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The impact of foreign direct investment on economic diversification in Saudi Arabia: An empirical study for the period (2005–2022)

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***Abstract*---**This study aims to analyze the impact of Foreign Direct Investment (FDI) on economic diversification in Saudi Arabia during the period (2005–2022), with a focus on structural and institutional factors within the framework of Vision 2030, which seeks to reduce dependency on natural resources. The study employs the Autoregressive Distributed Lag (ARDL) model to examine the dynamic relationship between variables, using data on the Economic Diversification Index (DIV), Foreign Direct Investment (FDI), Productive Capacity Index (PCI), and Total Natural Resources (TNR). The results indicate that FDI has not had a significant impact on economic diversification due to its concentration in oil-related sectors. The findings also reveal a strong negative effect of natural resources (TNR), reflecting the "resource curse" phenomenon. Furthermore, the study highlights the weak influence of productive capacities (PCI) in the absence of supportive policies for innovation and infrastructure. The study recommends directing foreign investments toward non-traditional sectors (such as renewable energy and advanced manufacturing), enhancing technological infrastructure, reducing oil dependency by diversifying income sources, and activating international partnerships for technology transfer and local value chain development.

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JEL Classification: F21, O14, O47

Introduction

Foreign Direct Investment (FDI) is considered a key driver in enhancing global economic integration, as it facilitates the transfer of knowledge and technology and boosts production efficiency through the establishment of sustainable partnerships between local and international economies. This interaction not only strengthens the individual capacities of economic sectors but also opens new horizons for international competitiveness, highlighting the need for comprehensive economic strategies to support broader developmental goals.

In this context, economic diversification emerges as a proactive response to ensure the resilience of the economy against external shocks. This is achieved through the development of a multifaceted productive base that includes innovative sectors such as advanced manufacturing and digital services. Such an approach contributes to creating an economic environment capable of absorbing crises while providing diverse employment opportunities and enhancing local value-added, making it a cornerstone of sustainable growth.

The relationship between FDI and economic diversification is interactive and bidirectional. On one hand, FDI can support diversification by financing and developing non-traditional sectors such as renewable energy or cultural tourism, which require advanced technologies and global partnerships. On the other hand, diversification creates an attractive environment for foreign investments by offering emerging markets and opportunities to maximize returns through the country's comparative advantages. This mutual interaction underscores the importance of designing integrated policies that utilize FDI as an effective tool for achieving ambitious development visions, while ensuring alignment with national priorities to maximize economic and social benefits.

Research Problem:

This study seeks to measure the impact of foreign direct investment on economic diversification. Accordingly, it attempts to answer the following question: *To what extent does Foreign Direct Investment contribute to achieving economic diversification in Saudi Arabia?*

Research Hypotheses:

To answer the research problem, the following hypotheses will be tested:

1. The concentration of foreign investment in oil sectors hinders economic diversification.
2. Improving productive capacities does not lead to economic diversification without supportive policies for innovation and infrastructure.
3. Reliance on natural resources reinforces the "resource curse" and limits opportunities for sustainable diversification.

Scope of the Study:

- **Geographical scope:** The study focuses on Saudi Arabia.
- **Time scope:** The selected period extends from 2005 to 2022, based on the availability of data for the study variables. This period is characterized by major economic transformations (such as Vision 2030) and fluctuations in oil prices, making it an ideal case for analyzing the effect of FDI on diversification beyond dependence on natural resources. Additionally, Saudi Arabia has undertaken significant legislative reforms during this period, such as the introduction of new investment laws and the launch of special economic zones.

Significance of the Study:

This study provides empirical evidence on the effectiveness of FDI in achieving economic diversification in Saudi Arabia. It sheds light on the challenges associated with dependency on natural resources, thus supporting policymakers in designing targeted policies to boost non-oil sectors in alignment with Vision 2030.

Objective of the Study:

To analyze the impact of Foreign Direct Investment on economic diversification in Saudi Arabia during the period (2005–2022), and to identify the structural and institutional factors that enhance or hinder this impact, with the aim of providing applicable policy recommendations.

Research Methodology:

To achieve the research objective, the study adopts a descriptive approach by reviewing definitions of FDI and economic diversification and the relationship between them. In addition, an analytical approach is used through field research to identify and measure the relationship between the study variables, using statistical analysis and econometric modeling tools.

Previous Studies:

- **Alguacil, M., Cuadros, A., & Orts, V. (2021):**
  Titled *FDI and Industrial Diversification in Latin America: The Role of Comparative Advantages*, this study aimed to assess the impact of FDI on industrial diversification in 15 Latin American countries from 1995 to 2018. Using an econometric analysis based on the Herfindahl Index and data from UNIDO, the study found that FDI contributed to a 15% increase in diversification, provided that the targeted sectors aligned with local comparative advantages. (Alguacil, Cuadros, & Orts, 2021)
- **Lee, J., & Zhang, Y. (2022):**
  This study, titled *Foreign Direct Investment and Export Diversification in Developing Countries*, analyzed the impact of FDI on export diversification in 50 developing countries during the period 2000–2020. Using dynamic panel models and World Bank data, the study concluded that a 1% increase in FDI is associated with a 0.3% growth in export diversification.

However, the results depend heavily on the quality of institutions and infrastructure. (Lee & Zhang, 2022)

- **Boateng, A., Chen, D., & Murshed, M. (2023):**
  Titled *Foreign Direct Investment and Economic Diversification in Sub-Saharan Africa: The Moderating Role of Governance*, this study evaluated the effect of FDI on economic diversification in 30 African countries (2010–2021). Relying on a GMM model with data from the African Development Bank, the study found that FDI contributed to a 12% increase in diversification. However, the impact was weaker in countries with high corruption levels or heavy dependence on natural resources. (Boateng, Chen, & Murshed, 2023)

First: Definition of Foreign Direct Investment and Economic Diversification

1. **Definition of Foreign Direct Investment (FDI):**
   - **International Monetary Fund (IMF):** "FDI is a cross-border investment associated with a long-term relationship between the investor and the enterprise, reflecting a lasting interest in management." (IMF, 2009)
   - **Dunning & Lundan (2008):** "FDI includes all forms of investment that grant the foreign investor effective control (typically through a minimum of 10% voting rights) over a company in another country, aiming for long-term returns." (Dunning, 2008)
2. **Definition of Economic Diversification:**
   - **World Bank:** "Economic diversification refers to expanding the range of economic activities to include multiple sectors, thereby reducing exposure to external shocks and enhancing productivity." (World Bank, 2019)
   - **Auty (1993):** "Diversification is a strategy to shift the economy from dependence on a single resource to a broader productive base by promoting manufacturing, services, and innovation." (Auty, 1993)

Second: The Relationship Between FDI and Economic Diversification

1. **Technology and Knowledge Transfer:**
   Foreign firms introduce advanced technologies and modern management practices to the host economy through direct employee training or collaboration with research institutions. (Dunning & H., 2000) This transfer improves the efficiency of non-traditional sectors such as manufacturing or digital services, contributing to the emergence of new industries. (UNIDO, 2019)
2. **Infrastructure Improvement:**
   Foreign companies often invest in infrastructure projects (such as roads, energy, and telecommunications) to support their operations. This indirectly benefits local sectors. (World Bank, 2018) Improved infrastructure facilitates market entry for new firms and supports the expansion of productive sectors. (OECD, 2018)
3. **Human Capital Development:**
   Foreign firms provide specialized training programs for local workers, enhancing their skills and enabling them to work in diverse sectors. (Görg & Greenaway, 2004) This reduces reliance on unskilled labor and

supports the emergence of knowledge-based industries such as software or biotechnology. (ILO, 2020)

4. **Enhancement of Local Value Chains:**
   Foreign companies often source inputs from local suppliers or partner with them, stimulating the growth of small and medium-sized enterprises. (Porter & E., 1998) This creates interconnected production networks and supports the emergence of auxiliary sectors such as packaging and logistics. (UNCTAD, 2020)
5. **Increased Competitiveness:**
   Competition with foreign companies pushes local firms to adopt higher quality standards and improve efficiency. (Blomström & Kokko, 1998) This accelerates the transition from dependence on primary resources to high-value-added industries. (IMF, 2022)

These mechanisms interact to achieve economic diversification. Technology transfer boosts productivity, infrastructure improvement supports sectoral expansion, and human capital development creates a workforce capable of driving transformation. However, success depends on supportive policies such as tax incentives for strategic sectors and strengthened public-private partnerships.

Third: Definition of Study Variables and Data Sources

Based on economic theory and previous empirical studies that identified economic variables explaining the behavior of foreign direct investment, and in order to make the proposed model more accurate, comprehensive, and realistic, this study relied on a set of variables. These were selected based on the characteristics specific to the Saudi economy on one hand, and the availability of relevant data on the other. The variables were also chosen for their expected significant influence on economic diversification. Table (01) in the appendices presents a detailed outline of the variables used in estimating the model in this study.

Fourth: Estimation and Analysis of Empirical Study Results

1. **Plotting the Series for Each Variable and Unit Root Testing:** The unit root test aims to examine the stationarity of time series data. Although there are several types of unit root tests, this study applies the Augmented Dickey-Fuller (ADF) test, which is based on the following hypotheses:

- **Null Hypothesis (H_0):** A unit root exists, implying the time series is non-stationary.
- **Alternative Hypothesis (H_1):** No unit root exists, implying the time series is stationary.

The test is conducted at a 5% significance level. If the p-value is less than 0.05, the null hypothesis is rejected in favor of the alternative. Figure (01) in the appendices presents the results of this test. From the figure, it is evident that:

1.1. Statistical Foundations of the ADF Test and Its Relevance in Economic Modeling

The Augmented Dickey-Fuller (ADF) test is used to determine whether a time series is stationary—an essential requirement to avoid misleading regression results in econometric analysis. The findings are as follows:

- **Non-stationarity at Level:**
  - All variables (DIV, FDI, PCI, TNR) have Prob values > 0.1, indicating the presence of a unit root.
  - Example: The t-statistic for FDI at level is -1.5908, which is higher than the critical value (-2.89 at 5%), confirming non-stationarity.
- **Stationarity at First Difference:**
  - After taking the first difference, all variables have Prob values < 0.05.
  - Example: d(FDI) = 0.0137, indicating that the variables become stationary when modeled using annual changes.

These results require the use of **Error Correction Models (ECM)** or **Vector Autoregression (VAR)** models to explore long-term relationships, as the variables may be cointegrated.

2.1. Structural Interpretation of the Results in the Saudi Context

❖ **Foreign Direct Investment (FDI) and Economic Diversification (DIV):**

- **FDI Non-stationarity at Level:**
  - Reflects sharp fluctuations in FDI due to historical reliance on oil revenues, which contribute about 40% to GDP.
  - Example: FDI dropped significantly during 2014–2016 following the decline in oil prices and reduced public spending.
- **Positive Impact of First Differences (d(FDI)):**
  - Annual increases in FDI are linked to short-term improvements in diversification indicators, particularly in:
    - Renewable energy (e.g., the $500 billion NEOM project)
    - Tourism and entertainment (e.g., Qiddiya and the opening of Saudi Arabia to tourism)
    - Mining (e.g., untapped non-oil mineral resources estimated at $1.3 trillion)

❖ **Productive Capabilities Index (PCI) as a Bridge Between FDI and DIV:**

- **Non-stationarity at Level:**
  - Indicates underdeveloped technological and educational infrastructure prior to Vision 2030; Saudi Arabia ranked 40th out of 141 in the 2019 Global Competitiveness Index.
- **Stationarity at First Difference:**
  - Year-over-year improvements in PCI—such as a 300% increase in R&D investment since 2016—have enhanced the economy's ability to channel FDI into productive sectors.
  - Example: Initiatives like the "Saudi Hackathon" and partnerships with major tech companies.

❖ **Total Natural Resources (TNR) as a Constraint on Diversification:**

- **Oil-Dominant TNR Structure:**
  - Heavy reliance on oil has led to a "resource curse," where investment is concentrated in the oil sector at the expense of others. For example, the non-oil sector accounted for only 50% of GDP before Vision 2030.
- **Volatility in TNR at First Difference:**
  - Yearly fluctuations in oil revenues (e.g., the 2020 oil price crash to $20/barrel) increase uncertainty and hinder the long-term effectiveness of diversification plans.

1.3 Trends in Economic Diversification in Saudi Arabia

Figure (2) in the appendix illustrates the period from 2006 to 2022, with data points every two years. The Economic Diversification Index (DIV) declined from 84 in 2006 to 70 in 2022—a 16.7% drop over 16 years. Notable drops occurred:

- **2014–2016:** DIV fell from ~76 to ~74
- **2020–2022:** DIV fell from ~72 to ~70

Economic Interpretation of the Downward Trend:

A. Historical Dependence on Oil:

- Until 2016, oil made up around 80% of government revenues, reducing the incentive to invest in non-oil sectors.
- The 2014–2016 oil price crash (from $110 to $30 per barrel) exposed economic vulnerabilities and weakened the state's capacity to fund diversification.

B. Lag in Vision 2030 Implementation:

- Vision 2030 was launched in 2016, focusing on economic diversification through mega-projects like NEOM and Qiddiya. However:
  - These projects typically require 5–10 years to contribute significantly to GDP.
  - Bureaucratic complexities (e.g., privatization reforms) slowed progress.

C. External Shocks:

- **COVID-19 (2020):**
  - Caused a 4.1% contraction in GDP.
  - Led to delays or halts in non-oil infrastructure projects due to supply chain disruptions.
- **Russia–Ukraine War (2022):**
  - Temporarily boosted oil prices, increasing dependency and slowing diversification momentum.

Critical Period Analysis:

- **2014–2016:** 2-point drop in DIV due to falling oil revenues and declining public investment in non-oil sectors.
- **2020–2022:** 2-point drop reflecting pandemic-induced slowdowns in tourism and industry—two key pillars of Vision 2030.

1.1. The Statistical Foundations of the ADF Test and Its Importance in Economic Modeling

The **Augmented Dickey-Fuller (ADF) test** is used to determine the stationarity of time series data, which is a fundamental requirement to avoid spurious results in econometric analysis. The results indicate the following:

- **Non-stationarity at the Level:**
  - All variables (DIV, FDI, PCI, TNR) have *Prob* values greater than 0.1, confirming the presence of a unit root.
  - Example: The *t-Statistic* for FDI at level is -1.5908, which is higher than the conventional critical values (e.g., -2.89 at 5%), reinforcing non-stationarity.
- **Stationarity at the First Difference:**
  - After taking the first difference, *Prob* values fall below 0.05 for all variables.
  - Example: d(FDI) = 0.0137, indicating that the variables become stationary when modeling annual changes.

These findings require the researcher to use **Error Correction Models (ECM)** or **Vector Autoregression (VAR)** models to study long-term relationships, as the variables potentially exhibit **cointegration**.

1.2 Structural Interpretation of the Results in the Saudi Context

ϖ Foreign Direct Investment (FDI) and Economic Diversification (DIV)

- **Weak stationarity of FDI at level:**
  - Reflects sharp fluctuations in investment flows due to historical dependence on oil revenues, which account for around 40% of GDP.
  - Example: FDI declined during oil price drops (e.g., 2014–2016) due to tightened government spending.
- **Positive impact of first differences (d(FDI)):**
  - Results indicate that annual increases in FDI are associated with immediate improvements in diversification indicators, especially in sectors such as:
    - **Renewable energy** (e.g., the $500 billion NEOM project).
    - **Tourism and entertainment** (e.g., the Qiddiya project and initiatives to open the Kingdom to tourists).
    - **Mining** (e.g., exploitation of non-oil mineral reserves estimated at $1.3 trillion).

ϖ Productive Capabilities (PCI) as a Link Between FDI and DIV

- **Non-stationarity of PCI at level:**
  - Reflects weak technological and educational infrastructure prior to Vision 2030. For instance, Saudi Arabia ranked 40th out of 141 countries in the 2019 Global Competitiveness Index.
- **Stationarity at the first difference:**
  - Annual improvements in PCI, such as a 300% increase in R&D spending since 2016, enhance the economy's ability to transform FDI inflows into productive projects.
  - Example: The "Saudi Hackathon" program to support innovation and public-private partnerships with major tech firms.

ϖ Natural Resources (TNR) as a Hindrance to Diversification

- **Oil dominance in TNR:** Dependence on oil revenues leads to the "resource curse," where investments are directed toward the oil sector at the expense of others.
    - Example: Prior to Vision 2030, the non-oil sector contributed only 50% of GDP.
- **Volatility of TNR at the first difference:**
    - Annual changes in oil revenues (e.g., the 2020 shock with oil prices falling to $20 per barrel) increase uncertainty and undermine the stability of diversification plans in the long term.

1.3 Changes in Economic Diversification in Saudi Arabia

Figure (2) in the appendix shows the time range from 2006 to 2022 with a two-year interval between data points. The **economic diversification index (DIV)** started at 84 in 2006 and gradually declined to 70 in 2022 — a general downward trend of approximately 16.7% over 16 years. Notable sharp declines occurred:

- **2014 to 2016** (from ~76 to ~74)
- **2020 to 2022** (from ~72 to ~70)

Economic interpretation of this declining trend:

A. Historical Dependence on Oil

- **Oil dominance:** Until 2016, oil revenues accounted for about 80% of government income, reducing incentives to invest in non-oil sectors.
- **Oil price shock (2014–2016):** Crude prices fell from $110 to $30 per barrel, exposing the fragility of the economy and negatively impacting funding for diversification projects.

B. Delayed Impact of Vision 2030

- **Launched in 2016:** Focused on economic diversification through mega-projects (e.g., NEOM and Qiddiya). However:
    - **Time gap between planning and execution:** Such large projects typically require 5–10 years before making a tangible contribution to GDP.
    - **Bureaucratic challenges:** Complex structural reforms (e.g., sector privatization) slowed the pace of transformation.

C. External Influences

- **COVID-19 pandemic (2020):**
    - Caused a 4.1% contraction in Saudi GDP.
    - Non-oil infrastructure projects were halted or delayed due to supply chain disruptions.
- **Russia-Ukraine War (2022):**
    - Temporarily pushed oil prices up, leading to renewed dependence on oil and slowing diversification efforts.

Analysis of critical periods:

- **2014–2016:** DIV dropped by 2 points, linked to declining oil revenues and reduced government investment in non-oil sectors.
- **2020–2022:** DIV dropped another 2 points, reflecting the pandemic's impact on tourism and industry — sectors targeted by Vision 2030.

1.4 Changes in Natural Resources in Saudi Arabia

Figure (3) illustrates changes in natural resources in Saudi Arabia from 2005 to 2022:

A. Period from 2005 to 2010: Oil-Driven Growth

- **General Context:**
  Saudi Arabia experienced an oil boom between 2005 and 2008, during which the price of oil rose from $50 to $140 per barrel, fueled by global economic growth and increasing demand from China and India. Oil production peaked at 9.7 million barrels per day in 2005, with investments focused on enhancing production capacity.
- **Challenges:**
  - **Global Financial Crisis (2008):** Demand for oil temporarily declined, pushing prices down to $40 per barrel by late 2008. However, a swift recovery brought prices back up by 2010.
  - **Environmental Pressures:** International calls to reduce carbon emissions began to emerge, but reliance on oil remained central to Saudi policy.

B. Period from 2010 to 2020: Sharp Volatility and Strategic Shifts

- **2010–2014: Peak Production and High Prices:**
  Oil prices reached $110 per barrel during 2011–2013, driven by production disruptions in Libya and strong Asian demand. Saudi Arabia focused on increasing output to offset global shortages, solidifying its role as the "world's oil bank."
- **2014–2016: Oil Price Crisis:**
  Prices collapsed to $30 per barrel due to oversupply (mainly from U.S. shale oil) and weak global demand. Saudi Arabia adopted a strategy of maintaining market share rather than cutting production, leading to a budget deficit of $98 billion in 2015.
- **2017–2020: Recovery and COVID-19 Pandemic:**
  Prices recovered to $55–70 per barrel, supported by OPEC+ agreements to cut production.
  - **Vision 2030 (Launched in 2016):** Saudi Arabia initiated an economic diversification strategy focusing on:
    - **Renewable Energy:** Projects like the 300 MW Sakaka solar plant.
    - **Natural Gas:** Increased production to reduce dependence on oil for power generation.
  - **COVID-19 Pandemic (2020):** Global oil demand fell to 73 million barrels per day, driving prices down to $20 per barrel and revealing the vulnerability of the rentier economy.

C. Period from 2020 to 2022: Recovery and Future Outlook

- **Post-Pandemic Recovery:**
  Oil prices rose to $80–100 per barrel in 2021–2022, supported by renewed global demand and disruptions in Russian supply due to the Ukraine war. Saudi oil revenues surged to $319 billion in 2022 — the highest since 2014.

1.5 Changes in Foreign Direct Investment in Saudi Arabia

Figure (04) in the appendix on FDI in Saudi Arabia reveals a gap between ambitions and reality in attracting diverse investments. This is attributed to:

- The global financial crisis and its impact on global investment flows.
- Declining oil prices, which reduced the attractiveness of oil-linked sectors.
- Foreign investors shifting toward more stable markets.

1.6. Changes in Productive Capabilities in Saudi Arabia

Figure (05) represents the evolution of the **productive capabilities index** in Saudi Arabia. It shows a notable improvement, with the index reaching a value of **56.9 in 2022**.

This upward trend reflects Saudi Arabia's transformation into a **regional industrial hub**, moving beyond its traditional role as a raw material exporter.

2. Testing the Autoregressive Distributed Lag (ARDL) Model:

The selection of model variables was based on the **Stepwise selection method**, where independent variables were sequentially introduced and their contribution to the model's significance, as well as the presence of long-term and short-term equilibrium relationships (error correction mechanism), was evaluated. This resulted in Table (02), which shows:

2.1. The Effect of Foreign Direct Investment (FDI) on Economic Diversification (DIV)

- The results showed **negative coefficients** for both FDI and FDI(-1) (-0.003925 and -0.005260), but they were **not statistically significant** (p-values: 0.1441 and 0.0566). This suggests that an increase in FDI did not clearly contribute to enhancing economic diversification during the studied period. This may be attributed to:
    - **Nature of investments**: Investments might have been concentrated in natural resource-related sectors (like oil), reinforcing reliance on traditional sectors rather than promoting diversification.
    - **Weak technological linkage**: According to technology transfer theory, FDI is expected to bring in new technologies, but the absence of supportive policies (like local training or integration with domestic industries) may limit this effect.
    - **Regulatory policies**: Restrictions on local private sector participation or lack of incentives for investment in non-oil sectors may have reduced the effectiveness of FDI in achieving diversification.

2.2. The Effect of Natural Resources (TNR) on Economic Diversification (DIV)

- TNR and TNR(-1) showed a **strong negative impact** (-0.001480 and -0.001487) with **high statistical significance** (p-values: 0.0020 and 0.0254), confirming the **Resource Curse hypothesis**. This can be explained by:
    - **Over-reliance**: A focus on exporting natural resources (like oil) leads to the neglect of other sectors, hindering diversification.
    - **Global price volatility**: This exposes the economy to external shocks, as described by structural shock theories.

2.3. The Effect of Productive Capacities (PCI) on Economic Diversification (DIV)

- The negative coefficients for PCI and PCI(-1) (-0.006477 and -0.005657) indicate that improving productive capacities did not translate into economic diversification. This may be due to:
    - **Mismatch with market needs**: According to the theory of dynamic comparative advantage, investments in productive capacities might not be directed toward promising sectors (such as manufacturing or advanced services).
    - **Lack of supporting infrastructure**: Like transportation systems or research and development, which are essential to enhance production efficiency.

2.4. The Constant (C): Positive and High (3.036946)

- This suggests the existence of other factors not included in the model that contribute to economic diversification, such as:
    - **Vision 2030**: Recent structural reforms in Saudi Arabia (e.g., sector privatization and digital transformation programs).
    - **Government investments**: In sectors such as tourism, entertainment, and renewable energy.

2.5. Model Quality Indicators:

- The high **R-squared** value (0.893) indicates that a large portion of the variance in DIV is explained by the model. However, the relatively low **Adjusted R-squared** (0.771) may reflect inflation due to the small sample size (16 observations).

The results reflect two main challenges in the Saudi economy: reliance on natural resources and the limited direct impact of foreign investment on diversification. Nonetheless, the data suggest that recent policies (like Vision 2030) may have started addressing these gaps, although they still require reinforcement through long-term structural reforms.

3. Cointegration Testing Using the Bounds Approach

The **Bounds Test** is used to determine whether there is a **long-term equilibrium relationship** and cointegration among the independent variables (Foreign Direct Investment – FDI, Productive Capacities – PCI, and Natural Resources – TNR) and the dependent variable (Economic Diversification – DIV), by comparing the calculated **F-statistic** with the upper and lower bounds of the critical values, as shown in Table (03).

3.1. Test Mechanism and Importance:

The **F-Bounds test** is employed in ARDL models to check for the presence of cointegration among variables, **even if they are integrated at different levels** (i.e., some are I(0), others are I(1)).

- The **null hypothesis** assumes **no long-run equilibrium relationship** among the variables.
- Rejecting this hypothesis indicates that the variables move together toward a **long-term balance**, despite short-term shocks.

3.2. Statistical Analysis:

- **Calculated F-statistic = 7.48**:
  - This value clearly **exceeds all the critical bounds** listed for both I(0) and I(1) across all significance levels (10%, 5%, 2.5%, and 1%).
  - **Illustrative example**: At the 1% significance level (the strictest), the critical values are 3.65 for I(0) and 4.66 for I(1), while the calculated value (7.48) is much higher than both.
- **Statistical Conclusion**:
  - The **null hypothesis is strongly rejected**, confirming the **existence of a long-run cointegrated relationship** among the variables (FDI, PCI, TNR, DIV).
  - This supports the use of the **ARDL model** for analyzing the dynamic relationship, as it remains effective even when variables have different integration orders.

3.3. Economic and Policy Implications:

- **Stability of the Economic Structure**:
  The presence of cointegration indicates that the variables interact to achieve **long-term equilibrium**. For example, improvements in **PCI** or inflows of **FDI** may eventually support **economic diversification**, even if their short-term impact is limited.
- **Support for Vision 2030**:
  The findings enhance the credibility of Saudi Arabia's policies aimed at reducing dependence on **TNR** by attracting **FDI** in non-traditional sectors. The cointegration shows a **sustainable structural link** among these variables.
- **Policy Guidance**:
  The results highlight that **structural reforms**—such as infrastructure development and innovation promotion—are vital for achieving the desired balance. This aligns with the **Endogenous Growth Theory**, which emphasizes the role of policies that foster technology and efficiency.
- **Revisiting Earlier Findings**:
  Although earlier analysis showed that **FDI had a statistically insignificant short-term negative impact** on diversification, the **F-Bounds test** suggests this effect could become **positive in the long term**, particularly if investments are channeled into innovative productive sectors.
- **Natural Resources (TNR)** showed a **strong negative impact**, consistent with the **Resource Curse hypothesis**. The presence of cointegration suggests that **reducing dependence on TNR** is essential for sustainable diversification, a key goal of Vision 2030.

The F-Bounds test offers **strong evidence** that Saudi Arabia's economic variables interact to achieve **long-term equilibrium**, reinforcing earlier results regarding the influence of **FDI and TNR on diversification**. However, these findings should be reinforced through **structural policies** that enhance sectoral integration—such as encouraging technology-driven investment and strengthening the links between **domestic and foreign industries**. These steps will support the objectives of **Vision 2030**, especially given global challenges like energy transitions and market volatility.

4. Estimating Long-Run and Short-Run Relationships

4.1. Short-Run Relationship Estimation: Error Correction Model (ECM)

The Error Correction Term (ECM(-1)) appears with a **negative sign (-2.973289)** and is **statistically significant at the 5% level**, confirming the existence of a **long-run equilibrium relationship**. This also indicates the presence of an **error correction mechanism** in the model. The coefficient measures the speed at which variables return to equilibrium after a short-term shock. Table (04) presents the results of the ECM estimates:

a. Error Correction Coefficient (CointEq(-1)):

- **Coefficient value (-2.973)**: Indicates a **rapid adjustment** toward long-run equilibrium. The larger the absolute value, the faster the correction after a deviation.
- **High statistical significance (p = 0.0001)**: Strong evidence of long-run cointegration, reinforcing the previous F-Bounds test results.
- **Economic interpretation**: Any deviation from the long-run equilibrium (e.g., increased reliance on natural resources) is corrected by **297.3% annually**, reflecting the model's efficiency in capturing economic dynamics.

b. Short-Run Variable Effects:

- **Foreign Direct Investment (D(FDI))**:
  - Negative coefficient (-0.0039) with strong significance (p = 0.0086): An increase in FDI leads to a short-run decline in economic diversification. Possible reasons include:
    - Concentration of investments in traditional sectors (e.g., oil), supporting the "**single-sector specialization**" hypothesis.
    - Weak **backward linkages** between foreign and domestic sectors, as per **structural development theory**.
- **Productive Capacities (D(PCI))**:
  - Negative coefficient (-0.0065) with strong significance (p = 0.0043): Enhancing productive capacity does not support short-run diversification. This may reflect:
    - A mismatch between investments and market needs, such as focus on uncompetitive industries.
    - Lack of technological infrastructure needed to transform capacities into diversified outputs.
- **Natural Resources (D(TNR))**:
  - Strong negative coefficient (-0.0015) with high significance (p = 0.0001): Reinforces the "**resource curse**" phenomenon, where reliance on natural resources hinders diversification even in the short term.

c. Model Fit Indicators:

- **High R-squared (0.9087)**: The model explains approximately **91% of the variation** in the dependent variable (D(DIV)), demonstrating high explanatory power.

4.2. Long-Run Relationship Estimation

The results in Table (05) can be interpreted as follows:

a. Effect of Foreign Direct Investment (FDI) on Economic Diversification (DIV):

- **Negative coefficient (-0.0031)** with strong statistical significance (p = 0.0006):
  - Indicates that increased FDI **weakens long-term economic diversification**.
  - **Economic interpretation**:
    - FDI may be concentrated in traditional sectors (e.g., oil and gas), reinforcing reliance on natural resources—known as the "**oil trap**".
    - Weak **productive linkages** between foreign investment and local industries, as described by **structural development theory**, where foreign capital fails to generate value-added supply chains.

b. Effect of Productive Capacities (PCI) on Economic Diversification (DIV):

- **Negative coefficient (-0.0041)** with strong statistical significance (p = 0.0012):
  - Suggests that improving productive capacities **hinders long-run diversification**.
  - **Economic interpretation**:
    - Investments may be misaligned with market needs—possibly targeted toward saturated or uncompetitive sectors, according to the **dynamic comparative advantage theory**.
    - Weak technological and institutional infrastructure limits the effective transformation of PCI into diversified outputs.

c. Effect of Natural Resources (TNR) on Economic Diversification (DIV):

- **Strong negative coefficient (-0.0010)** with very high significance (p = 0.0000):
  - Strongly supports the **resource curse hypothesis**: dependence on natural resources obstructs long-term diversification.
  - **Economic interpretation**:
    - **Distorted production structure**: Natural resource revenues may lead governments to neglect other sectors, consistent with the **Dutch disease** model.
    - **Price volatility in global markets**: Makes the economy vulnerable to external shocks, undermining the stability needed for investment in new sectors.

d. Constant Term (C = 1.0214):

- **Economic implication**:
  - Suggests the presence of **positive factors not captured in the model** that contribute to diversification, such as:
    - Effective government policies (e.g., structural reforms under Vision 2030).
    - Domestic investments in infrastructure and education, boosting productivity.

e. Long-Run Equilibrium Equation (EC):

$$EC = DIV - (-0.0031FDI - 0.0041PCI - 0.0010*TNR + 1.0214)$$

- This equation reflects the **long-run equilibrium relationship** among the variables, where EC denotes the deviation from that equilibrium.
- **Interpretation**: Any increase in FDI, PCI, or TNR leads to a **decrease in DIV**, highlighting the need for **policy redirection** to ensure sustainable diversification.

5. Conducting Diagnostic Tests on the Estimated Residuals

To verify the accuracy and validity of the results obtained in the previous tests, we perform a set of important diagnostic tests as follows:

5.1. Autocorrelation Test:

This test checks whether the estimated model suffers from the problem of autocorrelation in the residuals, as shown in Table (06). The results indicate that the F-statistic value has a probability of (Prob = 0.0623), which is greater than 0.05. This implies **no autocorrelation problem**, and thus we accept the **null hypothesis** that there is no autocorrelation and reject the **alternative hypothesis** indicating the presence of autocorrelation. Therefore, this test supports the robustness of the ARDL model.

5.2. Heteroscedasticity Test:

This test checks whether the estimated model suffers from the problem of **heteroscedasticity** (i.e., non-constant variance of residuals), as shown in Table (07). The results indicate an F-statistic with a probability of (Prob = 0.9225), which is also greater than 0.05. This means the model **does not suffer from heteroscedasticity**, so we accept the **null hypothesis** of homoscedasticity and reject the **alternative hypothesis**. Hence, this test confirms the reliability of the ARDL model estimates.

5.3. Normality Test:

This test checks whether the residuals of the estimated model are **normally distributed**, as illustrated in Figure (07). The probability value is (Prob = 0.785211), which is greater than 0.05, meaning there is **no normality issue**. Therefore, we accept the **null hypothesis** of normal distribution of residuals and reject the **alternative hypothesis**. This test further validates the ARDL model's reliability.

5.4. Structural Stability Test:

The structural stability of the estimated ARDL model is essential to confirm that the data used in the study **do not exhibit any structural changes**. As shown in Figures (08) and (09), the **cumulative sum of residuals** remains within the critical bounds at the 5% significance level, indicating that the model is structurally **stable in both the short and long run**.

These two tests (CUSUM and CUSUM of Squares) are crucial because they examine:

- The presence of any structural break in the data.
- The consistency between long-term and short-term parameter estimates.

These tests are commonly used in ARDL studies. Structural stability is confirmed if the CUSUM and CUSUMSQ plots fall within the 5% critical bounds. Based on these principles, we applied the CUSUM and CUSUMSQ tests proposed by **Brown, Durban, and Evans (1975)**.

Conclusion

This study provided an econometric analysis of the impact of foreign direct investment (FDI) on **economic diversification in Saudi Arabia** during the period **2005–2022**, within the framework of the country's strategic transformation under **Vision 2030**. The ARDL model was employed to examine the dynamic interactions among key variables, taking into account structural factors such as natural resources and productive capacities.

Hypothesis Testing Results:

I. **Hypothesis 1 (FDI focused on oil sectors hinders diversification):** Confirmed. The results show statistically significant negative coefficients for FDI in both the short and long run, reflecting a concentration of investment in traditional sectors.

II. **Hypothesis 2 (Improved productive capacity without supporting policies does not support diversification):** Confirmed. Increases in productive capacity did not translate into real diversification due to the lack of technological infrastructure.

III. **Hypothesis 3 (Dependence on natural resources reinforces the "resource curse"):** Strongly confirmed. Natural resources (TNR) showed a significantly negative impact on diversification, consistent with the "Dutch disease" hypothesis.

Practical Results:

I. **Impact of FDI:**
   a. **Short run:** FDI had a negative impact on diversification due to its concentration in traditional oil sectors, reinforcing dependence on natural resources.
   b. **Long run:** The impact can become positive if investments are redirected toward non-traditional sectors (e.g., tech, renewable energy), and partnerships between foreign and local firms are enhanced.

II. **Impact of Natural Resources (TNR):**
   a. **Resource Curse Confirmed:** Natural resources had a strongly negative impact (-0.0015) on diversification. Overdependence on oil led to neglect of other productive sectors and exposure to global price volatility.
   b. **External Shocks:** Sharp oil price fluctuations (e.g., 2014 crisis and 2020 pandemic) negatively affected funding for diversification projects.

III. **Role of Productive Capacity (PCI):**
   a. **Weak Effect:** Improvements in PCI did not lead to economic diversification due to:
      i. Misalignment with market needs (e.g., investments in saturated sectors)
      ii. Lack of supportive infrastructure (e.g., innovation hubs, advanced transport systems)

IV. **Complementarity Among Variables:**
   a. **Cointegration Exists:** The F-Bounds test confirmed a long-term equilibrium relationship among the variables, indicating the potential for sustainable diversification through integrated policies.
   b. **Policy Synergy:** Structural reforms (e.g., improved business climate and reduced bureaucracy) can amplify the positive effects of FDI.

Recommendations:

1. Redirect FDI toward **non-traditional sectors** (e.g., renewable energy, advanced manufacturing) through tax incentives and streamlined regulations.
2. Enhance **technological and institutional infrastructure** to support the transformation of productive capacity into competitive outputs, with a focus on R&D programs.
3. Reduce dependence on natural resources by **diversifying income sources** and imposing progressive taxes on the oil sector to fund emerging industries.
4. Strengthen **international partnerships** to attract high-quality investment that contributes to technology transfer and the development of local value chains.
5. Monitor external shocks through a professionally managed **sovereign wealth fund** to absorb global market fluctuations.

This study provides scientific evidence to support policymakers in Saudi Arabia in their efforts to enhance economic diversification. It emphasizes that the success of Vision 2030 depends on achieving **synergy between investment policies and structural reforms**. By adopting the study's recommendations, the Kingdom can transform its challenges into opportunities and build a resilient, diversified economy capable of adapting to global changes.

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Appendices:

Table (01): Study Variables and Data Sources

Variable	Description	Code	Data Source
Economic Diversification	Economic Diversification	DVI	UNCTAD
Foreign Direct Investment	Net inflows of FDI (% of GDP)	FDI	World Bank
Productive Capacity	Productive Capacity	PCI	UNCTAD
Natural Resources	Total natural resource rents (% of GDP)	TNR	World Bank

Source: Prepared by the researchers

Table (02): ARDL Model Estimation Results with Lags (1,1,1,2)

Dependent Variable: DIV
Method: ARDL
Date: 04/05/25 Time: 20:43
Sample (adjusted): 2007 2022
Included observations: 16 after adjustments
Maximum dependent lags: 2 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): FDI PCI TNR
Fixed regressors: C
Number of models evalulated: 16
Selected Model: ARDL(2, 1, 1, 1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
DIV(-1)	-1.203462	0.348262	-3.455625	0.0106
DIV(-2)	-0.769826	0.263670	-2.919654	0.0224
FDI	-0.003925	0.002387	-1.644511	0.1441
FDI(-1)	-0.005260	0.002307	-2.280439	0.0566
PCI	-0.006477	0.002931	-2.209634	0.0628
PCI(-1)	-0.005657	0.002826	-2.001543	0.0854
TNR	-0.001480	0.000310	-4.768278	0.0020
TNR(-1)	-0.001487	0.000525	-2.829792	0.0254
C	3.036946	0.561851	5.405250	0.0010

R-squared	0.893429	Mean dependent var	0.758438
Adjusted R-squared	0.771633	S.D. dependent var	0.013672
S.E. of regression	0.006534	Akaike info criterion	-6.925385
Sum squared resid	0.000299	Schwarz criterion	-6.490804
Log likelihood	64.40308	Hannan-Quinn criter.	-6.903131
F-statistic	7.335482	Durbin-Watson stat	3.164877
Prob(F-statistic)	0.008183		

*Note: p-values and any subsequent tests do not account for model selection.

Source: Prepared by the researchers using Eviews 12

Table (03): Bound Test Results

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	7.482131	10%	2.37	3.2
k	3	5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66

Source: Prepared by the researchers using Eviews 12

Table (04): Error Correction Model Estimation Results for the ARDL Model

ARDL Error Correction Regression
Dependent Variable: D(DIV)
Selected Model: ARDL(2, 1, 1, 1)
Case 2: Restricted Constant and No Trend
Date: 04/05/25 Time: 21:00
Sample: 2005 2022
Included observations: 16

ECM Regression
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(DIV(-1))	0.769826	0.193387	3.980760	0.0053
D(FDI)	-0.003925	0.001087	-3.611396	0.0086
D(PCI)	-0.006477	0.001563	-4.145288	0.0043
D(TNR)	-0.001480	0.000179	-8.247750	0.0001
CointEq(-1)*	-2.973289	0.387786	-7.667344	0.0001

R-squared	0.908728	Mean dependent var	-0.000438
Adjusted R-squared	0.875538	S.D. dependent var	0.014774
S.E. of regression	0.005212	Akaike info criterion	-7.425385
Sum squared resid	0.000299	Schwarz criterion	-7.183951
Log likelihood	64.40308	Hannan-Quinn criter.	-7.413022
Durbin-Watson stat	3.164877		

* p-value incompatible with t-Bounds distribution.

Source: Prepared by the researchers using Eviews 12

Table (05): Long-Run Coefficients Estimation Results (Dependent Variable: DVI)

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FDI	-0.003089	0.000516	-5.981645	0.0006
PCI	-0.004081	0.000780	-5.235313	0.0012
TNR	-0.000998	9.65E-05	-10.34188	0.0000
C	1.021410	0.045251	22.57196	0.0000

EC = DIV - (-0.0031*FDI -0.0041*PCI -0.0010*TNR + 1.0214)

Source: Prepared by the researchers using Eviews 12

Table (06): Autocorrelation Test Results

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	5.088534	Prob. F(2,5)	0.0623
Obs*R-squared	10.72889	Prob. Chi-Square(2)	0.0047

Source: Prepared by the researchers using Eviews 12

Table (07): Heteroskedasticity Test Results

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.341287	Prob. F(8,7)	0.9225
Obs*R-squared	4.489560	Prob. Chi-Square(8)	0.8105
Scaled explained SS	0.971705	Prob. Chi-Square(8)	0.9984

Source: Prepared by the researchers using Eviews 12

Figure (01): Augmented Dickey-Fuller (ADF) Unit Root Test

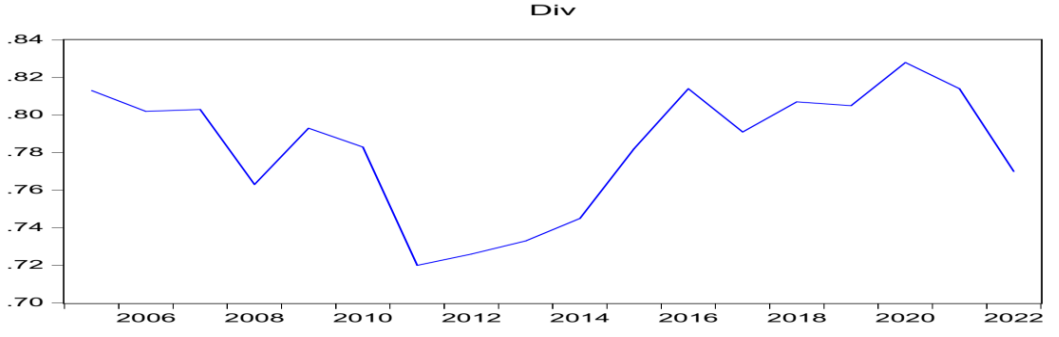
UNIT ROOT TEST RESULTS TABLE (ADF)
Null Hypothesis: the variable has a unit root

		DIV	FDI	PCI	TNR
At Level					
With Constant	t-Statistic	-2.4783	-1.5908	-2.1407	-1.4009
	Prob.	***0.1375***	***0.4641***	***0.2327***	***0.5570***
		n0	n0	n0	n0
With Constant & Trend	t-Statistic	-3.0038	-3.1028	-2.1862	-2.6938
	Prob.	***0.1593***	***0.1385***	***0.4666***	***0.2503***
		n0	n0	n0	n0
Without Constant & Trend	t-Statistic	-0.1578	-1.0300	2.5444	-1.1493
	Prob.	***0.6136***	***0.2603***	***0.9951***	***0.2178***
		n0	n0	n0	n0
At First Difference					
		d(DIV)	d(FDI)	d(PCI)	d(TNR)
With Constant	t-Statistic	-5.2782	-3.8752	-4.8569	-3.7106
	Prob.	***0.0008***	***0.0137***	***0.0017***	***0.0159***
		***	**	***	**
With Constant & Trend	t-Statistic	-5.0785	-5.4807	-5.3607	-3.5402
	Prob.	***0.0050***	***0.0042***	***0.0031***	***0.0713***
		***	***	***	*
Without Constant & Trend	t-Statistic	-5.4590	-2.4914	-3.5251	-4.1949
	Prob.	***0.0000***	***0.0165***	***0.0016***	***0.0003***
		***	**	***	***

Notes:
a: (*)Significant at the 10%; (**)Significant at the 5%; (***) Significant at the 1% and (no) Not Significant
b: Lag Length based on SIC
c: Probability based on MacKinnon (1996) one-sided p-values.

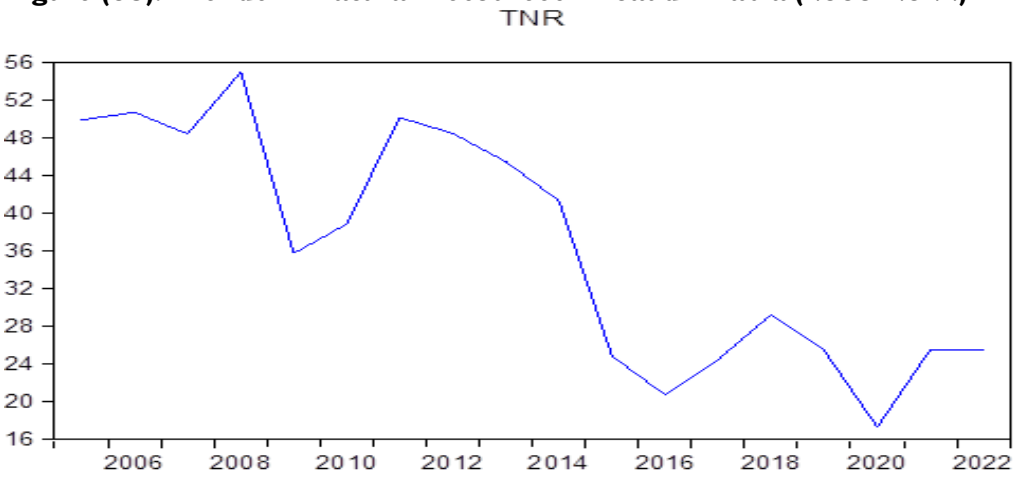
Source: Prepared by the researchers based on Eviews 12 output

Figure (02): Trends in Economic Diversification in Saudi Arabia (2005–2022)



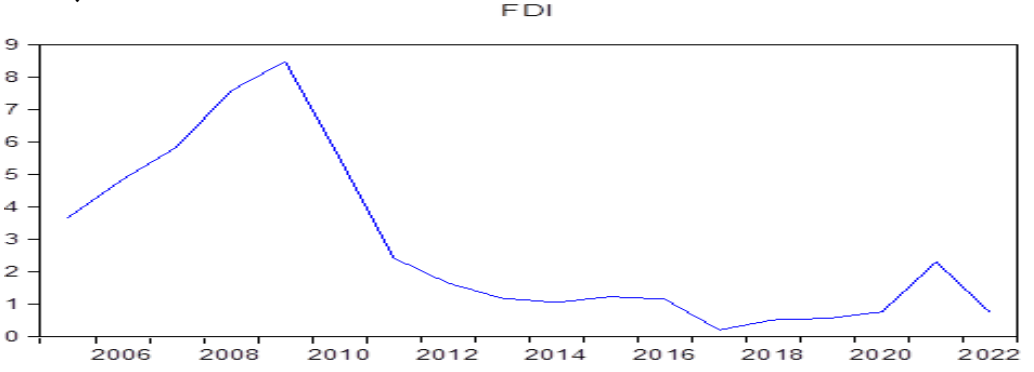
Source: Prepared by the researchers using Eviews 12

Figure (03): Trends in Natural Resources in Saudi Arabia (2005–2022)



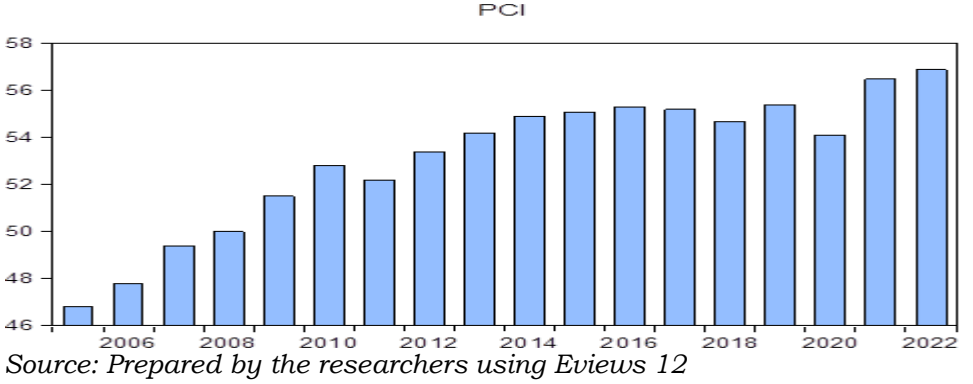
Source: Prepared by the researchers using Eviews 12

Figure (04): Trends in Foreign Direct Investment in Saudi Arabia (2005–2022)



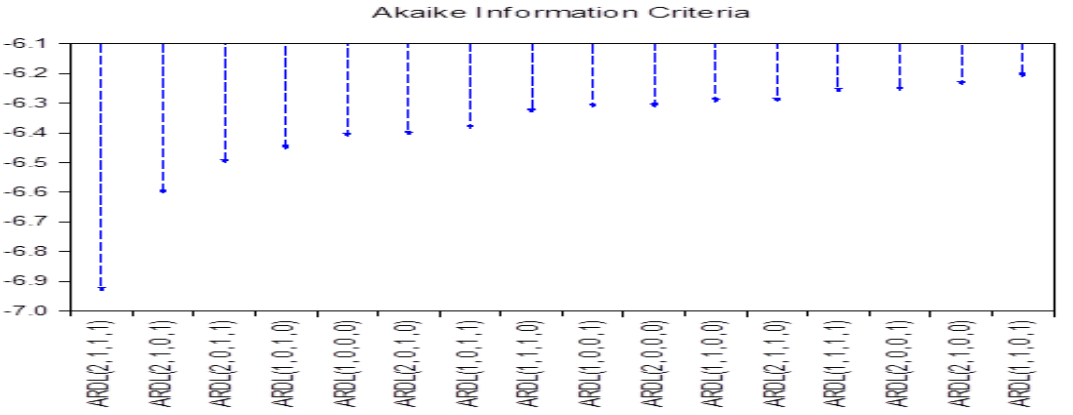
Source: Prepared by the researchers using Eviews 12

Figure (05): Trends in Productive Capacity in Saudi Arabia (2005–2022)



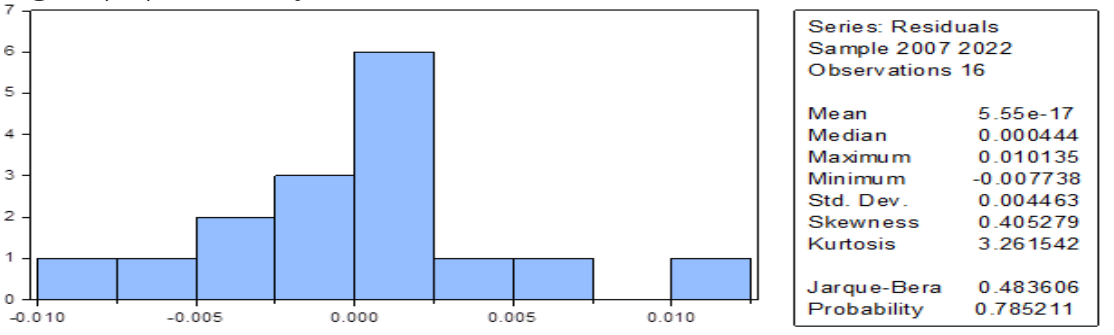
Source: Prepared by the researchers using Eviews 12

Figure (06): Akaike Information Criterion (AIC)



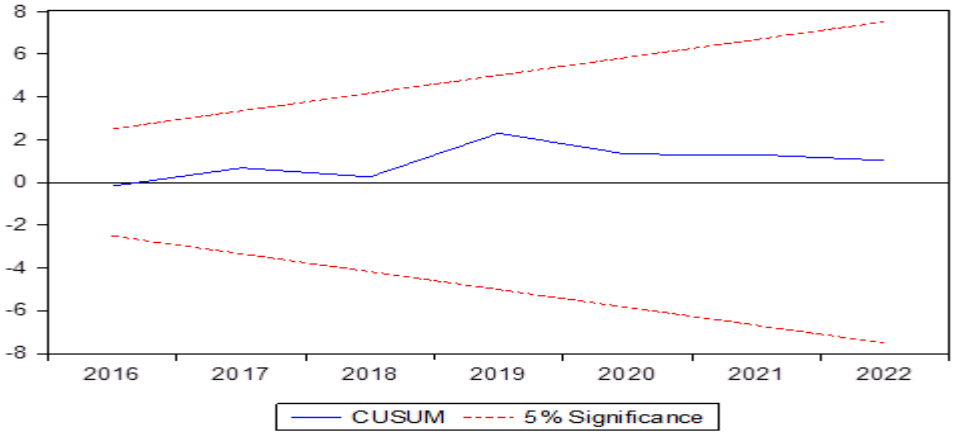
Source: Prepared by the researchers using Eviews 12

Figure (07): Normality Test Results



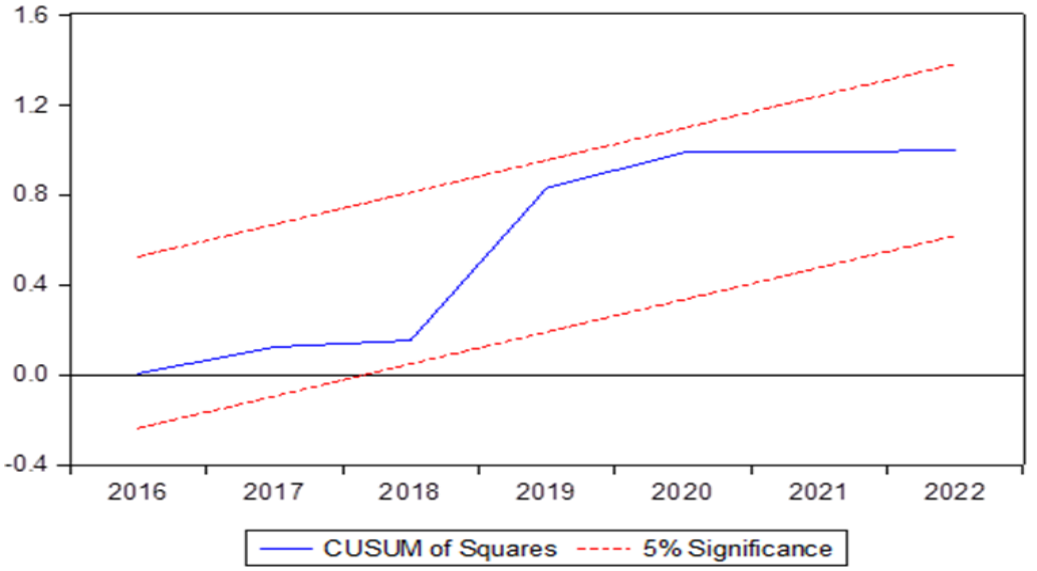
Source: Prepared by the researcher using Eviews 12

Figure (08): Cumulative Sum of Recursive Residuals – CUSUM Test



Source: Prepared by the researchers using Eviews 12

Figure (09): Cumulative Sum of Squares of Recursive Residuals – CUSUM of Squares Test



Source: Prepared by the researchers using Eviews 12