oil sector. This study examines the long-run relationship among globalization, economic globalization, government consumption spending, and economic diversification in Saudi Arabia from 1970 to 2022, utilizing the Herfindahl–Hirschman Index (HHI) as a measure of sectoral concentration. The analysis employs the Autoregressive Distributed Lag (ARDL) bounds testing approach to examine both short-run and long-run relationships among the variables. To ensure robustness, the long-run ARDL estimates are cross-validated using Fully Modified Ordinary Least Squares (FMOLS), Dynamic Ordinary Least Squares (DOLS), and Canonical Cointegrating Regression (CCR). The results indicate that government spending is significantly associated with greater economic diversification, as reflected by its negative and significant association with the HHI. Domestic credit to the private sector is also positively associated with economic diversification, while foreign direct investment exhibits a weak positive association with diversification. In contrast, both overall globalization and economic globalization are associated with higher sectoral concentration, suggesting that the benefits of global integration for diversification are not automatic. These findings highlight the importance of complementary domestic policies, including support for SMEs, expanded private-sector financing, and innovation-driven investment, to strengthen the relationship between globalization and sustainable economic diversification in Saudi Arabia.

Keywords: economic diversification; globalization; autoregressive distributed lag model

Academic Editor: Jacob Arie Jordaan

Received: 24 June 2026

Revised: 15 July 2026

Accepted: 19 July 2026

Published: 2 August 2026

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1. Introduction

From a macroeconomic perspective, the phenomenon where countries endowed with abundant natural resources experience long-term economic underperformance is widely recognized as the “resource curse” or the “paradox of plenty” [1]. In such economies, a heavy reliance on total natural resource rents often diminishes overall economic efficiency, making the transition toward sustainable development exceptionally challenging [2]. Consequently, these nations remain highly vulnerable to volatile global commodity prices due to chronic underinvestment in productive non-resource sectors, particularly manufacturing. Overcoming this structural trap requires genuine economic diversification. Diversification

is not merely an economic objective but a fundamental pillar for enhancing macroeconomic stability, increasing productivity, and promoting long-term structural transformation [1].

However, transitioning away from resource dependency is conceptually and practically complex. Recent literature highlights that institutional quality plays a pivotal role in shaping the success of economic diversification in resource-rich economies. Strong institutional frameworks foster innovation, promote research and development, improve governance and regulatory quality, and strengthen policy implementation, thereby enabling resource-rich economies to transform natural resource wealth into productive investment, structural transformation, and long-term economic diversification. In contrast, weak institutional environments constrain the effectiveness of globalization and public policies by limiting productive investment, hindering technological upgrading, and perpetuating dependence on natural resource-based activities [2,3].

Another important theoretical perspective for understanding the diversification challenges faced by resource-rich economies is the Dutch Disease Theory. The theory argues that resource booms may generate structural distortions by increasing national income and domestic spending (the spending effect), leading to real exchange rate appreciation. Consequently, the competitiveness of non-resource tradable sectors, particularly manufacturing, may decline as labor and capital shift toward the booming resource sector and non-tradable activities. These structural changes reinforce dependence on natural resource revenues and constrain long-term economic diversification. In an increasingly globalized economy, greater openness to trade, investment, and technology flows may either amplify or mitigate these effects, depending on the quality of institutions and the effectiveness of government policies. Therefore, this theoretical perspective provides an important foundation for examining how globalization and government expenditure may influence economic diversification in resource-dependent economies such as Saudi Arabia [4].

Consistent with the implications of Dutch Disease, Saudi Arabia has experienced several episodes of oil price booms and downturns since the early 1970s that have significantly influenced public revenues, government expenditure, and the pace of economic diversification [5]. These recurrent shocks have reinforced the importance of reducing dependence on oil and provide an important historical context for examining the effectiveness of globalization and fiscal policy in promoting long-term structural transformation.

Against this historical and theoretical background, Saudi Arabia presents a profound case study of a resource-dependent economy attempting a massive structural transformation. Rather than merely a policy agenda, Saudi Arabia's Vision 2030 represents a comprehensive structural shock designed to break the resource trap. Within this framework, Saudi officials have launched targeted strategies focused on diminishing reliance on oil through building a knowledge infrastructure that utilizes foreign direct investment, technology transfer, and research aligned with industry needs to grow non-oil exports and foster sustained diversification [6]. Crucially, these specific initiatives align directly with our key empirical metrics. For instance, the strategic push to expand the broad-based non-oil industrial base and reduce sectoral concentration is best captured empirically by the comprehensive Hirschman–Herfindahl Index (HHI). Simultaneously, efforts to build a knowledge infrastructure through foreign direct investment and global technology transfer are precisely represented by the multidimensional KOF indices, which distinctly measure both economic and overall globalization.

While globalization generally facilitates the cross-border flow of capital, goods, and knowledge [7], its specific impact on resource-dependent economies remains conceptually ambiguous. Some evidence suggests it promotes diversification [8–10], whereas competing perspectives warn it might centralize authority or reinforce existing comparative advantages in natural resources [11–14]. These contrasting results underscore the necessity for

research within the Saudi setting. Concurrently, government expenditure serves as a primary internal driver for diversification, especially where the state plays a central economic role, as seen in Saudi Arabia and similar resource-rich nations [15,16].

The core research problem centers on the enduring challenge of achieving genuine structural transformation in resource-dependent economies. While economic diversification is a primary policy objective, the simultaneous impacts of external integration (globalization) and internal fiscal policies (government consumption spending) remain fiercely debated. Specifically, it is theoretically and empirically unresolved whether these dual forces act as catalysts for sustainable non-oil growth or inadvertently reinforce existing structural vulnerabilities and commodity reliance. In the context of Saudi Arabia's ambitious economic transition, resolving this uncertainty is critical, prompting the following overarching research questions:

1. What is the long-run relationship between different dimensions of globalization—particularly economic globalization versus overall globalization as measured by the KOF indices—and economic diversification in the Kingdom of Saudi Arabia?
2. To what extent is government expenditure associated with structural transformation and economic diversification when jointly modeled with globalization dynamics?
3. How do the estimated long-run relationships of globalization compare with those of domestic government expenditure in terms of magnitude and statistical significance for economic diversification in Saudi Arabia?

Accordingly, this study advances the existing theoretical frameworks and contributes to broader literature in four distinct ways: First, from a theoretical perspective, it moves beyond standard confirmatory analyses by structurally testing competing theoretical mechanisms (e.g., the Market Expansion vs. Factor Endowment hypotheses). By providing a unified framework that simultaneously models external integration (globalization shocks) and internal demand-pull (government consumption expenditure), this study effectively mitigates the omitted variable bias prevalent in previous research that isolated these variables. Second, regarding measurement and proxy selection, it distinguishes between overall and economic globalization using the comprehensive KOF indices. Furthermore, unlike studies relying on fragmented proxies, it utilizes the Hirschman–Herfindahl Index (HHI) to capture genuine, broad-based structural transformation rather than superficial re-export shifts. Third, methodologically, it significantly upgrades the empirical rigor. Rather than relying solely on a singular ARDL approach, this study uniquely cross-validates the long-run estimates utilizing three additional robust econometric models (FMOLS, DOLS, and CCR). This multi-estimator approach provides highly robust, unbiased evidence tailored for policy formulation. Finally, contextually, it extends the temporal scope to 2022, providing novel empirical evidence that captures the recent, unprecedented, and rapid structural diversification initiated under Saudi Vision 2030, which could not be inferred from earlier literature.

The rest of this paper is structured as follows: Section 2 presents the theoretical background. Section 3 reviews the relevant literature. Section 4 examines the association among overall globalization, government consumption spending, and economic diversification in Saudi Arabia. Section 5 details the data and methodology. Finally, Section 6 presents the results, Section 7 discusses the findings, and Section 8 offers the conclusion.

2. Theoretical Background

Economic diversification is commonly characterized as the shift from dependence on certain industries toward a wider and more value-added economic framework. Achieving this shift demands strategies aimed at decreasing reliance on a sector, especially oil, concerning its share in GDP, export income, and government funding [17,18]. Reduc-

ing reliance on oil involves growing areas such as services, manufacturing, tourism, and agriculture, enabling these to develop into enduring streams of public income [17]. Economic diversification contributes to fostering development and supports the transition to a knowledge- and services-oriented high-productivity economy. An economy with a composition enhances its capacity to respond to global market fluctuations and increases its resilience to external shocks [18]. Accomplishing diversification involves a series of structural adjustments within the economy. Its effectiveness depends on the flexibility of resources, labor, capital, and technology. In oil nations, the main goal of diversification is to lessen dependence on hydrocarbons and encourage growth in industries beyond the oil sector. Diversification can be categorized into product diversification and export-market diversification. It may also take place within sectors, enabling the production of goods within the area. For example, in the energy sector, this might involve reallocating resources and investments from upstream to oil and gas operations or developing new non-fossil fuel products, such as renewable energy. Diversification can also include the creation of non-hydrocarbon industries or shifting investment among sectors to increase the value added in national production [17,19].

3. Literature Review

3.1. *The Globalization-Diversification Nexus: Competing Theoretical Mechanisms*

Rather than viewing the external drivers of economic diversification through a purely thematic lens, the current economic literature can be synthesized through the lens of competing theoretical mechanisms. Specifically, the literature has increasingly debated whether globalization acts as a catalyst for genuine structural transformation or whether it merely reinforces existing resource-based specializations. This theoretical tension is primarily reflected in the conflict between the ‘Market Expansion’ hypothesis, which suggests that globalization facilitates technology transfer and sector growth, and the ‘Factor Endowment’ perspective, which warns of deepened resource dependency in commodity-rich nations.

3.1.1. The Market Expansion and Sustainable Spillover Mechanism

The first theoretical mechanism suggests that globalization may promote economic diversification by expanding market frontiers and facilitating knowledge spillovers. Rooted in New Trade Theory, Krugman [20] argues that trade is propelled by economies of scale rather than sheer factor endowments, acting as a catalyst for firms to diversify. Similarly, Romer [21] highlights the knowledge spillover mechanism, where global market integration accelerates the transfer of human capital and technology, allowing the development of productive industries and encouraging improved economic diversification.

Empirically, this mechanism is supported by studies employing robust time-series and panel data techniques to demonstrate that globalization enhances economic variety. For instance, Osakwe and Kilolo [9], utilizing 2SLS and two-step GMM estimations for 145 developing countries (2003–2015), reveal that trade openness, market size, and FDI inflows reduce export concentration. This is further corroborated by Qamruzzaman [10], who, employing an ARDL approach for BRICS nations (1985–2019), finds that globalization positively influences energy diversification, with FDI acting as a key driver in Brazil, Russia, and South Africa. Evidence from China also supports this mechanism [22], using ARDL and VEC models within the Melitz framework (1987–2017), and finds that FDI stimulates reciprocal export diversification.

Furthermore, recent literature underscores this mechanism’s vital role in achieving broader sustainability goals. As highlighted by Shahbaz [8], using a bootstrapped ARDL-based Granger causality approach for the Chinese economy (1995–2022), economic global-

ization positively dictates energy diversification. Interestingly, [8] identifies an inverted-U-shaped relationship, suggesting that this sustainable spillover mechanism is complex and dynamic over time.

3.1.2. The Factor Endowment and Superficial Transformation Mechanism

In direct contrast, a competing theoretical mechanism—grounded in the classical Heckscher–Ohlin model—suggests that globalization may promote specialization rather than diversification. Because countries naturally export goods utilizing their abundant domestic factors [23], trade liberalization can trap economies in narrow, resource-intensive sectors.

Empirical evidence supporting this specialization mechanism relies on diverse econometric frameworks. Applying GMM estimations to 79 countries (1962–2000), Agosin et al. [11] provide robust evidence that trade openness contributes to greater specialization. This is corroborated by Zhang et al. [14], who employed system-GMM and quasi-maximum likelihood estimators for 109 countries (2000–2018) to find that trade openness and FDI typically promote specialization rather than diversification. Regionally, Elhannani et al. [12] utilized 2SLS for Algeria, while Osakwe et al. [13] investigated Sub-Saharan Africa; both concluded that trade openness intensifies export concentration in the long run. Even when examining specific variables like FDI, Qamruzzaman [10] found that FDI inflows were largely directed toward industrial output, limiting broader energy-sector diversification in China and India. Similarly, Jolo et al. [1], using feasible generalized least squares (FGLS) for 14 resource-rich countries (2001–2019), confirm that inward FDI reinforces resource-dependent growth patterns.

Moreover, a critical strand of the literature argues that even when integration appears to diversify an economy, this effect may be a superficial structural shift. As highlighted by Işık et al. [24], shifting trade patterns may inflate re-export activities rather than building real domestic productive capabilities. Consequently, even when utilizing advanced time-series methods—such as the ARDL models applied to Saudi Arabia (1970–2018) by Alkhathlan et al. [19]—results often highlight the highly conflicting impacts of using fragmented proxies. Specifically, they observe that although FDI improves government revenue diversification, it diminishes export diversification; meanwhile, trade openness boosts investment and employment diversification but lowers revenue diversification. This fragmentation is consistent with the argument that relying on isolated external channels can yield contradictory outcomes, ultimately failing to capture genuine, broad-based structural transformation.

3.2. Government Expenditure and Economic Diversification

Independent of external integration shocks, the literature explores internal structural transformation through the “fiscal demand-pull mechanism.” Under this framework, government expenditure may act as an active catalyst, creating new domestic demand that stimulates emerging and non-traditional sectors.

Empirical research indicates that targeted fiscal policy can artificially create the necessary economies of scale for new industries, although the outcomes can be complex. For example, employing an ARDL framework for Saudi Arabia, Alkhathlan et al. [19] found that government spending successfully stimulates production and investment diversification, even as it appears to restrain diversification in government revenues and exports. On the other hand, focusing on broader metrics within the same Saudi context, Sweidan and Elbargathi [15] utilized an ARDL approach to confirm that government expenditure generally exerts a positive influence on overall economic diversification in both the short and long run. However, the efficiency of this mechanism heavily depends on the specific type of expenditure. In Iraq, Khalaf et al. [16] utilized an ARDL model (2004–2019) to show

that while investment expenditure supports long-run diversification, operational spending actually exerts a negative effect.

Broadening this scope, Phiri [25] applied a panel ARDL model to 17 Sub-Saharan African countries (1995–2014), demonstrating that sectoral public spending (e.g., in ICT, agriculture, and education) activates long-term export diversification. Conversely, structural rigidities can mute this fiscal mechanism; Jolo and Koç [26] employed a panel vector autoregression (VAR) model for the GCC (2001–2019) and found that shocks to public capital formation exert only a limited influence on non-resource diversification.

The critical evaluation of these competing mechanisms reveals significant gaps in existing literature. Notably, the majority of prior research has relied on fragmented, single-dimensional proxies—such as trade openness or FDI alone—to represent globalization. More importantly, previous studies tend to isolate these mechanisms, examining either globalization or internal fiscal policy independently. This fragmented approach may increase the risk of omitted variable bias, as it fails to account for the simultaneous, underlying presence of both external and internal forces. Consequently, the isolated estimates in prior literature may not accurately reflect the determinants associated with structural transformation. Furthermore, existing research predominantly focuses on fragmented outcomes (e.g., solely energy or export diversification) without critically assessing whether these represent genuine structural shifts or superficial re-export phenomena [24].

Empirically, studies specifically addressing the simultaneous long-run relationships of both globalization and government expenditure within the context of Saudi Arabia remain notably scarce. Moreover, the limited existing research on the Saudi economy typically restricts its applied analysis to periods ending around 2020, thereby failing to capture the rapid and dynamic structural transformations of recent years. Crucially, achieving economic diversification is increasingly recognized as a vital pathway toward broader sustainable development goals [8]. However, despite this theoretical importance, a significant methodological gap remains. Previous empirical literature largely relies on singular estimation techniques and frequently fails to integrate robust outcome measures like the Hirschman–Herfindahl Index (HHI) alongside comprehensive metrics such as the Economic Globalization Index and the Overall KOF Globalization Index. Addressing these critical limitations, this study provides a significant contribution by integrating both external globalization forces and internal fiscal demand mechanisms into a unified framework. Specifically, it examines the simultaneous, long-term relationship between both economic and overall globalization, alongside government consumption spending, on genuine economic diversification (using HHI) in Saudi Arabia from 1970 to 2022. By employing a robust multi-model econometric approach (ARDL, FMOLS, DOLS, CCR), this study provides highly reliable, unbiased, and cross-validated policy evidence.

Based on these considerations, the following hypotheses are proposed:

H1. *Globalization is positively associated with economic diversification in resource-dependent economies.*

H2. *Government expenditure is significantly associated with lower sectoral concentration in the long run.*

4. Empirical Analysis of the Relationships Among Overall Globalization, Economic Globalization, and Government Spending in Saudi Arabia

This section presents an empirical analysis of the evolution of globalization, fiscal policy, and economic diversification in Saudi Arabia over the period 1970–2022.

Figure 1 represents the Hirschman–Herfindahl Index (HHI) for Saudi Arabia from 1970 to 2022. During the 1970s, the economy showed a strong sectoral concentration

reaching a maximum of 0.72 in 1974, which aligned with a significant drop in government consumption spending to 8.43% of GDP (see Figure 2). Over the decades, the HHI decreased steadily, reflecting a move toward increased economic diversification despite notable fluctuations. Banafea and Ibnrubbian [5] indicate that the surge in oil prices between 1975 and 1979 encouraged investments in construction and infrastructure, whereas public consumption spending rose from 8.43% in 1974 to 24% in 1978 (Figure 2). During this timeframe, total globalization experienced growth, increasing from about 32 to 34 (Figure 3).

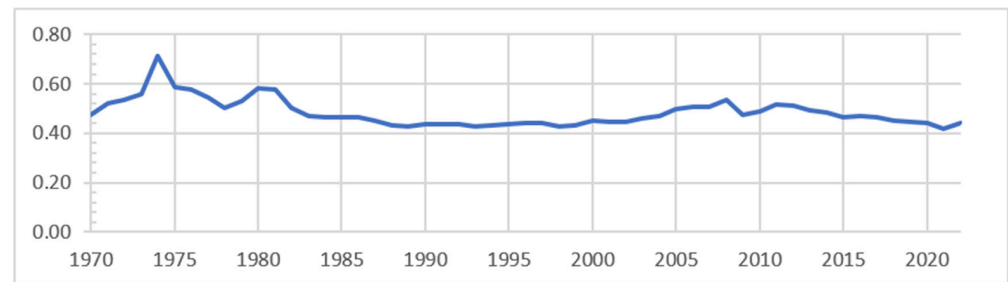


Figure 1. Trends in Economic Diversification in Saudi Arabia. Source: Authors' calculations of the Herfindahl–Hirschman Index (HHI) using data from the World Development Indicators (World Bank, 2024).

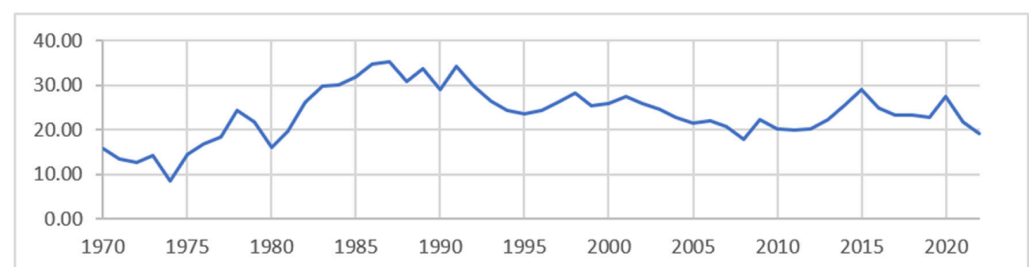


Figure 2. Government final consumption expenditure as a percentage of GDP in Saudi Arabia. Source: Prepared by the authors using data from the World Development Indicators (World Bank, 2024).

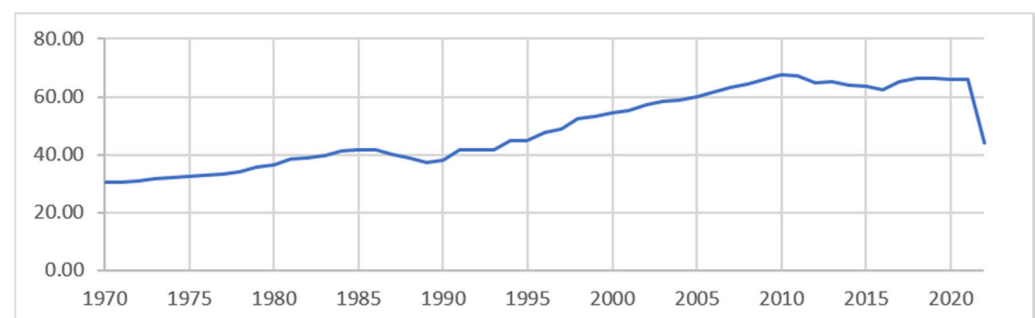


Figure 3. Overall globalization in Saudi Arabia. Source: Prepared by the authors using data from the KOF Globalisation Index Database.

The concentration index climbed more during 1979–1981 mainly because of higher oil prices during the Iran–Iraq War, which boosted sector profits and shifted investments toward oil-related sectors. Government spending dropped to 19.55% of GDP in 1981, while globalization rose to 38.51%. Although the HHI decreased throughout the 1990s and early 2000s, it saw another increase from 2005 to 2008, reaching 0.53 in 2008 compared to 0.43 in 1990, coinciding with a surge in globalization that peaked at 67.42 in 2010. Afterwards, the concentration index dropped to its minimum level of around 0.42 in 2021, indicating the limited effect of ongoing diversification initiatives, such as Vision 2030, whereas structural and institutional barriers still hinder additional advancement.

Government expenditure exhibited fluctuations, yet Figures 1 and 2 suggest a possible positive link between increased spending and decreased economic concentration, as times of lower HHI typically aligned with higher government outlays. Conversely, the link between globalization and economic diversification appears more complex or decoupled, as globalization exhibits a consistent upward trend while the concentration index displays marked volatility. To determine the statistical significance of globalization and government spending in shaping economic diversification, Section 4 employs an econometric analysis.

5. Materials and Methods

5.1. Data Description and Variable Measurement

The research investigates the effect of comprehensive globalization, economic globalization, and public expenditure on the diversification of Saudi Arabia's economy from 1970 to 2022, applying the Autoregressive Distributed Lag (ARDL) methodology. The examination is performed using the array of variables outlined in Table 1, which collectively encompass the principal determinants of diversification within the Saudi economic framework.

The Overall KOF Globalization Index and the Economic KOF Globalization Index are composite indicators developed and published by the KOF Swiss Economic Institute. They are constructed using a standardized aggregation procedure that combines multiple dimensions of globalization. Accordingly, this study employs the published KOF indices rather than reconstructing the underlying composite measures.

The use of government consumption expenditure is motivated by the availability of a consistent long-run fiscal series covering the entire sample period (1970–2022), which is essential for time-series estimation. Government consumption expenditure is used as an aggregate fiscal indicator, reflecting the broader fiscal demand channel within the economy, rather than a direct measure of public investment allocation or sector-specific development programs. Although the composition and efficiency of public spending may influence diversification outcomes, the present study focuses on the long-run association between aggregate government consumption expenditure and sectoral concentration.

Economic diversification is measured using the Herfindahl–Hirschman Index (HHI), which captures the degree of concentration in the sectoral structure of the economy. The index is constructed using the shares of major economic sectors in total GDP. Specifically, sectoral value-added data are used to calculate the proportion of each sector in overall economic output. The sectors included in the calculation are agriculture, forestry and fishing; industry (including construction); and services, each expressed as a percentage of GDP. Specifically, the HHI was constructed using the World Development Indicators (WDI) sectoral value-added indicators: Agriculture, forestry and fishing, value added (% of GDP) (NV.AGR.TOTL.ZS); Industry (including construction), value added (% of GDP) (NV.IND.TOTL.ZS); and Services, value added (% of GDP) (NV.SRV.TOTL.ZS). and The same sectoral classification was consistently applied throughout the entire sample period (1970–2022), ensuring full temporal comparability of the HHI.

Following the methodology proposed by the World Bank [27]

$$HHI = \sum_{i=1}^n s_i^2$$

where s_i represents the share of sector i in total gross domestic product (GDP), and n denotes the number of economic sectors included in the calculation. The sectoral shares are computed as:

$$s_i = GDP_i / GDP_t$$

Sectoral GDP data were obtained from the World Bank through the World Development Indicators database (2024 edition). The index ranges between 0 and 1, where higher

values indicate greater economic concentration and lower diversification, while lower values reflect a more diversified economic structure. Accordingly, the HHI is treated as an inverse measure of economic diversification throughout the analysis. The index is retained in levels because it is a normalized concentration measure, making logarithmic transformation unnecessary and less suitable for interpretation. By contrast, the globalization indices are expressed in natural logarithms to reduce potential skewness and allow the estimated coefficients to be interpreted as semi-elasticities. Although the HHI is theoretically bounded between 0 and 1, the observed values remain well within the interior of this range over the sample period, supporting the suitability of the linear ARDL specification.

The FDI_GDP series contains negative observations, reflecting instances of net disinvestment where capital outflows exceed inflows. These values are consistent with the definitions provided by the World Bank WDI and are retained in full without any outlier removal or winsorization, ensuring that the dataset accurately captures the actual economic dynamics.

Table 1. Description of Variables and Sources.

Variable	Definition/Measure	Source
Dependent Variable		
Economic Diversification (HHI)	Measured using the Herfindahl–Hirschman Index calculated from sectoral GDP shares. A higher value indicates a more concentrated and less diversified economy.	Calculated using World Development Indicators (WDI), World Bank (2024)
Independent Variables		
Economic Globalization (LGECO)	Index measuring economic globalization based on actual economic flows (trade, FDI, portfolio investment, income payments) and restrictions on trade and capital. In Natural logarithm	KOF Globalization Index Database [28,29]
Overall KOF Globalization (LGL)	Natural logarithm of the KOF Overall Globalization Index (0–100), which captures economic, social, and political dimensions of globalization.	KOF Globalization Index Database [28,29].
Foreign Direct Investment (FDI_GDP)	Net inflows of foreign direct investment as a percentage of GDP.	World Development Indicators (WDI), World Bank (2024)
Government Spending (GS)	government final consumption expenditure as a percentage of GDP.	World Development Indicators (WDI), World Bank (2024)
Domestic Credit to Private Sector (PC)	domestic credit provided to the private sector (% of GDP), used as a proxy for financial sector development.	World Development Indicators (WDI), World Bank (2024)
Gross Fixed Capital Formation (GFCF)	Gross fixed capital formation (% of GDP), represents domestic investment levels.	World Development Indicators (WDI), World Bank (2024)

Source: By authors using the WDI and the KOF Globalization Index Database.

5.2. Model Specification

To examine the robustness of the empirical findings, globalization is measured using two alternative indicators from the KOF Globalization Database: the Overall KOF Global-

ization Index and the KOF Economic Globalization Index. These indicators are estimated in two separate ARDL specifications rather than being included simultaneously in a single model. This modelling strategy enables the assessment of whether the estimated long-run relationships remain robust across alternative measures of globalization while avoiding potential multicollinearity between the two highly correlated indices.

The Overall KOF Globalization Index captures the multidimensional process of global integration by incorporating economic, social, and political dimensions. In contrast, the KOF Economic Globalization Index focuses exclusively on economic integration through trade and financial openness. Estimating these two alternative specifications enables us to determine whether economic diversification in Saudi Arabia is more closely associated with the broader process of globalization or with its economic dimension alone.

Accordingly, employing both measures does not imply treating globalization as a homogeneous concept; rather, it allows the analysis to distinguish between the broader process of global integration and its specific economic dimension.

Foreign direct investment (FDI) is included as a control variable in both models to isolate the relationship between globalization and economic diversification while accounting for the role of international capital inflows. This specification provides a more comprehensive assessment of the long-run relationship between globalization and economic diversification, allowing the robustness of the empirical findings to be evaluated across alternative measures of globalization.

5.3. Model I: Overall Globalization, Government Spending and Diversification

The first model explores the impact of overall globalization and government spending on HHI while controlling for variables such as foreign direct investment (FDI), gross fixed capital formation (GFCF), and private-sector credit (PC). The long-run functional form of Model I is expressed in Equation (1):

$$HHI = f(LGL, GS, FDI_GDP, PC, GFCF) \quad (1)$$

To examine the long-run relationship in Equation (1), the ARDL bounds testing approach is employed, given its suitability for variables integrated of order I(0), I(1), or a combination of both. The unrestricted error-correction representation of Model I takes the following form in Equation (2):

$$\Delta HHI_t = C_0 + \sum_{i=1}^p \gamma_{1i} \Delta \ln HHI_{t-i} + \sum_{i=1}^{q_1} \gamma_{2i} \Delta LGL_{t-i} + \sum_{i=1}^{q_2} \gamma_{3i} \Delta GS_{t-i} + \sum_{i=1}^{q_3} \gamma_{4i} \Delta FDI_GDP_{t-i} + \sum_{i=1}^{q_4} \gamma_{5i} \Delta PC_{t-i} + \sum_{i=1}^{q_5} \gamma_{6i} \Delta GFCF_{t-i} + \beta_1 HHI_{t-i} + \beta_2 LGL_{t-i} + \beta_3 GS_{t-i} + \beta_4 FDI_GDP_{t-i} + \beta_5 PC_{t-i} + \beta_6 GFCF_{t-i} + \epsilon_t \quad (2)$$

where

Δ denotes the first-difference operator

γ_i represents short-run coefficients

β_i denote long-run parameters

ϵ_t is a white-noise disturbance term.

The bounds test is conducted by comparing the computed F-statistic with Narayan's [30] small-sample critical values. Upon confirming cointegration, the long-run equilibrium equation is estimated as in Equation (3):

$$HHI_t = \theta_0 + \theta_1 LGL_t + \theta_2 GS_t + \theta_3 FDI_GDP_t + \theta_4 PC_t + \theta_5 GFCF_t + \mu_t \quad (3)$$

The corresponding restricted ECM for short-run dynamics follows in Equation (4):

$$\Delta HHI_t = C_0 + \sum_{i=1}^p \gamma_{1i} \Delta \ln HHI_{t-i} + \sum_{i=1}^{q1} \gamma_{2i} \Delta LGL_{t-i} + \sum_{i=1}^{q2} \gamma_{3i} \Delta GS_{t-i} + \sum_{i=1}^{q3} \gamma_{4i} \Delta FDI_GDP_{t-i} + \sum_{i=1}^{q4} \gamma_{5i} \Delta PC_{t-i} + \sum_{i=1}^{q5} \gamma_{6i} \Delta GFCF_{t-i} + \psi EC_{t-1} + \mu_t \quad (4)$$

Figure 4 illustrates research procedure and analytical steps for the two ARDL models, including diagnostic tests and robustness checks (FMOLS, DOLS, CCR). Source: By authors.

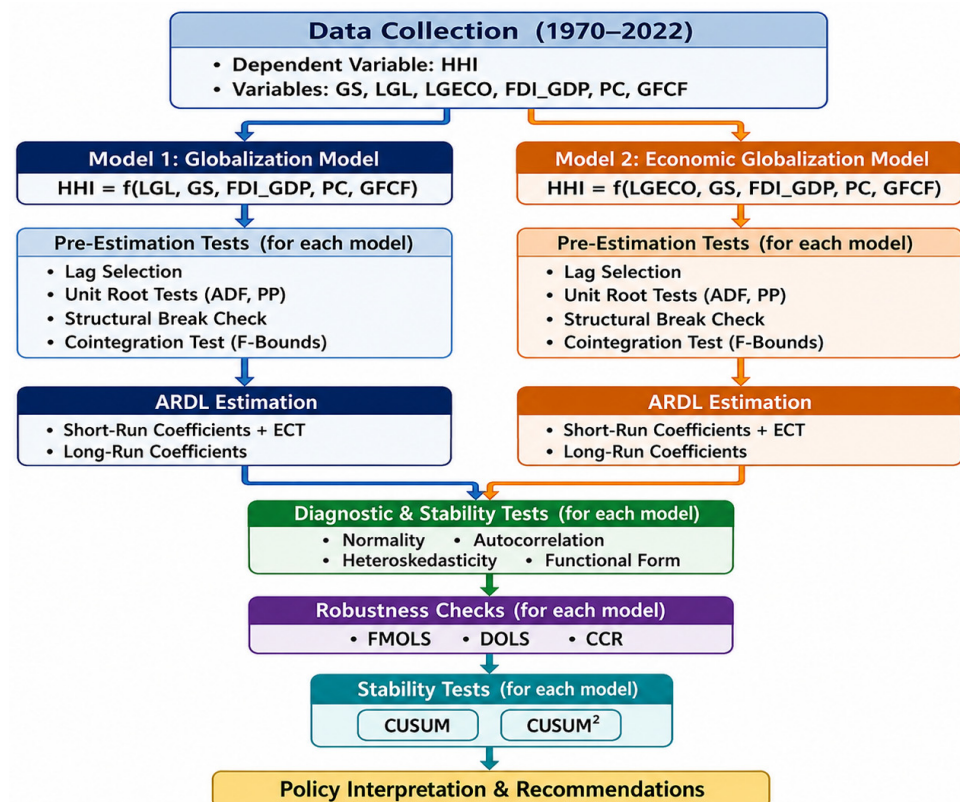


Figure 4. Research procedure.

5.4. Model II: Economic Globalization, Government Spending and Diversification

To gain deeper insight into how globalization influences diversification, the second model isolates the effect of economic globalization (LGECO) instead of using the overall globalization index. The dependent variable remains HHI, while the set of control variables is identical to that of Model.

The long-run functional form for Model II is

$$HHI = f(Gs, LGECO, FDI_GDP, PC, GfCF) \quad (5)$$

where GECO denotes the economic globalization component of the KOF index.

The unrestricted error-correction specification for Model II is:

$$\Delta HHI_t = C_0 + \sum_{i=1}^p \gamma_{1i} \Delta \ln HHI_{t-i} + \sum_{i=1}^{q1} \gamma_{2i} \Delta LGECO_{t-i} + \sum_{i=1}^{q2} \gamma_{3i} \Delta GS_{t-i} + \sum_{i=1}^{q3} \gamma_{4i} \Delta FDI_GDP_{t-i} + \sum_{i=1}^{q4} \gamma_{5i} \Delta PC_{t-i} + \sum_{i=1}^{q5} \gamma_{6i} \Delta GFCF_{t-i} + \beta_1 HHI_{t-i} + \beta_2 LGECO_{t-i} + \beta_3 GS_{t-i} + \beta_4 FDI_GDP_{t-i} + \beta_5 PC_{t-i} + \beta_6 GFCF_{t-i} + \epsilon_t \quad (6)$$

The long-run equilibrium equation is estimated as:

$$HHI_t = \theta_0 + \theta_1 LGECO_t + \theta_2 GS_t + \theta_3 FDI_GDP_t + \theta_4 PC_t + \theta_5 GFCF_t + \mu_t \quad (7)$$

The corresponding restricted ECM for short-run dynamics follows:

$$\Delta HHI_t = C_0 + \sum_{i=1}^p \gamma_{1i} \Delta \ln HHI_{t-i} + \sum_{i=1}^{q1} \gamma_{2i} \Delta LGECO_{t-i} + \sum_{i=1}^{q2} \gamma_{3i} \Delta GS_{t-i} + \sum_{i=1}^{q3} \gamma_{4i} \Delta FDI_GDP_{t-i} + \sum_{i=1}^{q4} \gamma_{5i} \Delta PC_{t-i} + \sum_{i=1}^{q5} \gamma_{6i} \Delta GFCF_{t-i} + \psi EC_{t-1} + \mu_t \quad (8)$$

5.5. Diagnostic and Stability Tests

To check our model's reliability, we ran several diagnostic tests after building it. We checked residual normality using the Jarque–Bera test [31], assessed serial correlation with the Breusch–Godfrey LM test [32], and tested for heteroskedasticity via the Breusch–Pagan–Godfrey test [33]. Model specification was evaluated using the Ramsey RESET test [34]. Finally, we examined parameter stability throughout the sample period using the CUSUM and CUSUM of Squares procedures [35].

5.6. Robustness Checks

To ensure the robustness of the estimated long-run relationships and to address potential endogeneity concerns, the ARDL results were validated using three alternative cointegration estimators: Fully Modified Ordinary Least Squares (FMOLS), Dynamic Ordinary Least Squares (DOLS), and Canonical Cointegrating Regression (CCR). These estimators are widely employed in cointegrated systems because they explicitly correct for endogeneity bias and serial correlation, thereby producing consistent long-run parameter estimates [36–38]. These estimators are widely used in cointegrated systems because they explicitly correct for potential endogeneity and serial correlation, thereby providing reliable and consistent long-run parameter estimates. The consistency of results across ARDL, FMOLS, DOLS, and CCR—in terms of coefficient signs, magnitudes, and statistical significance—strengthens the credibility and stability of the empirical conclusions [39].

Although each estimator relies on different correction mechanisms, the results remain qualitatively consistent across all estimation techniques in terms of coefficient signs and overall economic interpretation. Such consistency provides strong evidence of the stability and robustness of the estimated relationships between globalization, government spending, and economic diversification in Saudi Arabia. The convergence of results across ARDL, FMOLS, DOLS, and CCR estimators strengthens confidence in the robustness of the long-run estimates.

6. Results

6.1. Descriptive Statistics and Correlation Matrix

The descriptive statistics (Table 2) show that most variables have moderate means and standard deviations. However, certain variables, notably FDI_GDP and HHI, display high kurtosis and significant Jarque–Bera test results, indicating the presence of extreme values and deviations from normality. The skewness values suggest asymmetry in the distribution of some variables. These characteristics are considered in the subsequent econometric modeling, particularly in the ARDL framework, which is robust to non-normality in the residuals.

Table 3 presents the correlation matrix among the explanatory variables. Some moderate to high correlations are observed, for example, between overall globalization (LGL) and economic globalization (LGEKO) ($r = 0.79$). However, LGL and LGEKO are estimated in separate ARDL models. Therefore, these correlations do not compromise the estimation of long-run or short-run coefficients. The ARDL framework's inclusion of lagged regressors further mitigates potential issues of contemporaneous multicollinearity, ensuring robustness and interpretability of the results.

Table 2. Descriptive statistics.

	HHI	LGL	LGECO	FDI_GDP	LPC	GFCF	GS
Mean	0.483301	3.866490	4.142287	0.567593	2.956497	3.018260	23.55926
Median	0.466250	3.865036	4.114871	0.367201	3.107263	3.054817	23.45721
Maximum	0.715293	4.211015	4.328307	7.262047	4.030695	3.400890	35.22252
Minimum	0.417834	3.419499	4.022985	−8.218787	1.011817	2.178635	8.431545
Std. Dev.	0.055822	0.273774	0.099902	2.202672	0.851133	0.234202	5.905065
Skewness	1.700018	−0.152096	0.426278	−0.610036	−0.649029	−1.421813	−0.163601
Kurtosis	6.953145	1.528344	1.793991	7.677448	2.287310	5.637661	2.830133
Jarque–Bera	60.03926	4.987091	4.817056	51.60234	4.842614	33.22097	0.300149
Probability	0.000000	0.082617	0.089948	0.000000	0.088805	0.000000	0.860644
Sum	25.61494	204.9240	219.5412	30.08243	156.6943	159.9678	1248.641
Sum Sq. Dev.	0.162038	3.897504	0.518980	252.2917	37.67026	2.852241	1813.229
Observations	53	53	53	53	53	53	53

Source: By authors using Eviews 13.

Table 3. Correlation matrix.

GFCF	GS	GFCF	FDI_GDP	PC	LGL	LGECO
GS	1	0.4064746261063434	0.2860359191237193	0.1730006242636199	0.1251886482439631	0.09072574666827172
GFCF	0.4064746261063434	1	0.5250731348008765	0.4320488196788091	0.3898867394659155	0.1142000696038232
FDI_GDP	0.2860359191237193	0.5250731348008765	1	0.1990127569979768	0.1736496644806692	0.08241921958550746
PC	0.1730006242636199	0.4320488196788091	0.1990127569979768	1	0.3988003838384152	0.4590148790747593
LGL	0.1251886482439631	0.3898867394659155	0.1736496644806692	0.3988003838384152	1	0.7943432468989031
LGECO	0.09072574666827172	0.1142000696038232	0.08241921958550746	0.4590148790747593	0.7943432468989031	1

Source: By authors using Eviews 13.

6.2. Unit Root Test

To examine the stationarity properties of the variables, the Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) unit root tests were employed. The tests were conducted under two deterministic specifications: with an intercept and with an intercept and a linear trend, to ensure the robustness of the results. Unit root tests such as the Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) tests may produce different outcomes because of differences in their treatment of serial correlation, lag selection, and deterministic specifications [40].

Accordingly, when mixed results were obtained, the final order of integration was not determined based on a single test or model specification. Instead, it was established by considering the overall evidence from both the ADF and PP tests under the intercept-only and intercept-and-trend specifications. This conservative approach reduces the risk of misclassifying the integration order and provides a more robust basis for the subsequent ARDL analysis. Table 4 indicates that FDI_GDP is integrated of order zero, $I(0)$, whereas HHI, GS, LGL, LGECO, GFCF, and PC are integrated of order one, $I(1)$. To account for alternative deterministic components, both intercept-only and intercept-and-trend specifications were estimated. Overall, the variables comprise a mixture of $I(0)$ and $I(1)$ processes, while none is integrated of order two, $I(2)$, thereby satisfying the prerequisite for applying the ARDL bounds testing approach.

Table 4. Results of the ADF unit root test.

Variable	Model	ADF Statistic	PP Statistic	1% CV	5% CV	10% CV	Integration Order
HHI	C	−3.045 ***	−2.284	−3.584	−2.928	−2.603	I(1)
	C&T	−2.968	−2.905	−4.176	−3.513	−3.187	
	ΔC	−5.476 ***	−5.476 ***	−3.584	−2.928	−2.603	
	ΔC&T	−4.932 **	−4.932 **	−5.348	−4.860	−4.607	
GS	C	−2.147	−2.147	−3.563	−2.919	−2.598	I(1)
	C&T	−1.965	−1.919	−4.145	−3.499	−3.179	
	ΔC	−8.270 ***	−8.270 ***	−3.563	−2.919	−2.598	
	ΔC&T	−8.331 ***	−8.331 ***	−4.145	−3.499	−3.179	
FDI_GDP	C	−5.285 ***	−5.285 ***	−3.563	−2.919	−2.597	I(0)
	C&T	−5.421 ***	−5.421 ***	−4.145	−3.499	−3.179	
LGL	C	−0.824	−1.191	−3.563	−2.919	−2.598	I(1)
	C&T	−1.276	−1.304	−4.145	−3.499	−3.179	
	ΔC	−6.441 ***	−6.441 ***	−3.563	−2.919	−2.598	
	ΔC&T	−7.529 ***	−7.529 ***	−4.145	−3.499	−3.179	
LGECO	C	−0.990	−0.990	−3.563	−2.919	−2.598	I(1)
	C&T	−1.583	−1.583	−4.145	−3.499	−3.179	
	ΔC	−7.338 ***	−7.338 ***	−3.563	−2.919	−2.598	
	ΔC&T	−7.235 ***	−7.235 ***	−4.145	−3.499	−3.179	
GFCF	C	−4.859 ***	−2.529	−4.157	−3.504	−3.182	I(1)
	C&T	−2.833	−2.668	−4.186	−3.518	−3.190	
	ΔC	−7.826 ***	−7.826 ***	−3.563	−2.919	−2.598	
	ΔC&T	−7.968 ***	−7.968 ***	−4.186	−3.518	−3.190	
PC	C	−5.766 ***	−0.690	−4.153	−3.502	−3.181	I(1)
	C&T	−1.705	−2.452	−4.153	−3.502	−3.181	
	ΔC	−7.746 ***	−7.746 ***	−3.563	−2.919	−2.598	
	ΔC&T	−7.718 ***	−7.718 ***	−4.153	−3.502	−3.181	

Source: By authors using Eviews 13. ADF and PP denote Augmented Dickey–Fuller and Phillips–Perron unit root tests, respectively. C and C&T represent models with intercept and with intercept and linear trend. Critical values at the 1%, 5%, and 10% significance levels are reported for comparison with the test statistics. **, and *** indicate statistical significance at the 5%, and 1% levels, respectively. Lag lengths for the ADF test were selected using the Akaike Information Criterion (AIC), while the PP test employed the Newey–West bandwidth selection method.

To ensure the robustness of the stationarity analysis, the Zivot–Andrews (ZA) unit root test was employed in Table 5 to account for possible endogenous structural breaks. The ZA test was used as a complementary robustness check rather than as the primary criterion for determining the order of integration. The results indicate that allowing for structural breaks does not alter the overall integration properties of the variables. Although FDI_GDP was confirmed to be stationary at level, a few other variables showed level stationarity only under specific ZA model specifications. As these findings were neither consistent across alternative ZA specifications nor supported by the conventional ADF and Phillips–Perron tests, they were not considered sufficient to revise the integration order. Accordingly, the integration orders reported in Table 4 were retained for the subsequent ARDL analysis.

Table 5. Unit Root Tests with Structural Breaks (Zivot-Andrews).

Variable	Model	Level/ Δ	Break Date	t-Statistic	1% CV	5% CV	10% CV
HHI	C	Level	1974	−5.4757	−4.9491	−4.4436	−4.1936
	C&T	Level	1974	−4.9320	−5.3476	−4.8598	−4.6073
	C	Δ HHI	1980	−8.3306	−5.3476	−4.8598	−4.6073
	C&T	Δ HHI	1980	−8.3306	−5.3476	−4.8598	−4.6073
GS	C	Level	1981	−3.9001	−5.3476	−4.8598	−4.6073
	C&T	Level	1981	−3.3781	−4.9491	−4.4436	−4.1936
	C	Δ GS	1980	−8.3306	−5.3476	−4.8598	−4.6073
	C&T	Δ GS	1980	−8.3306	−5.3476	−4.8598	−4.6073
FDI_GDP	C	Level	1974	−7.5866	−5.3476	−4.8598	−4.6073
	C&T	Level	1974	−7.5866	−5.3476	−4.8598	−4.6073
LGL	C	Level	1990	−7.5291	−5.3476	−4.8598	−4.6073
	C&T	Level	2011	−2.2211	−5.3476	−4.8598	−4.6073
	C	Δ LGL	2012	−6.4410	−4.9491	−4.4436	−4.1936
	C&T	Δ LGL	2012	−3.9241	−4.9491	−4.4436	−4.1936
LGECO	C	Level	1980	−7.3379	−4.9491	−4.4436	−4.1936
	C&T	Level	2014	−4.0274	−5.3476	−4.8598	−4.6073
	C	Δ LGECO	2012	−7.2352	−5.3476	−4.8598	−4.6073
	C&T	Δ LGECO	2012	−2.0010	−4.9491	−4.4436	−4.1936
GFC_GDP	C	Level	1974	−7.8260	−4.9491	−4.4436	−4.1936
	C&T	Level	1974	−4.2091	−5.3476	−4.8598	−4.6073
	C&T	Δ GFC_GDP	1978	−7.9679	−5.3476	−4.8598	−4.6073
	C	Δ GFC_GDP	1978	−4.3910	−4.9491	−4.4436	−4.1936
PC	C	Level	1997	−1.5885	−4.9491	−4.4436	−4.1936
	C&T	Level	2014	−5.3513	−5.3476	−4.8598	−4.6073
	C	Δ PC	2015	−7.7459	−4.9491	−4.4436	−4.1936
	C&T	Δ PC	2015	−7.7176	−4.9491	−4.4436	−4.1936

Source: By authors using Eviews 13.

6.3. Diagnostic Tests

As evidenced in Panel C of Table 6, the residuals in both models exhibit a normal distribution, with the Jarque–Bera test p -values exceeding the 5% significance threshold. Furthermore, the residuals demonstrate homoscedasticity, as confirmed by the Breusch–Pagan–Godfrey test. The LM test similarly verifies the absence of first-order and second-order autocorrelation in the residuals. Additionally, the Ramsey RESET test confirms that the functional form specification appropriately captures the relationship between the variables.

6.4. Long-Run and Short-Run Results

As shown in panel A, Table 6, the long-run association among variables indicates that the effect of government spending on HHI is negative and significant in the two models. Based on this finding, the second hypothesis is supported, since government expenditure has a negative and statistically significant long-run relationship with HHI, indicating greater economic diversification, demonstrating that government consumption expenditure is positively associated with economic diversification in Saudi Arabia and is

consistent with the Saudi government's economic diversification objectives under Vision 2030. In both models, government consumption expenditure (GS) exhibits the strongest long-run association with economic concentration. With long-run coefficients of -0.4622 (LGECO) and -0.3946 (LGL), the results indicate that higher government consumption expenditure, as a percentage of GDP, is significantly associated with a lower Herfindahl–Hirschman Index (HHI). This result is supported by [15,16,19].

Table 6. ARDL Model Comparison: Economic vs Overall Globalization.

Panel A: Long-Run Relationship					
Variable	Long-Run Coefficient (LGECO)		Prob.	Long-Run Coefficient (LGL)	
LGECO/LGL	0.1786		0.0786	0.1801	
FDI_GDP	-0.0220		0.0783	-0.0185	
GS	-0.4622		0.0000	-0.3946	
PC	-0.0521		0.0205	-0.0946	
GFCF	0.0485		0.6319	0.0339	
Panel B: Short-Run/ECM	Coefficient (LGECO)		Prob.	Coefficient (LGL)	
D(GFCF)	-0.1685		0.0000	-0.1639	
CointEq(−1)	-0.2574		0.0000	-0.2923	
Model Statistics	LGECO			LGL	
R-squared	0.811			0.812	
Adjusted R-squared	0.807			0.808	
Durbin-Watson	1.743			1.734	
F-Bounds Test (F-statistic)	10.679			10.758	
I(0) (Lower bound, 5%)	2.82			2.14	
I(1) (Upper bound, 5%)	4.21			3.34	
Panel C: Diagnostic tests					
Test	LGECO	Prob.	LGL	Prob.	Conclusion
Jarque–Bera Normality	2.237	0.128	2.237	0.237	Residuals normally distributed
Breusch–Godfrey LM (2 lags)	0.9149	0.408	0.6190	0.543	No serial correlation
Breusch–Pagan–Godfrey	0.852	0.551	1.079	0.393	Homoskedasticity confirmed
Ramsey RESET (squares of fitted values)	2.247	0.141	1.872	0.178	Correct functional form

Source: By authors using Eviews 13.

The study also reveals that overall globalization and economic globalization were negatively associated with economic diversification, where the concentration index was positive and statistically significant (0.1786 for LGECO and 0.1801 for LGL). Based on the empirical findings, the first hypothesis is not supported, as both overall globalization and economic globalization are positively associated with HHI, indicating greater sectoral concentration rather than economic diversification. This finding is supported by [11–14]. Globalization is associated with market liberalization and the growing dominance of multinational corporations, which often associated with the exit or absorption of smaller firms that are unable to compete with large global entities. This dynamic is associated with greater economic concentration. Moreover, economic globalization may be associated with greater reliance on a single sector and with higher imports of goods and services rather than fostering the development of domestic industries, thereby weakening the competitiveness of local economic sectors. Globalization also tends to channel resources toward sectors in which a country holds a strong comparative advantage, further reinforcing structural concentration [41]. Our empirical findings confirm the Factor Endowment Hypothesis, suggesting that globalization in Saudi Arabia has historically reinforced existing comparative advantages in the resource sector, thereby increasing sectoral concentration. Table 7 summarizes the study hypotheses and the outcomes of the hypothesis tests (Supported/Not Supported).

Table 7. Summary of Hypothesis Testing Results.

Hypothesis	Empirical Evidence	Status
H1	Globalization is positively associated with HHI, indicating greater sectoral concentration.	Not Supported
H2	Government expenditure has a negative and significant long-run effect on HHI.	Supported

Source: By authors.

The ARDL long-run estimates indicate that foreign direct investment (FDI_GDP) is negatively associated with the HHI in both specifications, with coefficients of -0.0220 in the LGECO model and -0.0185 in the LGL model. These coefficients are statistically significant at the 10% level, suggesting that increases in FDI inflows are associated with a slight reduction in the concentration index and therefore indicate a modest improvement in economic diversification. However, the statistical significance of this relationship is relatively weak, and the magnitude of the coefficient indicates a limited quantitative association. This finding is partially consistent with the evidence reported by Qamruzzaman [10] for several emerging economies.

Private sector credit (PC) also associated with economic diversification, diversification, with coefficients of -0.0521 (LGECO) and -0.0946 (LGL), showing that increased access to financial resources spreads economic activity across multiple sectors. This result aligns with the result of Sultanova & Naser [42]. Finally, Gross fixed capital formation (GFCF) shows a positive but statistically insignificant association (0.0485 for LGECO and 0.0339 for LGL), implying that investment allocation across sectors is not broad enough to associate long-run economic concentration significantly.

In addition to the long-run results presented in Panel A, Panel B reports the short-run dynamics captured by the error correction model (ECM). The short-run coefficient of ΔGFCF is negative and statistically significant in both models, indicating that short-term changes in gross fixed capital formation temporarily indicate greater diversification.

The Error Correction Term (ECT) is negative and statistically significant in both models ($\text{ECT} = -0.2574$ for LGECO and -0.2923 for LGL), confirming the existence of a stable long-run equilibrium relationship among the variables. In ARDL error correction models, the stability condition requires the coefficient to be negative and lie between -1 and 0 , ensuring convergence toward the long-run equilibrium [43]. The estimated coefficients indicate that approximately 26–29% of short-run deviations from equilibrium are corrected within one period. This implies that the adjustment toward the long-run equilibrium takes approximately 3–4 years, reflecting a gradual convergence process in economic diversification.

These results illustrate that while short-run fluctuations may be temporarily linked to economic diversification, government spending, FDI, and other long-run determinants are associated with sustained structural changes in the Saudi economy.

The ARDL lag structure was selected automatically using the Akaike Information Criterion (AIC), ARDL (1,0,0,1,0,1) and ARDL (1,0,0,0,0,1). The AIC rankings for the top candidate ARDL models are presented in Appendix A Figures A1 and A2. Some short-run coefficients for excluded lags are not reported in the table.

Figures 5 and 6 display the CUSUM and CUSUM of Squares tests for two models, confirming structural stability. Test statistics remained within critical bounds across the full sample period, verifying parameter consistency and absence of structural breaks. This stability validates the model's estimates for robust economic policy analysis.

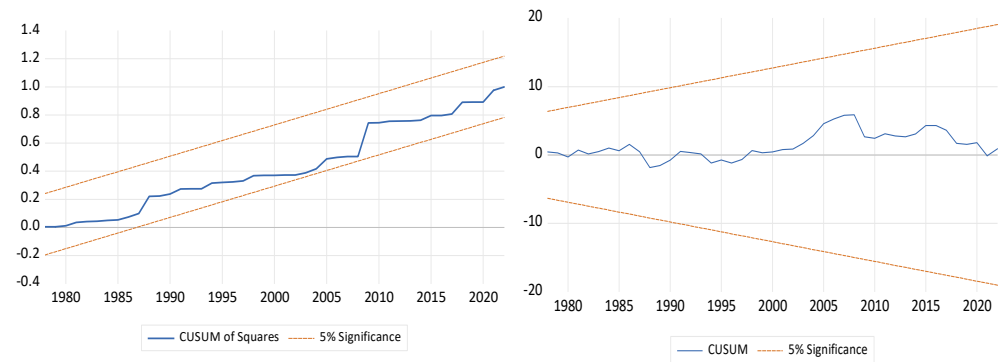


Figure 5. The CUSUM & CUSUM of Squares test for model 1. Source: By authors using Eviews 13.

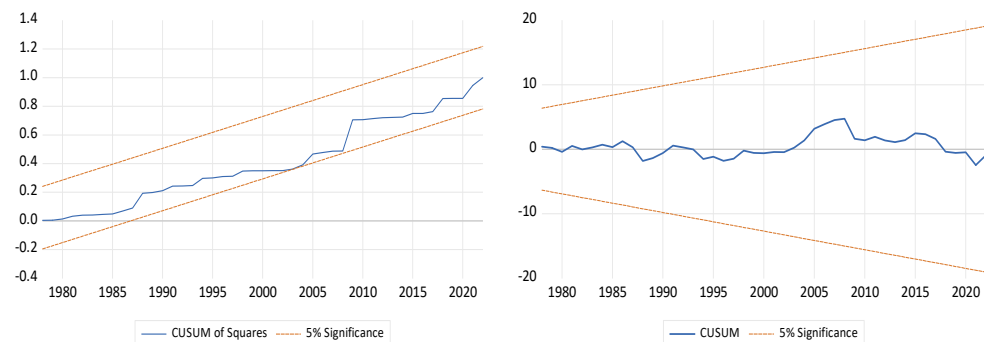


Figure 6. The CUSUM & CUSUM of Squares test for model 2. Source: By authors using Eviews 13.

6.5. Robustness Checks Results

We verified the reliability of our ARDL results by running FMOLS, DOLS, and CCR estimators in Tables 8 and 9. Overall, the three estimators provide broad support for the ARDL findings. Although some differences in coefficient magnitude and statistical significance are observed across the alternative estimators, particularly for FDI and GFCF, the overall direction of the main long-run relationships remains broadly consistent with the ARDL results, supporting the robustness of the estimated long-run relationships.

Table 8. FMOLS, DOLS, and CCR estimation for the economic globalization index.

Variable	FMOLS Coefficient	Prob.	DOLS Coefficient	Prob.	CCR Coefficient	Prob.
IGECO	0.269006	0.0442	0.003784	0.0004	0.274097	0.0522
FDI_GDP	−0.005836	0.2544	−0.009218	0.1146	−0.005085	0.4595
GS	−0.285724	0.0000	−0.091402	0.0003	−0.282587	0.0000
PC	−0.079494	0.0000	−0.066410	0.0000	−0.080482	0.0001
GFCF	0.210497	0.0006	0.243324	0.0000	0.204239	0.0009

Source: By authors using Eviews 13.

Table 9. FMOLS, DOLS, and CCR estimation for the overall globalization index.

Variable	FMOLS Coefficient	Prob.	DOLS Coefficient	Prob.	CCR Coefficient	Prob.
LGL	0.470079	0.0000	0.427528	0.0302	0.364250	0.0117
FDI_GDP	−0.003771	0.4739	0.006653	0.5255	−0.003121	0.6312
GS	−0.141541	0.0068	−0.186343	0.0375	−0.188937	0.0042
PC	−0.203883	0.0000	−0.203228	0.0071	−0.172337	0.0007
GFCF	0.142801	0.0219	0.118109	0.1767	0.122900	0.0587

Source: By authors using Eviews 13.

7. Discussion

The empirical results presented in the previous section provide valuable insights into the determinants of economic diversification in Saudi Arabia. This discussion interprets the findings in light of relevant economic theories and the institutional context of Saudi Arabia.

The negative and significant relationship between government consumption spending and the Herfindahl–Hirschman Index (HHI) indicates that government consumption expenditure is strongly associated with economic diversification. This outcome aligns with the structural transformation theory, which suggests that targeted government consumption expenditure across multiple sectors is associated with lower dependency on a single industry and broader productive capabilities [44]. In the Saudi context, these findings are consistent with the public spending strategies implemented under Vision 2030. While the estimated variable captures government consumption expenditure rather than public investment, it may reflect the broader policy environment in which government expenditure is accompanied by initiatives supporting infrastructure development, service-oriented projects, and the expansion of non-oil sectors. Overall, the findings suggest that higher government consumption expenditure is associated with lower sectoral concentration and a broader production structure, consistent with greater economic resiliency.

Both overall globalization and economic globalization are positively and significantly associated with higher sectoral concentration, as reflected by their positive and statistically significant association with the HHI. These findings should be interpreted as empirical associations rather than definitive causal effects within the scope of the ARDL framework. A possible explanation, consistent with theories of comparative advantage and global market competition, is that increased global integration may strengthen the role of large multinational corporations in key sectors, potentially limiting the expansion of smaller domestic firms and reinforcing structural concentration. Moreover, economic globalization may direct resources toward sectors in which a country already holds a comparative advantage, which can increase reliance on imports and slow the diversification of domestic industries [45]. In Saudi Arabia, this highlights the importance of complementary domestic policies to ensure that globalization contributes positively to diversification rather than exacerbating concentration. The results do not support the initial hypothesis that globalization necessarily promotes economic diversification in Saudi Arabia. Instead, the empirical findings indicate that both overall globalization and economic globalization are associated with higher sectoral concentration. This outcome suggests that the benefits of globalization for diversification are not automatic and may depend on the domestic economic structure and policy environment.

The ARDL results suggest a negative association between FDI_GDP and the HHI, indicating that higher inflows of foreign capital may contribute to economic diversification. However, this relationship is statistically weak, as the coefficient is significant only at the 10% level in the ARDL estimates and becomes statistically insignificant in the robustness checks using FMOLS, DOLS, and CCR. Therefore, the long-run influence of FDI_GDP on diversification should be interpreted with caution. From a theoretical perspective, foreign investment can still play a potential role associated with greater diversification through technology transfer, improved management practices, and the expansion of productive capacities across sectors, as suggested by Schumpeterian innovation theory [46]. In the Saudi context, although FDI inflows have been directed toward several non-oil activities in recent years, the empirical evidence does not provide strong support for a stable long-run diversification relationship.

Credit to the private sector also associated positively to diversification by distributing financial resources across multiple industries rather than concentrating them in a few sectors. This finding is consistent with the development finance perspective, which empha-

sizes that access to capital enables private firms to expand and innovate in non-traditional sectors. The Saudi experience, aligned with Vision 2030, demonstrates that expanding credit facilities effectively supports economic diversification by stimulating private sector activity in varied industries.

Although gross fixed capital formation is negatively associated with the HHI, its association is statistically insignificant in the ARDL long-run estimates. This may reflect the concentration of investment in a limited number of sectors, such as energy and infrastructure, rather than a broad distribution across diverse economic activities. However, the robustness estimations using FMOLS, DOLS, and CCR indicate a statistically significant long-run relationship. This difference may arise from methodological distinctions between the estimators, as ARDL incorporates dynamic adjustments and lag structures that may absorb part of the investment effect, whereas FMOLS, DOLS, and CCR focus directly on the long-run equilibrium relationship and correct for endogeneity and serial correlation. Therefore, the results suggest that the impact of capital formation on economic diversification becomes more visible when the long-run equilibrium relationship is estimated using alternative cointegration techniques.

The negative and significant ECT indicates that deviations from the long-run equilibrium are corrected over time. For instance, if economic diversification temporarily deviates due to shocks in globalization or government spending, the system adjusts back toward equilibrium in subsequent periods.

8. Conclusions

The study examines the long-run relationship between globalization, government consumption spending, and economic diversification in Saudi Arabia over the period 1970–2022. The ARDL results indicate that both overall globalization and economic globalization are positively associated with sectoral concentration (HHI) and, consequently, lower economic diversification, whereas government consumption spending is negatively associated with sectoral concentration and therefore aligns with greater economic diversification. Domestic credit is also associated with lower sectoral concentration, while foreign direct investment is associated with a more diversified economic structure. In contrast, gross fixed capital formation shows no statistically significant long-run association with diversification.

Globalization is often expected to enhance diversification. According to our findings, the evidence indicates that globalization and economic globalization can increase concentration [47,48]. This occurs through two main channels [49]; First, increased global competition forces less efficient firms to exit, reducing the number of market participants and strengthening the pricing power of the remaining firms. Second, market shares tend to shift toward larger and more productive companies that already operate with higher markups.

The robustness of these findings is confirmed by the FMOLS, DOLS, and CCR estimators, which produce results broadly consistent with the ARDL estimates in terms of coefficient signs and statistical significance, thereby strengthening confidence in the identified long-run relationships.

Based on these findings, policies that improve the effectiveness of government consumption spending, expand access to private-sector credit, and direct foreign direct investment toward productive non-oil sectors may further support economic diversification. At the same time, the positive association between globalization and sectoral concentration suggests that greater global integration alone is insufficient to achieve diversification. Accordingly, complementary domestic policies—including support for SMEs, innovation, and the development of competitive non-oil industries—remain essential to ensure that the benefits of globalization are more closely associated with sustainable structural diversification.

Limitations of the Research and Future Research

Despite providing useful insights into the long-run relationship between globalization, government consumption expenditure, and economic diversification in Saudi Arabia, this study is subject to several limitations. First, the empirical analysis is constrained by the availability of the KOF Globalization Index, as consistent observations for both the Overall and Economic Globalization indices are currently available only up to 2022. This limits the ability to capture more recent developments in globalization and post-pandemic economic adjustments.

Second, due to the availability of a consistent long-run fiscal series, government consumption expenditure is employed as an aggregate proxy for fiscal policy. Consequently, the analysis does not distinguish between different categories of public expenditure, whose sectoral allocation may have heterogeneous implications for economic diversification.

Third, the empirical framework is based on a linear ARDL specification and therefore captures average long-run relationships without explicitly accounting for potential nonlinearities, structural changes, or the influence of institutional factors that may shape the relationship between globalization and economic diversification.

Future research may address these limitations by extending the sample period as updated KOF data become available, incorporating disaggregated fiscal expenditure measures, institutional and policy-related variables, and structural break indicators, as well as applying nonlinear econometric approaches, such as threshold models and nonlinear ARDL, to examine whether the relationship varies across different economic regimes. In addition, future studies may incorporate uncertainty indicators, including Economic Policy Uncertainty (EPU), to further investigate how external shocks and policy uncertainty influence economic diversification.

Author Contributions: Conceptualization, M.M.A.M. and H.I.A.O.; methodology, M.M.A.M.; software, M.M.A.M.; validation, M.M.A.M.; formal analysis, M.M.A.M.; investigation, M.M.A.M. and H.I.A.O.; resources, M.M.A.M. and H.I.A.O.; data curation, M.M.A.M.; writing—original draft preparation, M.M.A.M. and H.I.A.O.; writing—review and editing, M.M.A.M. and H.I.A.O.; visualization, M.M.A.M.; supervision, M.M.A.M.; project administration, M.M.A.M. All authors have read and agreed to the published version of the manuscript.

Funding: This work was supported and funded by the Deanship of Scientific Research at Imam Mohammad Ibn Saud Islamic University (IMSIU). (grant number IMSIU-DDRSP2602).

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data used in this study are publicly available from the World Development Indicators (World Bank) and the KOF Swiss Economic Institute databases. The datasets analyzed during the current study are available from the corresponding author upon reasonable request.

Acknowledgments: The authors thank the Deanship of Scientific Research at Imam Mohammad Ibn Saud Islamic University (IMSIU).

Conflicts of Interest: The authors declare no conflicts of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

Abbreviations

The following abbreviations are used in this manuscript:

ARDI	Auto Regressive Distributed Lag model
FMOLS	Fully Modified Ordinary Least Squares
DOLS	Dynamic Ordinary Least Squares

Appendix A

Table A1. Representative Sectoral Shares Used in the Construction of the Herfindahl–Hirschman Index (HHI).

Year	Agriculture	Industry	Services	HHI
1970	4.23	58.27	36.32	0.473
1990	5.64	48.55	44.22	0.434
2005	3.19	61.74	34.26	0.500
2022	2.40	53.14	39.86	0.442

Source: Authors’ calculations based on WDI (World bank, 2024).

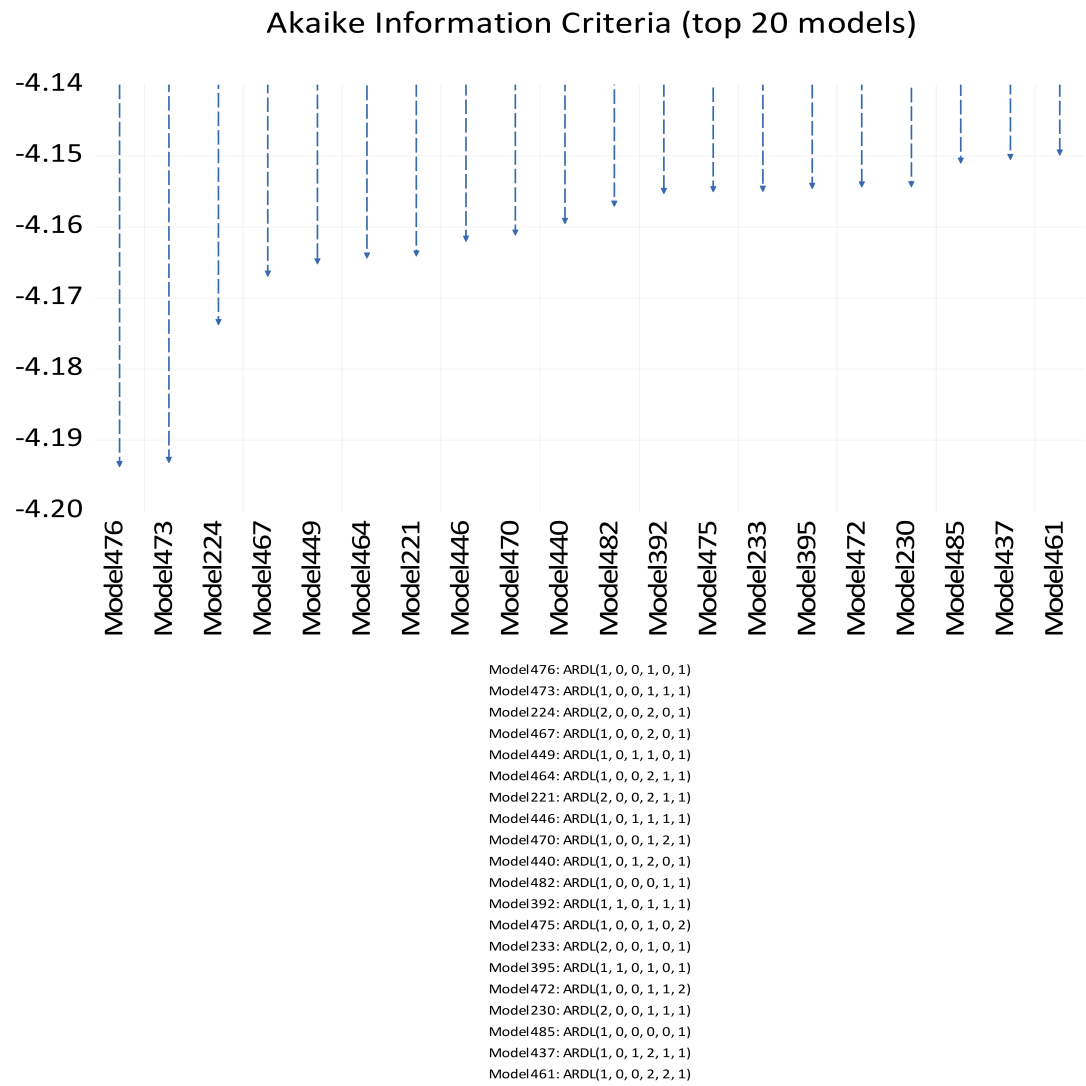


Figure A1. Top 20 ARDL Models Ranked by Akaike Information Criterion (AIC) for model 1.

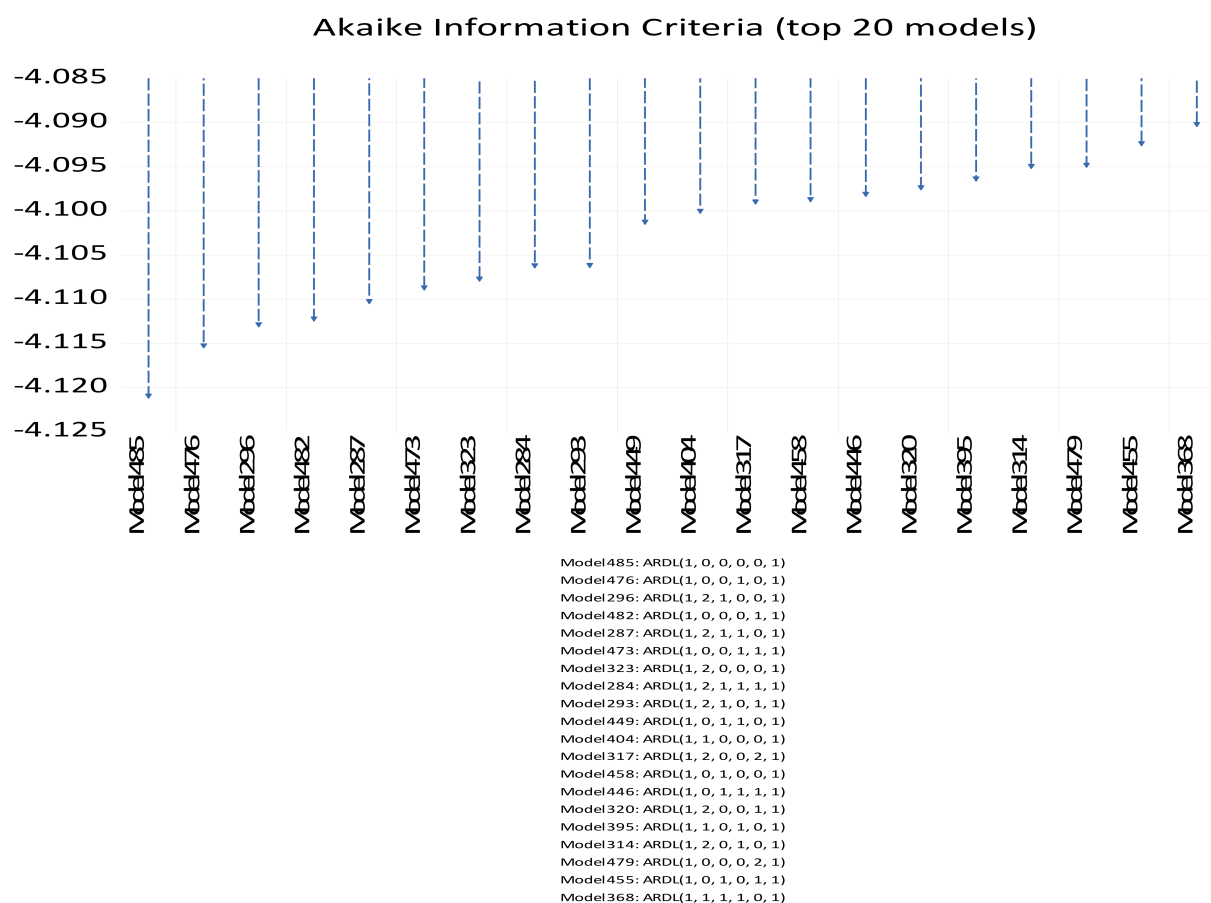


Figure A2. Top 20 ARDL Models Ranked by Akaike Information Criterion (AIC) for model 2.

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