*Jordan Journal of Economic Sciences,* Volume **13**, No.**1, 2026**

# Investigating the Dynamic Relationship between the Blue Economy and Economic Growth in Jordan: A Time-Series Econometric Analysis

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Received: 19/6/2025
Revised: 12/8/2025
Accepted: 17/11/2025
Published: 1/1/2026

Citation: Al-Adayleh , R. . (2026). Investigating the Dynamic Relationship between the Blue Economy and Economic Growth in Jordan: A Time-Series Econometric Analysis. *Jordan Journal of Economic Sciences*, 13(1), 34–47. https://doi.org/10.35516/jjes.v13i1.4501



## Abstract

**Objective:** This study seeks to investigate the dynamic relationship between the blue economy and economic growth in Jordan during the period (1982–2023), with the aim of identifying the extent to which blue economy activities contribute to supporting the path of sustainable economic growth and strengthening its foundations.

**Methods:** The study employs the Autoregressive Distributed Lag (ARDL) methodology to estimate the short-run and long-run relationships among the research variables. Unit root tests are conducted to verify the integration order of the variables and ensure the validity of the econometric modeling.

**Results**: Unit root test results indicate that the variables under study—total fish production (TFP), aquaculture production (AP), the agriculture, forestry, and fishing sector (AFF), trade volume (TRD), and economic growth in Jordan (LNEG)—are integrated of orders I(0) and I(1), confirming the suitability of the ARDL approach for this analysis. The econometric results reveal a statistically significant long-run equilibrium relationship for aquaculture production, the agriculture–forestry–fishing sector, and trade volume, each demonstrating the expected positive effect on economic growth. In contrast, total fish production is found to have a negative impact on economic growth. This is attributed to its limited contribution to GDP, due to the small size of Jordan's water resources (restricted to the Gulf of Aqaba), the country's heavy reliance on imported marine products, and the weak linkage with value-added manufacturing industries such as canning, freezing, and export processing—factors that reduce the multiplier effect of these activities on the broader economy. Furthermore, the results of the CUSUM and CUSUMSQ tests confirm the structural stability of the model throughout the study period.

**Conclusion:** The study concludes with a recommendation to expand investment in the development of sustainable aquaculture, strengthen related manufacturing industries, and reinforce policies for marine resource protection. Such measures are essential to enhancing the contribution of the blue economy to stimulating sustainable economic growth and improving its overall capacity in Jordan**.**

**Keywords**: economic growth**,** Blue economic, Total Fishery Production, Aquaculture production.

# استقصاء العلاقة الديناميكية بين الاقتصاد الأزرق والنمو الاقتصادي في الأردن: تحليل قياسي باستخدام بيانات السلاسل الزمنية

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## ملخّص

**هدف البحث:** تسعى هذه الدراسة إلى استقصاء العلاقة الديناميكية بين الاقتصاد الأزرق والنمو الاقتصادي في الأردن خلال الفترة (1982–2023)، بهدف الوقوف على مدى إسهام أنشطة الاقتصاد الأزرق في رفد مسيرة النمو الاقتصادي المستدام وتعزيز دعائمه.

**المنهجية:** اعتمدت الدراسة منهجية الانحدار الذاتي للإبطاء الموزع (ARDL) بغية تقدير العلاقات في الأجلين الطويل والقصير بين متغيرات البحث، مع إجراء اختبارات جذور الوحدة للتحقق من رتبة تكامل هذه المتغيرات وضمان صحة النمذجة القياسية.

**النتائج:** أظهرت نتائج اختبارات جذور الوحدة تكامل المتغيرات محل الدراسة — ممثلةً في إجمالي الإنتاج السمكيTFP) )، وإنتاج الاستزراع السمكي (AP)، وقطاع الزراعة والغابات وصيد الأسماك (AFF) ، وحجم التجارة(TRD) ، والنمو الاقتصادي في الأردن — (LNEG) من الدرجتين I(0) وI(1)، مما يؤكد ملاءمة تبني نموذج ARDL في هذه الدراسة. كما أظهرت النتائج القياسية وجود علاقة توازنيه طويلة الأمد ذات دلالة إحصائية لإنتاج الاستزراع السمكي، وأنشطة الزراعة والغابات وصيد الأسماك، فضلاً عن حجم التجارة، حيث بيّنت النتائج الأثر الإيجابي المتوقع لهذه المتغيرات على مسار النمو الاقتصادي. وعلى النقيض، اتضح أن لإجمالي الإنتاج السمكي أثراً سلبياً على النمو الاقتصادي، ويُعزى ذلك إلى محدودية إسهامه في الناتج المحلي الإجمالي، نتيجة ضيق المسطحات المائية المتاحة (المنحصرة في خليج العقبة)، والاعتماد الكبير على واردات المنتجات البحرية، وضعف الترابط مع الصناعات التحويلية ذات القيمة المضافة كالتعليب والتجميد والتصدير، الأمر الذي يقلل من الأثر المضاعف لهذه الأنشطة على الاقتصاد الكلي. كما أكدت نتائج اختباري CUSUM و CUSUMSQاستقرار هيكل النموذج طيلة فترة الدراسة.

**الاستنتاج:** خلصت الدراسة إلى التوصية بضرورة العمل على توسيع الاستثمارات الموجهة لتطوير الاستزراع السمكي المستدام، والنهوض بالصناعات التحويلية المتصلة به، إلى جانب إحكام سياسات حماية الموارد البحرية، بما يضمن تعظيم مساهمة الاقتصاد الأزرق في تحفيز النمو الاقتصادي المستدام وتعزيز قدراته في الأردن.

**الكلمات الدالة:** النمو الاقتصادي؛ الاقتصاد الأزرق؛ إجمالي الإنتاج السمكي؛ إنتاج الاستزراع السمكي.

**1- INTRODUCTION**

The concept of the blue economy originated in the early 2000s, although its earliest roots can be traced back to 1999 when it was introduced at the Quebec Forum in Canada under the title "The Blue Economy and Saint Lawrence Development." The term was later popularized by Gunter Pauli, who presented a new economic vision based on the efficient and sustainable use of ocean resources. His 2011 book, "The Blue Economy: 10 Years, 100 Innovations, 100 Million Jobs," further cemented the concept, emphasizing innovation-driven sustainability grounded in marine resources (Marwan Youssef, 2023). The idea gained global prominence during the United Nations Conference on Sustainable Development (Rio+20) in 2012, where oceans, seas, and coastal zones were formally recognized within the broader framework of sustainable development. This acknowledgment contributed to the global adoption of Agenda 21, although no precise definition of the blue economy was provided at that time (Li et al., 2025).

A more formal definition emerged in 2015 when the World Wide Fund for Nature (WWF) described the blue economy as "a model for sustainable economic development grounded in marine resources, accompanied by sustainability standards." In 2017, the World Bank added another widely used definition, describing the blue economy as "economic activities that sustainably utilize ocean resources to promote economic growth, improve livelihoods and employment, and preserve the health of marine ecosystems." Since then, the blue economy has evolved into a key driver of sustainable development strategies globally.

As the concept gained international traction, various countries and regional organizations integrated blue-economy principles into their development agendas. The European Union incorporated the blue economy within the objectives of the European Green Deal, reflecting its commitment to environmentally responsible growth. Similarly, the African Union adopted the African Blue Economy Strategy at the 33rd AU Summit in 2020. In Asia, ASEAN released the ASEAN Blue Economy Framework in 2023 as a guide for regional cooperation. Leaders of Pacific Island Countries (PICs) also pushed for the inclusion of oceans as a standalone goal in the 2030 Sustainable Development Agenda (Keen, 2018). This momentum culminated in the 2050 Strategy for the Blue Pacific Continent, issued in 2022 during the 51st Pacific Islands Forum Leaders Meeting (Li et al., 2025).

The blue economy is generally conceptualized as a multidimensional framework. The economic dimension includes fisheries, aquaculture, marine biotechnology, and tourism. The environmental dimension encompasses biodiversity conservation, climate change mitigation and adaptation, pollution prevention, and ecosystem-based management. The technological dimension is associated with advancements in marine robotics, remote sensors, and artificial intelligence for ocean monitoring. The cultural dimension reflects traditional fishing, seafaring heritage, maritime storytelling, and cultural tourism. Finally, the governance dimension focuses on institutional arrangements, policy coordination, and stakeholder engagement to ensure sustainable and equitable use of marine resources.

A wide range of activities fall under the umbrella of the blue economy. These include capture fisheries, aquaculture, seafood processing, marine biotechnology (e.g., pharmaceuticals and chemical products), offshore oil and gas extraction, and deep-sea mining. Marine renewable energy—such as offshore wind—is also a key component, along with marine manufacturing industries, aquaculture technologies, maritime logistics, and port operations. Additionally, marine education, training, and research constitute an essential part of capacity-building for sustainable ocean development (Roy, 2019).

Regarding Jordan, the blue economy has been reframed as a national security tool in response to rising water scarcity, leading to major investments in desalination technology and coastal infrastructure. Jordan's national development strategies now incorporate blue-economy principles alongside water diplomacy, climate-finance initiatives, and efforts to strengthen academic capacity and digital innovation. The blue economy remains an emerging area of research in Jordan, as there is a notable lack of empirical studies examining its role in stimulating economic growth. Furthermore, previous literature has not addressed the dynamic relationship between blue-economy variables and economic growth in the Jordanian context.

To the best of the researcher's knowledge, there is a critical need for in-depth analysis to understand how blue-economy components influence economic growth in Jordan. This study therefore identifies a clear research gap, positioning itself as the first to investigate the dynamic relationship between the blue economy and economic growth in Jordan through the application of time-series econometric techniques. Specifically, the study aims to empirically estimate the contribution of key blue-economy variables—Total Fishery Production (TFP), Aquaculture Production (AP), Agriculture, Forestry, and Fishing (AFF), and Trade Volume (TRD)—in stimulating economic growth in Jordan over the period 1982–2023. Economic growth is measured using GDP per capita.

This is achieved by examining the equilibrium relationship between blue-economy variables and economic growth using the Autoregressive Distributed Lag (ARDL) model and the Bounds Testing Approach. This methodology allows for robust estimation of both short-run and long-run dynamics, making it well suited for datasets with mixed integration orders.

The remainder of the paper is organized as follows: Section 1 presents the literature review. Section 2 outlines the research methodology and model specification. Section 3 provides the empirical analysis. Section 4 concludes with key findings and offers policy recommendations.

## 2- LITERATURE REVIEW

A large and growing body of literature has examined the impact of the blue economy on economic growth in various countries around the world. These studies consistently highlight the strategic importance of blue-economy components as critical drivers of sustainable development. For example, Smith et al. (2018), using OLS regression models to analyze Indonesia's economy, demonstrated a positive relationship between marine investment, coastal tourism, and economic growth. Similarly, Md. Khairul Islam et al. (2018) concluded that Bangladesh can significantly enhance its economic growth by efficiently utilizing its marine resources.

In the same vein, Jannatul I. et al. (2025) explored the relationship between aquaculture production, fisheries production, labor, capital, and economic growth in Bangladesh using the ARDL model. Their findings indicated a positive impact of fisheries and aquaculture production on the country's economic growth. Likewise, Elisha (2019), using the ARDL model for Nigeria, examined the effects of fisheries production and climate change on economic growth. The study revealed that blue-economy activities contribute to food security, sustainable fisheries, renewable energy development, and natural resource preservation in Nigeria.

González (2019) found similar evidence in Morocco, reporting that the blue economy significantly contributes to employment and GDP growth. In Egypt, Ahmed (2020) reported that blue-economy variables exert a positive influence on economic growth. In addition, Majed Alharthi and Imran Hanif (2020), using panel data models, concluded that the blue economy plays an essential role in promoting economic growth in SAARC countries and is crucial for achieving the Sustainable Development Goals.

Opritescu et al. (2020) demonstrated a short-run Granger causality between economic growth and the blue economy in Baltic countries, along with a significant long-run impact of the blue economy on greenhouse gas emissions. A positive and statistically significant effect of blue-economy factors on Pakistan's GDP growth in both the short and long run was confirmed by Tagar et al. (2021). Similarly, Alhamdi et al. (2025) investigated the effects of fish production, aquaculture production, renewable energy, and green innovations on Pakistan's economic growth using Dynamic OLS (DOLS) and Fully Modified OLS (FMOLS). Their findings showed that blue-economy components provide valuable policy implications for fostering higher and more sustainable economic growth in Pakistan.

A large and growing body of literature has examined the relationship between blue-economy activities and economic growth across various countries. Bhattacharya and Dash (2021) studied Asia-Pacific Island countries and found that the expansion of the blue economy is positively influenced by gross fixed capital formation and responds significantly to the implementation of sustainable ocean-governance policies. Similarly, Bădîrcea et al. (2021), using a panel data model for the European Union, found evidence of short-run causality between economic growth and the blue economy, and demonstrated that blue-economy activities have a significant long-run impact on greenhouse-gas emissions. These findings are consistent with the results reported by Martínez-Vázquez et al. (2023) in their study of the EU economy.

In Vietnam, the positive impact of the blue economy on economic growth was confirmed by Huyen et al. (2021). In China, Ahammed and Sufain (2024) conducted an applied study using the ARDL model to analyze the effects of blue-economy variables—such as total fishery production (TFF), agriculture–forestry–fishing (AFF), and aquaculture production (AP)—on economic development. Their findings indicate a positive and significant influence of these variables on China's economic growth.

Mogila et al. (2024), applying Leontief's input–output (I–O) model, examined maritime economic activities in Poland and emphasized the significant and broad influence of the blue economy on Poland's development. Geng et al. (2024), using the Driscoll–Kraay regression technique on ACD nations, also demonstrated the significant role of blue-economy factors in promoting inclusive economic growth.

Further evidence was provided by Salarvand et al. (2025), whose empirical study showed that fisheries, aquaculture production, and maritime transport contribute significantly to Iran's economic growth. Using RLS, 2SLS, and OLS methods applied to EU13 and EU14 countries, Alsaleh and Wang (2025) found that growth in aquaculture output significantly enhances the sustainability of coastal tourism in developed European nations. Similarly, Prasetyo et al. (2025), using OLS for Sumenep Regency, reported that blue-economy activities have the potential to create jobs, raise coastal community incomes, and increase contributions to Gross Regional Domestic Product. Habib et al. (2025) found that Algeria's blue-economy program supports SDG 14 by fostering coastal economic growth and addressing governance, development, and climate challenges.

Collectively, these studies highlight the critical role of blue-economy activities as a primary driver of economic growth across various countries, employing diverse methodological approaches such as ARDL, panel data analysis, Dynamic OLS (DOLS), Fully Modified OLS (FMOLS), and the Leontief input–output model.

In contrast to the majority of findings, Saghrouni (2025) demonstrated a negative impact of the blue economy on Tunisia's economic growth. Likewise, Oyakhilomen (2013), in his analysis of the relationship between fishery production and economic growth in Nigeria from 1970 to 2011, found that fishery production does not significantly influence economic growth—an outcome attributed to low domestic output levels and high import dependence.

Overall, most research on the effects of blue-economy activities on economic growth has been quantitative and has focused primarily on the economic dimension of the blue economy using econometric approaches. However, such studies often overlook the influence of other dimensions—including social, technological, cultural, and governance aspects—on economic growth and sustainable development. This gap highlights a clear need for further research to develop a more holistic understanding of the blue economy's multidimensional impacts.

## 3-METHODOLOGY AND MODEL SPECIFICATION:

### 3.1 Variables definitions and data sources

The objective of the current study is to estimate the long-run and short-run dynamic relationships between the blue-economy variables—Total Fishery Production (TFP) in metric tons, Aquaculture Production (AP) in metric tons, Agriculture, Forestry, and Fishing (AFF) as a percentage of GDP, and Trade Volume (TRD)—and economic growth in Jordan, proxied by gross domestic product per capita (LNEG). Accordingly, these variables will hereafter be referred to as TFP, AP, and AFF, respectively. The study seeks to answer the following key research question: "How does the blue economy impact Jordan's economic growth?" Table 1 presents the definitions of the variables and the data sources. All data were obtained from the World Bank's World Development Indicators (WDI) 2025 database.

**Table (1). Variable definitions and data sources**

| Variables | Variable definitions | Unit | Variable's label | Frequency | Span period | Data sources |
|---|---|---|---|---|---|---|
| Economic growth | GDP per capita growth | GDP per capita (constant 2015 US$ | EG | Annual | 1982-2023 | World Bank, WDI (2025 |
| Total Fishery Production | Annual fish output from capture fisheries | in metric tons | TFP | Annual | 1982-2023 | World Bank, WDI (2025 |
| Aquaculture production | Cultured aquatic species yield under controlled farming | in metric tons | AP | Annual | 1982-2023 | World Bank, WDI (2025 |
| Agriculture, forestry and fishing | Share of primary sector in GDP | of GDP % | AFF | Annual | 1982-2023 | World Bank, WDI (2025 |
| Trade volume | Exports plus imports relative to GDP | of GDP% | TRD | Annual | 1982-2023 | World Bank, WDI (2025 |

### 2.2 Descriptive Statistic

Table (2) shows that the variables exhibit symmetric distributions, with means close to their medians. This is further confirmed by the values of skewness, kurtosis, and the Jarque–Bera test, except for LNTFPJ, which is highly leptokurtic and non-normal (Jarque–Bera $p < 0.001$). This indicates sensitivity to outliers and potential heteroscedasticity. Such characteristics justify the use of the ARDL approach, which is suitable for variables with mixed integration orders and is robust to small sample sizes and non-normal data distributions.

**Table (2). Descriptive statistics**

| | LNEG | LNAPJ | LNAFFJ | LNTFPJ | LNTRDJ |
|---|---|---|---|---|---|
| Mean | 8.268 | 5.659 | 1.355 | 6.633 | 4.722 |
| Median | 8.277 | 6.244 | 1.476 | 6.933 | 4.745 |
| Maximum | 8.505 | 7.925 | 1.980 | 8.142 | 5.007 |
| Minimum | 8.010 | 2.708 | 0.670 | 3.466 | 4.191 |
| Std. Dev. | 0.133 | 1.504 | 0.363 | 1.031 | 0.184 |
| Skewness | -0.160 | -0.481 | -0.259 | -1.279 | -0.694 |
| Kurtosis | 1.871 | 2.112 | 2.064 | 5.073 | 3.211 |
| Jarque-Bera | 2.411 | 2.995 | 2.001 | 18.967 | 3.445 |
| Probability | 0.299 | 0.224 | 0.368 | 0.000 | 0.179 |
| Sum | 56.924 | 237.697 | 347.237 | 133.662 | 278.565 |
| Sum Sq. Dev. | 5.397 | 92.759 | 0.728 | 1.532 | 43.565 |
| Observations | 42 | 42 | 42 | 42 | 42 |

### 2.3 Research Methods and Model Specification

The Autoregressive Distributed Lag (ARDL) approach to cointegration, also known as the bounds testing method, is applied in the present study to estimate both the long-run and short-run relationships among the study variables. This method offers several advantages over other cointegration procedures, particularly because it can be employed as long as none of the variables are integrated of order I(2) (Pesaran et al., 2001). ARDL is also suitable for small sample sizes and for models involving regressors with mixed integration orders, making it an appropriate choice for this study.

To estimate the long-run equilibrium relationship between Total Fishery Production (TFP), Aquaculture Production (AP), Agriculture, Forestry, and Fishing (AFF), and Trade Volume (TRD), and their impact on economic growth in Jordan, the following ARDL model is used:

$$EG = f(TFP, AP, AFF, TRD) \quad (1)$$

The logarithmic-linear specification of the model can be expressed as:

$$LNEG = \propto_0 + \propto_1 LNTFP_{t-i} + \propto_2 LNAP_{t-i} \propto_3 LNAFF_{t-i} + \propto_4 LNTRDJ_{t-i} + \varepsilon_t \quad (2)$$

The conditional Error Correction Model (ECM) representation of the ARDL framework, which captures both the short-run dynamics and the long-run equilibrium adjustment process of economic growth (EG) and its determinants, is specified as follows:

$$\Delta LNEG_t = \propto_0 + \sum \propto_{1i} \Delta LNEG_{t-i} + \sum \propto_{2i} \Delta LNAFF_{t-i} + \sum \propto_{3i} \Delta LNAP_{t-i} + \sum \propto_{4i} \Delta LNTEPG_{t-i} + \sum \propto_{5i} LNTRDJ_{t-i} + \beta_1 LNEG_{t-1} + \beta_2 LNAFF_{t-1} + \beta_3 LNAP_{t-1} + \beta_4 LNTEPG_{t-1} + \beta_5 LNTRDJ_{t-1} + \varepsilon_t \quad (3)$$

Where LNEG, LNTEPT, LNAPJ, LNAFFJ, and LNTRDJ are the variables defined previously; Δ is the first-difference operator; $\alpha_1$, $\alpha_2$, $\alpha_3$, $\alpha_4$, and $\alpha_5$ are the short-run coefficients; $\beta_1$, $\beta_2$, $\beta_3$, $\beta_4$, and $\beta_5$ are the long-run coefficients; and $\varepsilon_t$ is the white-noise error term. The coefficients $\alpha_1$, $\alpha_2$, $\alpha_3$, $\alpha_4$, and $\alpha_5$ are expected to be positive, i.e., $\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5 > 0$.

## 3- EMPIRICAL ANALYSIS

### 3.1 Unit Root Test for Stationary

Before implementing the ARDL bounds test, it is necessary to determine the order of integration of the study variables to ensure that none of them are integrated of order I(2). This is important because Pesaran's F-statistics become invalid when any variable is I(2), which violates the fundamental assumptions of the bounds-testing procedure.

For this purpose, the Augmented Dickey–Fuller (ADF) unit root test was applied. The results confirm that all variables are integrated of order I(0) or I(1). The results are presented in Table (3) below.

**Table (3): the study variables stationarity test results (root test)**

| VAR | I(0) | Decision inference | I(1) | Decision inference |
|---|---|---|---|---|
| LNEG | -1.849 | NS | -3.990*** | I(1) |
| LNAFFJ | -1.813 | NS | -4.045*** | I(1) |
| LNAPJ | -1.307 | NS | -5.286*** | I(1) |
| LNTFP | -3.713*** | I(0) | | |
| LNTRDJ | -2.214 | NS | -5.190 | I(1) |

Note: ***, imply significant at 1%. Source: Author's calculation using E-view.

### 3.2 ARDL Co- integration bound test

Based on the stationarity test results (unit root tests) presented in Table (3), the ARDL modelling approach is employed to capture both the long-run and short-run dynamic relationships among the variables. The existence of a long-run relationship is tested by examining the null hypothesis:

$H0 : \beta_1 = \beta_2 = \beta_3 = \beta_4 \ \beta_5 = 0$ against its alternative $H_1 : \beta_1 \neq 0 , \beta_2 \neq 0, \beta_3 \neq 0 , \beta_4 \neq 0, \beta_5 \neq 0$

The bounds cointegration test results, reported in Table (4), indicate rejection of the null hypothesis at the 1% significance level, as the computed F-statistic (4.415) exceeds the upper critical value (4.37). This confirms a robust long-run cointegration relationship and a stable equilibrium among the variables.

**Table (4). ARDL bound test estimated results (Null hypothesis: No long –run relationship exist**

| Model to be estimated | F- statistics | Critical values | | | Decision inference |
|---|---|---|---|---|---|
| $F_{LNEG}$ (LNAFF, LNAP,LNTFP ,LNTROD) | 4.415 | **Lower bound** | **Upper bound** | **Sig level** | Co-integration |
| | | 2.2 | 3.09 | 10% | |
| | | 2.56 | 3.49 | 5% | |
| | | 2.88 | 3.87 | 2.5% | |
| | | 3.29 | 4.37 | 1% | |

Source: E-views package output

The long-run estimation results, detailed in Table (5), reveal that the coefficients of all explanatory variables are statistically significant at the 1% level and align with the hypothesized positive directions, with the exception of (LNTFP). This indicates that a one percent increase in (LNAFF), (LNAP), and (LNTRDL) leads to an increase in (LNEG) by (0.225), (0.306), and (0.567), respectively.

Meanwhile, (LNTFP) has a negative impact on (LNEG), although it is expected to be positive. This may be due to the following: firstly, its negligible contribution to GDP, because Jordan has a limited water body (mainly the Gulf of Aqaba). Secondly, the high import dependency, since Jordan imports most of its seafood. Thirdly, the low value-added processing, as fisheries production in Jordan is not integrated with value-added industries such as fish canning, freezing, and exports, which weakens its economic multiplier effect. Therefore, an increase in (LNTFP) will lead to a decrease in (LNEG) by (−0.383).

**Table (5): The long-run estimation results**

| Model Estimated | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| LNAFF | 0.225 | 0.068 | 3.285 | 0.003 |
| LNAP | 0.306 | 0.063 | 4.860 | 0.000 |
| LNTFP | -0.383 | 0.134 | -2.843 | 0.009 |
| LNTRD | 0.567 | 0.183 | 3.102 | 0.005 |
| C | 6.106 | 1.325 | 4.606 | 0.000 |

**Source**: E-views package output

The short-run dynamic results and the error correction model (ECM) estimations for the ARDL model are presented in Table (6). The findings indicate that (LNAFF), (LNTRD), and (LNTFP) exert a positive and statistically significant influence on (LNEG) in Jordan. A 1% increase in (LNAFFJ), (LNTFP), and (LNTRD) leads to increases in (LNEG) by (0.086), (0.060), and (0.065), respectively. In contrast, (LNAP) has a negative effect on (LNEG), likely due to its minimal contribution to GDP and Jordan's heavy reliance on fish imports; a 1% increase in (LNAP) results in a (0.103%) decrease in (LNEG). The error correction term, ECM(−1), is estimated at (−0.384), exhibiting the correct negative sign and significance at the 1% level, which suggests a rapid adjustment to equilibrium, with approximately (38%) of the disequilibrium caused by shocks in the previous period corrected within the current period. These results provide robust evidence of a stable long-run cointegration relationship among the model variables (Samreth, 2009).

**Table (6). The Short Run Dynamic Results where LNEG is dependent variable, and LNAFFJ, LNAPJ, and LNTFP are explanatory variables**

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D(LNAP) | -0.103 | 0.021 | -4.928 | 0.000 |
| D(LNTFP ) | 0.060 | 0.026 | 2.306 | 0.031 |
| D(LNTRD) | 0.0651 | 0.042 | 1.523 | 0.142 |
| D(LNAFF) | 0.086 | 0.041 | 2.094 | 0.048 |
| ECM(-1) | -0.384 | 0.067 | -5.727 | 0.000 |

**Source**: E-views package output

**C-THE IMPULSE RESPONSE FUNCTIONS**

Fig. (1) presents the orthogonalized impulse response functions (IRFs) that rigorously evaluate the dynamic effects of structural shocks to (TFP), (AP), (AFF), and Trade Volume (TRD) on Jordan's economic growth. The IRFs show a statistically significant and strong positive response of economic growth to trade shocks (TRD). Shocks to (AP) initially display a delayed effect but gradually generate substantial and positive cumulative impacts, with responses shifting from negative to positive and becoming statistically significant after period four, indicating medium- to long-term growth potential in this sector. Shocks to (AFF) produce statistically inconsequential or moderately negative responses, suggesting structural inefficiencies or weak transmission mechanisms. Positive shocks to AFF begin to exert a slightly negative influence on growth starting in period four, becoming more persistent despite their initial insignificance. Shocks to (TFP) have a detrimental impact on economic growth throughout the entire horizon.

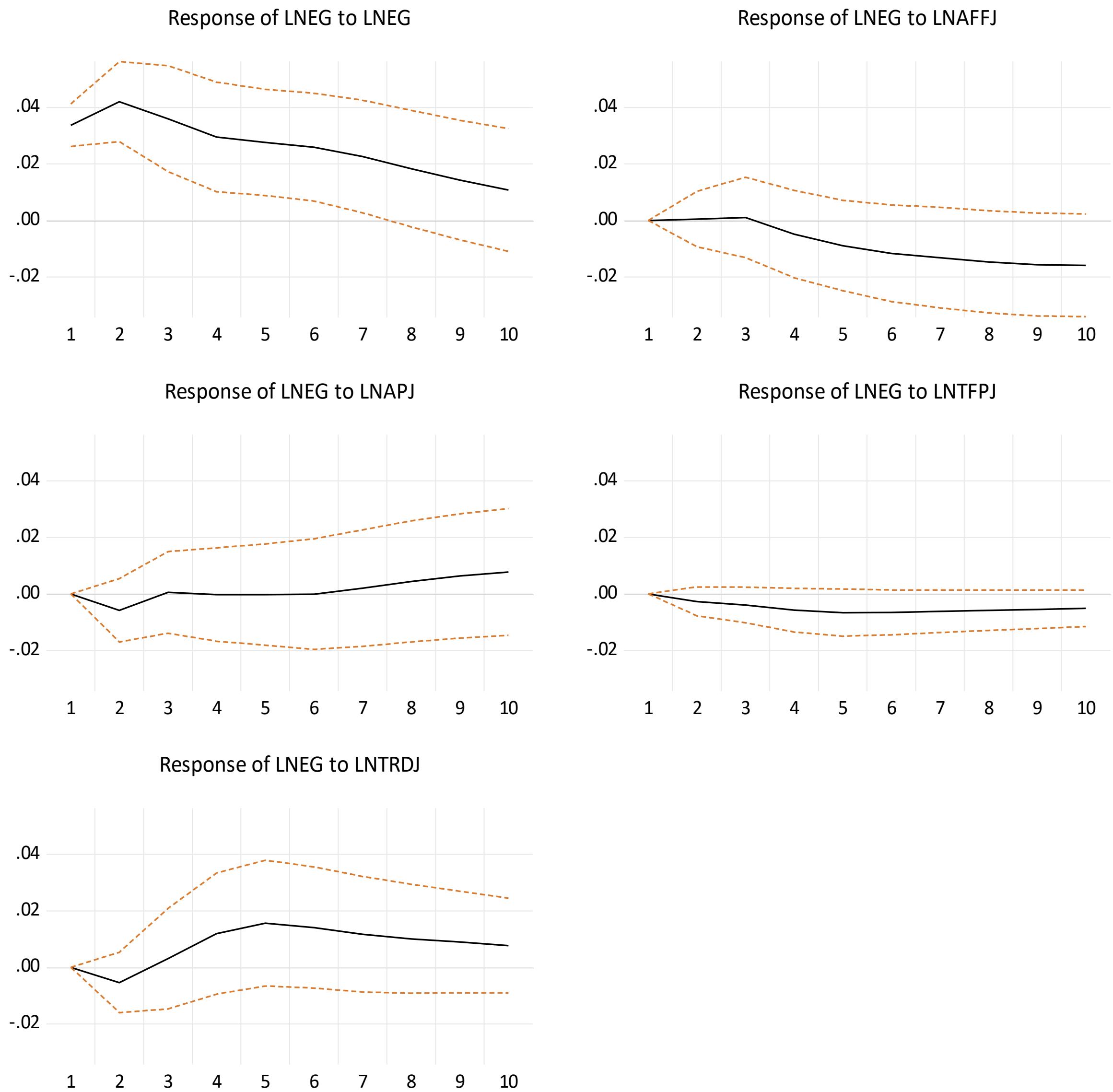


**Figure (1) the impulse response functions**

**D-THE VARIANCE DECOMPOSITION RESULTS**

Table (7) presents the Variance Decomposition results over a ten-quarter horizon, showing the proportion of LNEG forecast error variance explained by shocks to LNAFF, LNAP, LNTFP, and LNTRD. The analysis clearly demonstrates that TFP, AP, AFF, and TRD play diverse but increasingly significant roles in Jordan's economic development. While internal variables initially drive economic growth, external sectoral dynamics gradually take over. Trade volume (TRD) emerges early as a crucial engine of growth, particularly in the short to medium term. Over time, AFF becomes the most significant external contributor, whereas TFP and AP show a slower but noticeable increase in influence, indicating latent potential that could be realized through targeted development strategies and structural reforms in the fisheries and aquaculture sectors.

**Table (7) The Variance Decomposition estimated results**

| Period | SE | LNEG | LNAFF | LNAP | LNTFP | LNTRD |
|---|---|---|---|---|---|---|
| **1** | 0.033 | 100.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| **2** | 0.054 | 97.672 | 0.006 | 1.127 | 0.2346 | 0.959 |
| **3** | 0.065 | 97.772 | 0.0287 | 0.787 | 0.519 | 0.891 |
| **4** | 0.073 | 94.483 | 0.467 | 0.631 | 1.029 | 3.388 |
| **5** | 0.080 | 89.766 | 1.615 | 0.522 | 1.525 | 6.570 |
| **6** | 0.086 | 86.188 | 3.197 | 0.449 | 1.882 | 8.282 |
| **7** | 0.091 | 83.409 | 4.940 | 0.455 | 2.132 | 9.062 |
| **8** | 0.095 | 80.635 | 6.917 | 0.632 | 2.331 | 9.483 |
| **9** | 0.098 | 77.747 | 9.014 | 1.011 | 2.493 | 9.732 |
| **10** | 0.101 | 74.974 | 11.0299 | 1.552 | 2.619 | 9.824 |

**Source**: E-views package output

Several diagnostic tests, including the Breusch–Godfrey Serial Correlation LM test, the skewness and kurtosis test, and the Breusch–Pagan–Godfrey heteroskedasticity test, have confirmed the model's robustness. All diagnostic tests indicate that the model possesses sound econometric properties, with residuals that are serially uncorrelated and normally distributed, and with no evidence of heteroskedasticity. The results of the diagnostic tests are presented in Table (8).

The Breusch–Godfrey test results reveal no indication of serial correlation up to two lags, as both the F-statistic and Obs*R-squared p-values exceed the 5% significance level, indicating error-term independence and consistent coefficient estimation. The Breusch–Pagan–Godfrey test confirms homoskedasticity, implying constant error variance and allowing for efficient inference. Furthermore, the CUSUM and CUSUM of Squares tests indicate parameter stability and the absence of structural breaks, demonstrating the model's stability and robustness in analysing the drivers of Jordan's economic growth. The results are shown in Figures (2) and (3).

**Table (8) Results of Diagnostic Test**

| Item prob | Test Applied | F-statistic | Prob | Obs*R-squared | Prob. Chi-Square |
|---|---|---|---|---|---|
| Serial Correlation | Breusch-Godfrey Serial Correlation LM Test | 1.303112 | 0.2949 | 4.583703 | 0.1011 |
| Heteroscdasticity | Heteroskedasticity Test: Breusch-Pagan-Godfrey | 1.648685 | 0.1404 | 21.15708 | 0.1726 |
| Normality | Test of Skewness and Kurtosis | Jarque-Bera | 0.8851013 | | |

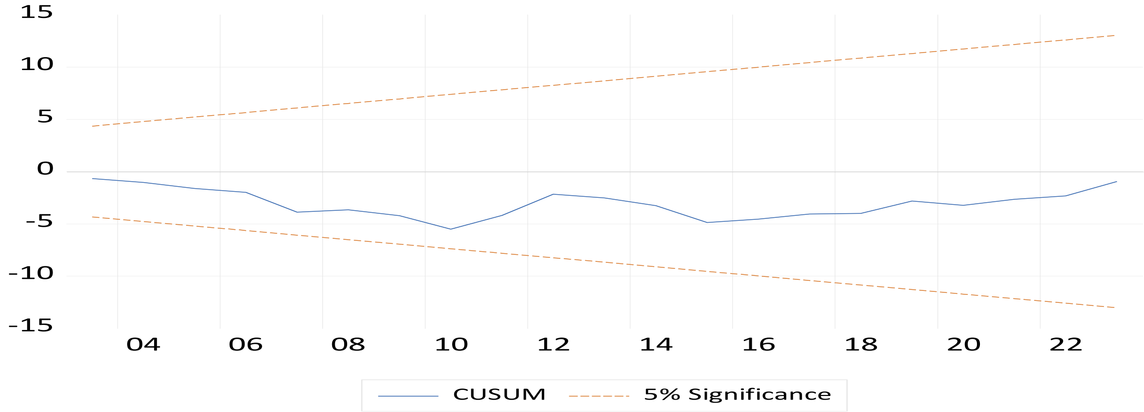


**Figure 2 Plot of Cumulative Sum of Recursive Residuals**

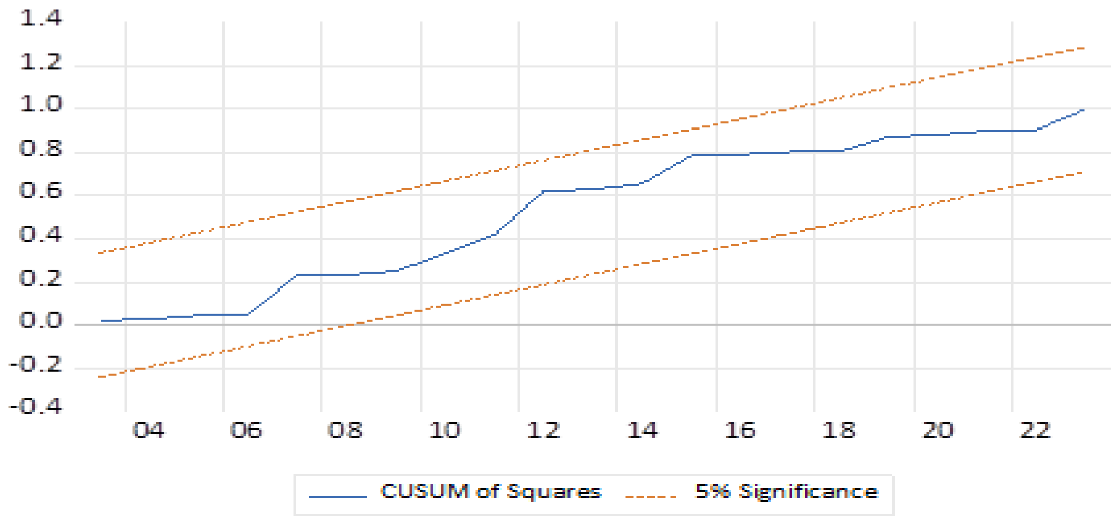


**Figure 3 Plot of Cumulative Sum of Squares of Recursive Residuals**

## 4-CONCLUSIONS AND POLICY RECOMMENDATION

This article explores the impact of the blue economy on Jordan's economic growth using the ARDL model (the bounds testing approach) and annual data from 1982 to 2023. The study variables—Total Fishery Production (TFP), Aquaculture Production (AP), Agriculture, Forestry, and Fishing (AFF), Trade Volume (TRD), and Economic Growth in Jordan (LNEG)—are found to be integrated of order I(0) or I(1) based on the Augmented Dickey–Fuller (ADF) unit root test. The empirical results show that AP, AFF, and TRD exhibit a long-run equilibrium relationship and have significant and expected impacts on economic growth.

In contrast, LNTFP has a negative effect on LNEG, which can be attributed to its negligible contribution to GDP due to Jordan's limited water bodies (primarily the Gulf of Aqaba), high dependency on seafood imports, and the weak integration of fisheries production with value-added processing industries such as canning, freezing, and exporting, resulting in a low economic multiplier effect. The findings of the current study are consistent with the results of previous studies such as Ahmed (2020), Majed Alharthi and Imran Hanif (2020), Huyen et al. (2021), Sarwar (2022), Hammoud Saad Muhaimid et al. (2022), Ahammed and Sufain (2024), Geng et al. (2024), Jannatul I. et al. (2025), He, Alhamdi et al. (2025), and Alsaleh and Wang (2025).

The CUSUM and CUSUMSQ tests were employed to assess the stability of both short-run and long-run coefficients in the ARDL error-correction model, and the results suggest that the model is structurally stable. Diagnostic tests further indicate that the model exhibits sound econometric properties, with residuals that are serially uncorrelated and normally distributed, and no evidence of heteroskedasticity.

The error-correction term, ECM(−1), is found to be negative and statistically significant. Its coefficient indicates that approximately 38% of the previous year's disequilibrium in LNEG from its long-run equilibrium path is corrected within the current year. Based on these findings, the study recommends increased investment in sustainable aquaculture and fish-processing industries, alongside the enforcement of robust measures to protect marine resources.

**Study limitations**

This current study is limited by its inability to analyze the impact of other blue-economy activities, such as marine tourism, maritime transport, and technological innovation in aquaculture, on economic growth in Jordan due to data unavailability. As a result, the findings of this study should be interpreted with caution. Therefore, future research is encouraged to address this gap by investigating the contribution of these omitted variables to economic growth in Jordan

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