



***Assessing the Economic Influence of Islamic Finance in Saudi Arabia:  
An In-depth Econometric Analysis (Q4 2013 - Q2 2022)***

Bouabdellah Mohammed amine<sup>1,\*</sup>, rekabi saddam<sup>2</sup>, iddir rania<sup>3</sup>

<sup>1</sup>University of Blida 2 (Algeria), aminebouabdellah44@gmail.com

<sup>2</sup>University of Eloued (Algeria), [rekabi-saddam@univ-eloued.dz](mailto:rekabi-saddam@univ-eloued.dz)

<sup>3</sup>University of Blida 2 (Algeria), [r.iddir@univ-blida2.dz](mailto:r.iddir@univ-blida2.dz)

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**Abstract:**

This paper examines the complex correlation between Islamic financing and economic development in Saudi Arabia from Q4 2013 to Q2 2022. The study used quarterly data to analyze financing dynamics in Islamic banking and its impact on economic growth by employing the ARDL model. The research first confirms the stationarity of the time series data using the Augmented Dickey-Fuller test. The following ARDL Bounds Test demonstrates a long-term equilibrium link between Islamic finance and economic advancement. The empirical evidence suggests that Islamic financing has a significant and beneficial effect on the long-term economic development of Saudi Arabia. More precisely, there is a clear correlation between a 1% increase in Islamic finance and a 1.16% increase in long-term economic growth.

**Keywords:** *Autoregressive Distributed Lag (ARDL) Model; Econometric Analysis; Economic Growth; Islamic Finance; Saudi Arabia.*

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\*Corresponding Author

## **I. INTRODUCTION**

Islamic banking, one of the most engaging and expanding sectors in the global banking system, owes its prominence to its unique characteristics and principles, which cater to the welfare of all parties involved, both banks and clients. These principles, rooted in Islamic Sharia law prohibiting usury, have become increasingly significant in recent years. Over the last ten years, Islamic finance has fostered economic expansion. Studies on the correlation between economic growth and finance have expanded to include three distinct approaches: supply-leading, demand-following, and reciprocal influences. With Saudi Arabia emerging as a leader in the financial sector, especially in Islamic finance, the recent years have witnessed substantial growth in Islamic financial institutions. This includes Islamic banks, takaful insurance companies, Islamic investment funds, Sukuk, and other components of Islamic finance. An analysis is required to assess the influence of the growing Islamic financing sector on the economic growth of Saudi Arabia. This study aims to determine the importance and effectiveness of Islamic finance, as well as interpret statistical findings and indicators that contribute to the role of Islamic finance in the overall economic activity.

### **Study Problem:**

**"How Does Islamic Banking Finance Influence Economic Growth in Saudi Arabia? An In-depth Econometric Investigation (Q4 2013 - Q2 2022)"?**

### **Study Hypotheses:**

- A correlation may be shown between Islamic banking financing and economic development.
- In Saudi Arabia, there is a durable and stable connection between economic development and Islamic finance.
- There is a statistically significant correlation between Islamic banking financing and economic development in Saudi Arabia in the near term.

### **Significance of the Study:**

The importance of this study is underscored by the global emphasis on economic growth, which all nations strive to achieve through various means. Additionally, the Islamic financial sector's strength and efficiency in financing diverse economic activities contribute significantly to achieving the highest possible economic growth in Saudi Arabia, known for its elevated growth indicators.

### **Study Objectives:**

The main focus of this research article is to examine the correlation between Islamic financing and economic development in Saudi Arabia. This will be achieved by an econometric analysis utilizing the ARDL model, analyzing quarterly data from 2013 to 2022.

### **Study Methodology:**

This study employs an inductive approach to review and understand previous studies, identifying research gaps, and an econometric analytical method to analyze the econometric study results of the influence of Islamic banking financing on economic development, as shown by the progression of the Gross Domestic Product.

## **1. Literature Review**

Islamic finance has become a substantial driver of economic expansion, particularly in nations with a primarily Muslim population. The correlation between Islamic financing and economic development has been extensively examined via a multitude of research, which have used diverse approaches and focused on different regions.

### **1.1. The influence of Islamic financing on the economic prosperity of Saudi Arabia and other Gulf Cooperation Council (GCC) nations.**

(Ledhem & Mekidiche, 2020) examined the correlation between the economic progress of many countries, including Saudi Arabia, and the monetary prosperity of Islamic banking. The investigation was done utilizing an endogenous growth model framework. This study suggests that the financial success of Islamic banks, namely in terms of return on equity, has a substantial impact on economic development.

(Grassa & Gazdar, 2014) We compared the progress of Islamic and conventional banking systems in five Gulf Cooperation Council (GCC) countries, including Saudi Arabia. This paper is noteworthy for its pioneering empirical study on the impact of Islamic finance on economic growth in the GCC region.

The research conducted by (Yıldırım, Yıldırım, & Diboglu, 2020) investigated the relationship between the sukuk market and economic progress in nine nations that have Islamic banking systems. Their study emphasizes the significant impact of the growth of the sukuk market on economic advancement.

### **1.2. An analysis of comparative studies and the significance of Islamic banking.**

In his study, (Al Mahish, 2016) constructed a financing index specifically for Saudi Arabia. The score highlighted the advantageous influence of Islamic financing on the nation's economic progress, especially during economic and political instability. (Rabaa & Younes, 2016) Moreover, (Farahani & Dastan, 2013) highlighted the favorable impact of Islamic banks' performance and funding on economic development. Rabaa emphasized the need for financial deregulation, whereas Farahani used a panel cointegration technique.

(Ashraf, 2012) conducted a study on Islamic mutual funds (IMFs) performance in the Saudi Arabian capital market throughout the global economic crisis. The research revealed that International Monetary Funds (IMFs) outperformed traditional funds, showcasing their resilience in the face of difficulties and ability to promote economic stability.

### **1.3. Wider ramifications and comparative viewpoints**

The study (Hossain, 2016) examined the transmission of inflationary shocks in countries with Islamic banking systems. The study's findings suggest that a consistent macroeconomic environment plays a crucial role in facilitating the growth of the Islamic financial industry. These results are crucial for understanding the dynamics of economic development in Saudi Arabia.

The research conducted (Miyajima, 2020) on bank lending in Saudi Arabia has important policy implications, especially in understanding the variables that impact bank lending in Islamic banking.

#### **1.4. Exploring the Intersection between Islamic Finance and Private Investment**

In their study, (Abid & Alotaibi, 2020) examined the correlation between crude oil prices and private investment in Saudi Arabia, emphasizing the substantial influence of oil prices on investment. This research is essential for comprehending the wider economic determinants that impact Islamic finance and the evolution of the economy in Saudi Arabia.

#### **1.5. The influence of the worldwide Islamic banking sector on economic expansion**

(Batorshyna, Volodymyr, Chekhovych, & Homotiuk, 2021) It revealed the distinctive characteristics of the worldwide Islamic banking sector, explicitly emphasizing its interaction with the economic progress of nations with a Muslim majority, such as Saudi Arabia. This report offers valuable insights into the prevailing developments in crucial sectors of the Islamic finance industry and their influence on economic growth.

#### **1.6. The relationship between religiosity, branding, and economic performance.**

The research conducted by (Alharbi, Yahya, & Kassim, 2021) examined the influence of religion and branding on the performance of small and medium-sized firms (SMEs) in Saudi Arabia. Their study yielded valuable insights into the key determinants of economic success in the context of Islamic finance and religion.

#### **1.7. Comparative International Studies**

##### **1.7.1. Islamic finance in Pakistan**

The research (Kamran & Ihsan, 2018) on Pakistan's Islamic banking financing demonstrated a substantial and enduring association with economic development, but no immediate connection was found. This discovery is essential for doing a comparison study of Saudi Arabia's Islamic banking system.

##### **1.7.2. The correlation between Islamic financing and non-oil economic development**

His research (Al-Ghifaili, 2012) investigated the impact of the development of the financial industry, including Islamic finance, on the non-oil economic growth of Saudi Arabia. The report emphasizes the substantial correlation between Islamic banking and Saudi Arabia's ambitions to achieve economic diversification.

An examination of the correlation between Islamic banking and economic development via econometric research.

The study undertaken by (Abdelkader Hadj & El korso, 2020) in Saudi Arabia examined the causal relationship between the emergence of Islamic banking and economic growth, affirming a significant and enduring impact. The techniques and findings of this study are an essential benchmark for the current research.

##### **1.7.3. The GCC countries and their relationship with Islamic finance**

In research undertaken by (Gandouz, 2021), the relationship between the development of Islamic finance and economic growth in the Gulf Cooperation Council (GCC) countries was investigated. This article presents a comprehensive examination of the demand-pushing theory, investigating the potential effects of the expansion of the Islamic banking

sector on economic growth. The text adopts a comparative approach, specifically emphasizing Saudi Arabia.

#### **1.7.4. Countries belonging to the Organization of Islamic Cooperation**

(Sharifi, Sawar, & Mokhtar, 2023) The researchers analyzed the impact of the spread of Islamic finance on the economic growth of countries belonging to the Organization of Islamic Cooperation. Through dynamic panel data analysis, their study revealed that Islamic finance had a significant and advantageous influence on economic growth. This offers significant perspectives on the broader ramifications of Islamic banking in a global context.

In conclusion, this literature study highlights the diverse and complex influence of Islamic financing on the economy's expansion, with a particular emphasis on Saudi Arabia. The evaluated papers thoroughly comprehend the many dynamics involved, including the profitability of Islamic banks, the durability of Islamic mutual funds, the influence of the sukuk market, and the broader economic consequences of Islamic financial practices. The findings reveal a positive correlation between Islamic finance and economic growth, offering valuable insights and standards for the current study. The study is improved by including comparative international research, which provides a more complete viewpoint on how Islamic financing contributes to economic growth in different contexts. This study presents a detailed econometric analysis of the impact of Islamic finance on the economic growth of Saudi Arabia, covering the period from Q4 2013 to Q2 2022.

## **2. Econometric Analysis**

### **2.1. Methodology and Tools Used:**

In order to accomplish the goal of this research, which is to determine the influence of Islamic financing on the economic development of Saudi Arabia, we will use the Autoregressive Distributed Lag (ARDL) model. This model aims to ascertain the impact of Islamic financing on economic development, including both the short-term and long-term effects. The study will rely on the quarterly data currently accessible for these variables and additional supplementary factors, spanning from the fourth quarter of 2013 to the second quarter of 2022.

#### **2.1.1. Model of Autoregressive Distributed Lag (ARDL):**

ARDL Model is a statistical model used to analyze the relationship between variables across time. Time series analysis is an essential statistical technique for analysing long-term economic events. The main objective of using time series models is to gather historical data points for a time series to construct a suitable model that accurately characterizes the underlying patterns of the series. Subsequently, this model is used to predict forthcoming values. (Adhikari & Agrawal, 2013, p. 9)

The Engle and Granger (1987) and Johansen and Juselius (1990) models are essential in cointegration analysis. These models require that the two series have the same level of integration and that the residuals, after calculating the link between them, have no integration. (Wooldridge, 2012, p. 646) The ARDL model developed by Sun (1998) and (Pesaran, Shin, & Smith, 2001, pp. 289-326.), The Vector Autoregression (VAR) model framework is well recognized for its effectiveness in assessing cointegration. Compared to well-known approaches like the Engle Granger Two-Step method or the Johansen

cointegration test, the VAR model is considered one of the finest econometric models. The ARDL approach has several benefits: (Afzal & et al, 2013, p. 25)

- This approach exhibits greater resilience in small samples comprising 30-80 observations.
- The ARDL model may be used for time series data regardless of whether they are integrated of order  $I(0)$ ,  $I(1)$ , or a combination of both. However, it is inefficient when any time series is integrated into order  $I(2)$ .
- The ARDL model utilizes a framework that progresses from a broad to a specialized modeling approach, including enough delays to reflect the underlying data-generating process effectively. The algorithm calculates  $(p + 1)^k$  regressions to identify the ideal lag length for each variable. Here,  $p$  represents the maximum lag length that may be used, while  $k$  denotes the number of internal variables in the equation.
- The selection of the model is determined by many statistical methods, such as the Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC), or the Hannan-Quinn Criterion (HQC).
- ARDL concurrently estimates both short-term and long-term associations, yielding unbiased and efficient estimates.

### 2.1.2. Study Period and Data Sources:

This study utilizes quarterly data from Saudi Arabia from Q4 2013 to Q2 2022. The relevant data for the study's variables were obtained from the General Authority for Statistics database in Saudi Arabia.

### 2.2. Study Model:

Grounded in economic theory and prior empirical research on the impact of Islamic financing on economic growth, the following model will be estimated:

$$lrgdp = f(lk, lg, lopen, lif) \dots\dots\dots (01) \quad t = 2013Q4-2022Q2$$

Where:

*lrgdp*: Logarithm of the real Gross Domestic Product;

*lk*: Logarithm of physical capital as a proportion of Gross Domestic Product;

*lg*: Logarithm of government expenditure as a proportion of Gross Domestic Product;

*open*: Logarithm of the trade openness index;

*lif*: Logarithm of total Islamic financing as a proportion of Gross Domestic Product.

The ARDL technique will be used to assess the influence of Islamic finance on economic development in Saudi Arabia. The approach will be in the following form:

$$\begin{aligned} \Delta lrgdp_t = & \beta_0 + \sum_{t=1}^p \beta_{1t} \Delta lrgdp_{t-i} + \sum_{t=1}^{q1} \beta_{2t} \Delta lk_{t-i} + \sum_{t=1}^{q2} \beta_{3t} \Delta lg_{t-i} + \sum_{t=1}^{q3} \beta_{4t} \Delta lopen_{t-i} \\ & + \sum_{t=1}^{q4} \beta_{5t} \Delta lif_{t-i} + \alpha_1 lrgdp_{t-1} + \alpha_2 lk_{t-1} + \alpha_3 lg_{t-1} + \alpha_4 lopen_{t-1} \\ & + \alpha_5 lif_{t-1} + \varepsilon_t \dots\dots\dots (02) \end{aligned}$$

Where:

$\Delta$ : denotes first differences;

$\beta_0$ : constant term;

$p, q_1, q_2, q_3, q_4$ : upper limits of the time lag periods for the study variables;

$t$ : time trend;

$\varepsilon_t$ : random error term;

$\beta_5, \beta_4, \beta_3, \beta_2, \beta_1$ : coefficients of the short-term relationship;

$\alpha_5, \alpha_4, \alpha_3, \alpha_2, \alpha_1$ : coefficients of the long-term relationship.

## II. Results and discussion :

### 1. Unit Root Test:

Before proceeding, it is crucial to do a stationarity analysis of the time series data to ascertain their integration level. Before using the ARDL model, it is necessary to ensure that all variables under investigation are integrated in the order I(0) or I(1). The Augmented Dickey-Fuller test (ADF) will be used in this research to determine the integration order of the study variables.

The findings of the Augmented Dickey-Fuller test for unit root or stationarity are shown in Table 01. Upon comparing the calculated values with the listed values at a significance level of 5% ( $\alpha$ ), it is clear that all variables under study (logarithm of real Gross Domestic Product GDP, logarithm of physical capital lk, logarithm of government expenditure lg, logarithm of the trade openness index lopen, and logarithm of total Islamic financing lif) are non-stationary at the base level. Nevertheless, they all halt after the variables are initially differenced and the ADF test is reapplied. Thus, all research variables are integrated at order I(1). Consequently, the Bounds Test technique may be used to run a cointegration test.

### 2. Cointegration Test Using Bounds Test:

In order to determine whether there is a stable and lasting link between the variables being studied, it is essential to calculate the Autoregressive Distributed Lag (ARDL) model. Determining the most suitable time delays is guided by the Akaike Information Criterion (AIC) to minimize AIC values. The selected model for this investigation is ARDL (4,4,4,3,4), as seen in Figure 01. The Unrestricted Error Correction Model (UECM) will examine the cointegration connection between the research variables. This will include estimating the following model:

$$\begin{aligned} \Delta lrgdp_t = & \beta_0 + \sum_{t=1}^p \beta_{1t} \Delta lrgdp_{t-i} + \sum_{t=1}^{q1} \beta_{2t} \Delta lk_{t-i} + \sum_{t=1}^{q2} \beta_{3t} \Delta lg_{t-i} \\ & + \sum_{t=1}^{q3} \beta_{4t} \Delta lopen_{t-i} + \sum_{t=1}^{q4} \beta_{5t} \Delta lif_{t-i} + \alpha_1 lrgdp_{t-1} + \alpha_2 lk_{t-1} \\ & + \alpha_3 lg_{t-1} + \alpha_4 lopen_{t-1} + \alpha_5 lif_{t-1} + \varepsilon_t \dots \dots \dots (03) \end{aligned}$$

In addition, we will conduct a test to see if there is a lack of cointegration (a long-term equilibrium connection) between the variables. This will be done as follows:

$$H_0: \alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = 0$$

Contrary to the alternative theory indicating the existence of a stable long-term relationship:

$$H_1: \alpha_1 \neq \alpha_2 \neq \alpha_3 \neq \alpha_4 \neq \alpha_5 \neq 0$$

The ARDL Bounds Test findings in Table 02 indicate that the F-statistic value is 7.6029, more statistically significant than the crucial value of 4.440 at the 1% significance level. Thus, the null hypothesis of no cointegration is rejected, suggesting a long-term equilibrium connection between the research variables.

### 3. Estimation of the Long-term Cointegration Relationship:

The previous findings have established cointegration among the research variables. Consequently, we will estimate the long-term equilibrium relationship for the ARDL(4,4,4,3,4) model.

The analysis of the connection between the research variables, as shown in Table 03, reveals that the variable representing physical capital (lk) does not significantly impact long-term economic growth (lrGDP) at a 5% significance level. Conversely, there is a favorable and statistically significant impact of government spending (lg) on long-term economic growth (significant at 5%). A 1% rise in government spending results in a 0.31% increase in economic growth. The effect of trade openness (open) on the impact is positive and statistically significant at a 1% significance level. The findings suggest that a marginal increase of 1% in trade openness resulted in a corresponding long-term rise of 1.7% in economic growth.

The Islamic funding variable (lif) exhibits a substantial and statistically significant positive impact, with a significance level of 1%. A 1% rise in Islamic finance leads to a corresponding 1.16% increase in the long-term economic growth rate. These findings are consistent with the rationale of economic theory and empirical research investigating Islamic finance's influence on economic development.

### 4. Estimation of the Error Correction Model (ARDL-ECM):

The Error Correction Model (ECM) estimation represents the short-term connection between the research variables. The ECM expresses the variables in different forms and includes the Error Correction Term (CointEq(-1)) as an explanatory variable. The Error Correction Term quantifies the rate at which short-term variances converge toward long-term equilibrium. A negative and substantial coefficient of the Error Correction Term suggests a long-term association between the variables.

The findings shown in Table 04 demonstrate that the coefficient of the Error Correction Term (CointEq(-1)) in the study's short-term model is statistically significant and has a negative value of (-0.3590). This demonstrates the presence of a long-term equilibrium connection among the analyzed variables. The Error Correction Term parameter signifies that about 35% of short-term aberrations in economic growth rates from the previous period may be rectified in the present period towards the long-term relationship when there are alterations or disturbances in the explanatory factors.



In addition, the findings of the short-term relationship estimate indicate a positive impact on economic growth in the near run when there is a rise in physical capital (Ik) at a 5% significant level. Simultaneously, it has adverse effects from the increase in government spending (Ig), trade liberalization (Ioppen), and Islamic finance (Iif).

## **5. Diagnostic Tests for Model Adequacy (ARDL-ECM):**

### **5.1. Structural Stability Test of Model Coefficients:**

Figure 02 demonstrates that the graphical depictions of the CUSUM and SUSUMSQ tests are contained inside the crucial boundaries at the 5% significance level. Thus, we conclude that the null hypothesis, which states that all computed model coefficients are stable, is accepted. This signifies the stability of the model's long-term and short-term parameters.

### **5.2. Autocorrelation Test:**

Table 05 shows that the LM test results reveal a probability (Prob) of 0.2566, which is above the threshold of 0.05. Therefore, we conclude that no autocorrelation exists among the residuals, thereby accepting the null hypothesis. This suggests that the calculated model is not affected by autocorrelation problems.

### **5.3. Heteroskedasticity Test:**

The findings of the Breusch-Pagan-Godfrey test, as shown in Table 05, indicate that the probability (Prob) value is 0.2292, which is above the significance level of 0.05. Therefore, we conclude that the null hypothesis is accepted, stating that the model does not display heteroskedasticity. This indicates that the calculated model is not affected by heteroskedasticity issues.

### **5.4. Model Specification Test (Ramsey RESET):**

The Ramsey RESET test demonstrates that the model is free from specification errors since the probability (Prob) value of 0.0879 is more statistically significant than the threshold of 0.05. This indicates that the functional form of the model is suitable.

### **5.5. Regular Distribution Test of Residuals:**

Based on the data shown in Figure 03, it is evident that the p-value of the Jarque-Bera test is 0.7259, which is statistically significant compared to the threshold of 0.05. Consequently, we affirm the null hypothesis that the residuals exhibit a normal distribution.

In general, the diagnostic tests conducted to assess the appropriateness of the ARDL-ECM model indicate that it is adequately defined and does not exhibit any issues related to structural instability, autocorrelation, heteroskedasticity, or non-normality of residuals.

### **III. Conclusion:**

This study aims to highlight the potential of Islamic banking in promoting substantial economic development by leveraging its various financial mechanisms in the financing process. Furthermore, it ensures the preservation of the interests of all individuals and the fair allocation of resources. Given Saudi Arabia's strong interest in Islamic banking and its ongoing efforts to enhance its role in the national economy, we have undertaken this research study to examine the relevant subject. We want to evaluate the capacity of Islamic banking and finance, as shown by the overall amount of Islamic financing in Saudi Arabia, to attain economic success. The results of our study indicate that Islamic financing has a considerable and statistically significant beneficial impact over a prolonged period.

#### **Hypothesis Testing:**

- The validity of the first hypothesis, which states that a correlation exists between Islamic banking financing and economic development, has been confirmed. The study work has validated this correlation via its empirical discoveries, consistent with prior studies and literature.
- The study's empirical findings corroborate the accuracy of the second hypothesis, which states that there is a long-term equilibrium link between economic development and Islamic financing in Saudi Arabia. This highlights the importance of the expanding Islamic finance industry's capacity to promote diverse economic endeavors and attain significant and sustainable economic development in the long run.
- The third hypothesis, which states a statistically significant association between Islamic banking financing and economic development in Saudi Arabia in the short term during the research period, is invalid. The study's empirical findings have shown a negative correlation between Islamic financing and short-term economic growth.

#### **Study Results:**

- All variables remained stationary after conducting first-order differences and performing an Augmented Dickey-Fuller test.
- The Common Integration Test (ARDL Bounds Test) indicated that the F-statistic surpasses the crucial threshold at a 1% significance level. This validates a stable and enduring connection between the variables under investigation.
- Long-term equilibrium relationship estimation results demonstrated a significant positive impact of Islamic finance in Saudi Arabia at a 1% significance level. These findings suggest that a 1% rise in Islamic financing is associated with a 1.16% increase in long-term economic growth, consistent with economic theory.
- The estimated findings for the short-term equilibrium relationship imply a negative impact of Islamic banking financing on economic growth, with a significance level of 5%.

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## Appendices

**Table (01): Results of the Unit Root Test for Study Variables Using the Augmented Dickey-Fuller (ADF) Test**

### UNIT ROOT TEST RESULTS TABLE (ADF)

Null Hypothesis: The variable has a unit root

		<u>At Level</u>				
		LRGDP	LK	LG	LOPPEN	LIF
With Constant	t-Statistic	-1.9282	-4.5142	-5.6087	-3.1087	0.2949
	Prob.	0.3160	0.0010	0.0000	0.0353	0.9746
		n0	***	***	**	n0
With Constant & Trend	t-Statistic	-3.0149	-5.3813	-7.0620	-4.9752	-1.3823
	Prob.	0.1431	0.0006	0.0000	0.0016	0.8482
		n0	***	***	***	n0
Without Constant & Trend	t-Statistic	1.6821	0.8991	-1.0289	-1.0499	3.2400
	Prob.	0.9752	0.8976	0.2672	0.2592	0.9994
		n0	n0	n0	n0	n0
		<u>At First Difference</u>				
		d(LRGDP)	d(LK)	d(LG)	d(LOPPEN)	d(LIF)
With Constant	t-Statistic	-7.5216	-13.2379	-25.7464	-14.0560	-5.2367
	Prob.	0.0000	0.0000	0.0001	0.0000	0.0001
		***	***	***	***	***
With Constant & Trend	t-Statistic	-7.2840	-16.7532	-23.0481	-14.3855	-6.5842
	Prob.	0.0000	0.0000	0.0000	0.0000	0.0000
		***	***	***	***	***
Without Constant & Trend	t-Statistic	-6.6623	-14.2393	-19.3692	-13.4879	-4.1941
	Prob.	0.0000	0.0000	0.0000	0.0000	0.0001
		***	***	***	***	***

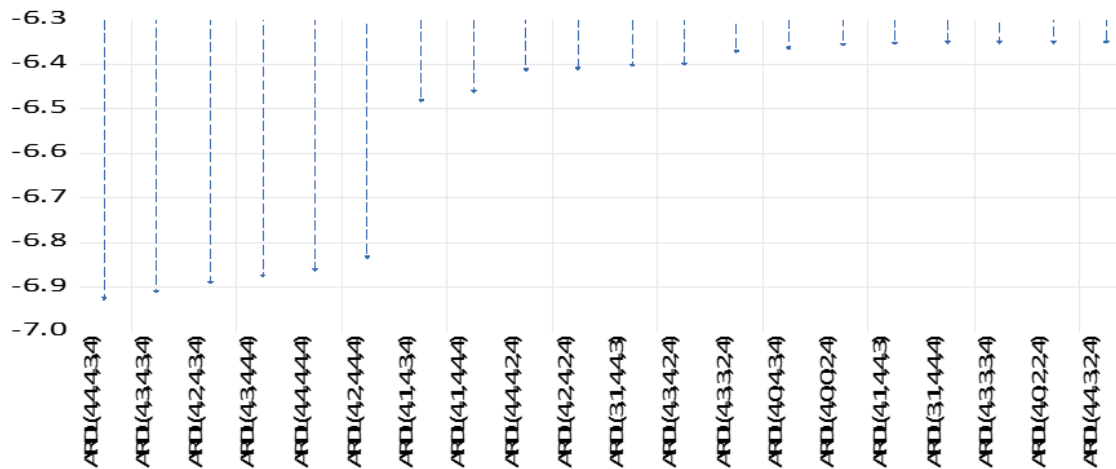
### Notes:

a: (\*)Significant at the 10%; (\*\*)Significant at the 5%; (\*\*\*) Significant at the 1% and (no) Not Significant

b: Lag Length based on SIC

Source: Outputs from Eviews13.

**Figure (01): Determining the Number of Lags in the ARDL Model.**



Source: Outputs from Eviews13.

**Table(02): Results of the Bounds Test.**

Bounds Test

Null hypothesis: No levels relationship	
Number of cointegrating variables: 4	
Trend type: None (Case 1)	
Sample size: 31	
Test Statistic	Value
F-statistic	7.602954
t-statistic	-3.758195

Bounds Critical Values

Sample Size	10%		5%		1%	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
F-Statistic						
30	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
35	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Asymptotic	1.900	3.010	2.260	3.480	3.070	4.440

Source: Outputs from Eviews 13.

**Table (03): Results of Long-term Coefficients Estimation.**

Cointegrating Specification

Deterministics: None (Case 1)

$$CE = LR GDP(-1) - (-0.194812 * LK(-1) + 0.312601 * LG(-1) + 1.705541 * LOPPEN(-1) + 1.166074 * LIF(-1))$$

Cointegrating Coefficients

Variable *	Coefficient	Std. Error	t-Statistic	Prob.
LK(-1)	-0.194812	0.109023	-1.786888	0.0852
LG(-1)	0.312601	0.132052	2.367262	0.0253
LOPPEN(-1)	1.705541	0.118277	14.41984	0.0000
LIF(-1)	1.166074	0.070733	16.48560	0.0000

Note: \* Coefficients derived from the CEC regression.

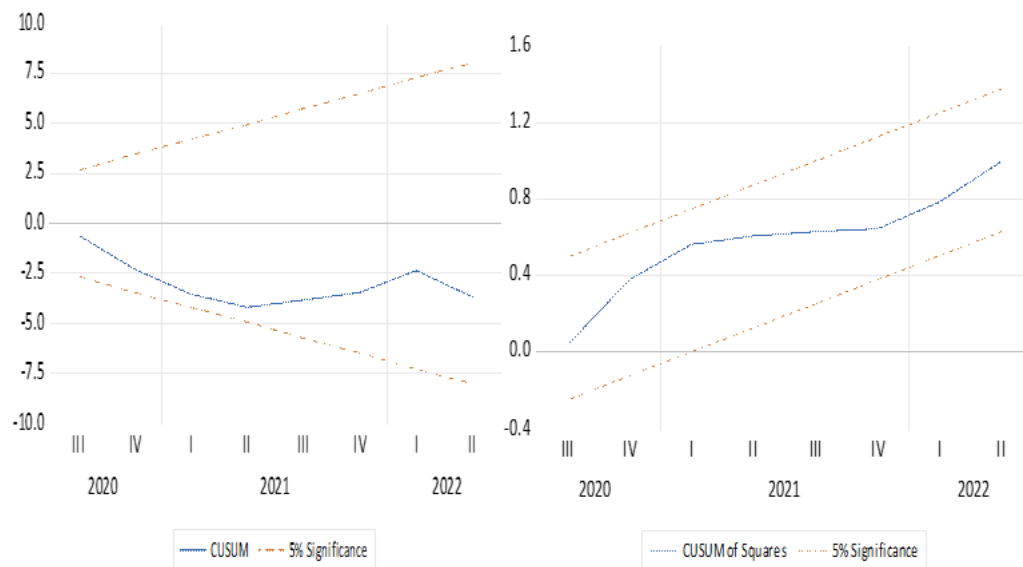
Source: Outputs from Eviews 13.

**Table (04): Results of Short-term Relationship Estimation.**

Dependent Variable: D(LRGDP)  
Method: ARDL  
Date: 02/23/23 Time: 19:38  
Sample: 2014Q4 2022Q2  
Included observations: 31  
Dependent lags: 4 (Automatic)  
Automatic-lag linear regressors (4 max. lags): LK LG LOPPEN LIF  
Deterministics: No constant and no trend (Case 1)  
Model selection method: Akaike info criterion (AIC)  
Number of models evaluated: 2500  
Selected model: ARDL(4,4,4,3,4)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
COINTEQ*	-0.359063	0.047550	-7.551301	0.0000
D(LRGDP(-1))	-0.184775	0.168889	-1.094058	0.2954
D(LRGDP(-2))	-0.500731	0.181165	-2.763950	0.0172
D(LRGDP(-3))	-0.879311	0.211927	-4.149127	0.0013
D(LK)	0.007181	0.015769	0.455371	0.6570
D(LK(-1))	0.090533	0.027006	3.352363	0.0058
D(LK(-2))	0.013646	0.018181	0.750560	0.4674
D(LK(-3))	-0.023591	0.014051	-1.678970	0.1190
D(LG)	0.005060	0.018683	0.270838	0.7911
D(LG(-1))	-0.089223	0.020133	-4.431621	0.0008
D(LG(-2))	-0.085943	0.022302	-3.853527	0.0023
D(LG(-3))	-0.074937	0.018209	-4.115402	0.0014
D(LOPPEN)	-0.042997	0.060589	-0.709646	0.4915
D(LOPPEN(-1))	-0.575947	0.116778	-4.931972	0.0003
D(LOPPEN(-2))	-0.306325	0.079501	-3.853079	0.0023
D(LIF)	-0.495188	0.066715	-7.422452	0.0000
D(LIF(-1))	-0.550364	0.188188	-2.924536	0.0127
D(LIF(-2))	-0.407099	0.153037	-2.660135	0.0208
D(LIF(-3))	-0.713439	0.171568	-4.158355	0.0013

Source: Outputs from Eviews 13.

**Figure (02): Cumulative Sum of Residuals and Cumulative Sum of Squared Residuals.**

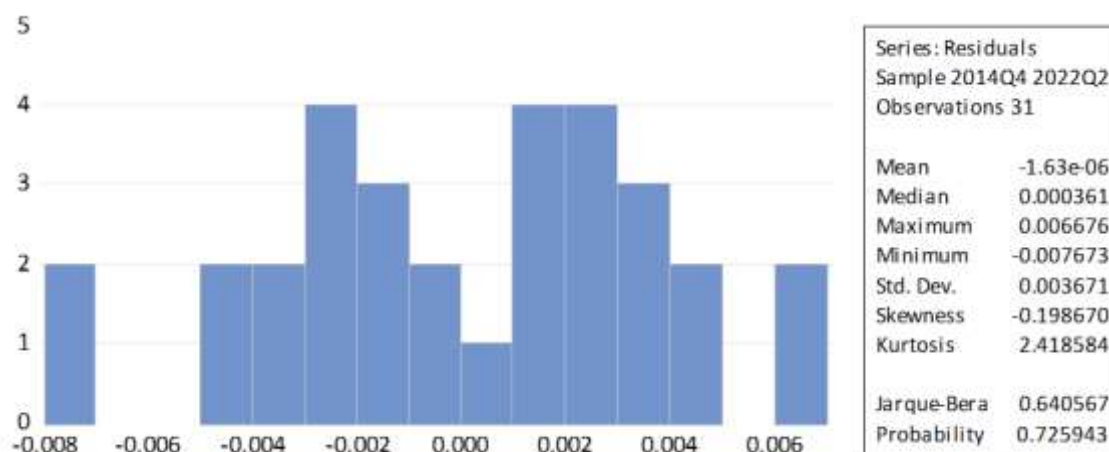
Source: Outputs from Eviews 13.

**Table (05): Results of Diagnostic Tests.**

Breusch-Godfrey Serial Correlation LM Test			
Null hypothesis: No serial correlation at up to 2 lags			
F-statistic	0.288625	Prob. F(2,6)	0.7591
Obs*R-squared	2.720707	Prob. Chi-Square(2)	0.2566
Heteroskedasticity Test: Breusch-Pagan-Godfrey			
Null hypothesis: Homoskedasticity			
F-statistic	2.515094	Prob. F(23,7)	0.1061
Obs*R-squared	27.65367	Prob. Chi-Square(23)	0.2292
Scaled explained SS	1.306606	Prob. Chi-Square(23)	1.0000
Ramsey RESET Test			
Equation: UNTITLED			
Omitted Variables: Squares of fitted values			
Specification: LRGDP LRGDP(-1) LRGDP(-2) LRGDP(-3) LRGDP(-4) LK			
LK(-1) LK(-2) LK(-3) LK(-4) LG LG(-1) LG(-2) LG(-3) LG(-4) LOPPEN			
LOPPEN(-1) LOPPEN(-2) LOPPEN(-3) LIF LIF(-1) LIF(-2) LIF(-3) LIF(-4)			
	Value	df	Probability
t-statistic	1.982271	7	0.0879
F-statistic	3.929396	(1, 7)	0.0879
Likelihood ratio	13.81192	1	0.0002

Source: Outputs from Eviews 13.

**Figure (03): Normality Test (Jarque-Bera).**



Source: Outputs from Eviews 13.