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RESEARCH ARTICLE ARAŞTIRMA MAKALESİ

Growth from the sea: The impact of the blue economy on growth in Türkiye

Denizden gelen büyüme: Türkiye'de mavi ekonominin büyüme üzerindeki etkisi

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Abstract: This study aims to examine the effects of some key indicators of the blue economy on economic growth in Türkiye for the period 1990-2022. For this analysis, the ARDL approach is employed. In the study, gross domestic product (GDP) is used as the dependent variable, while aquaculture production (AP), total fisheries production (TFP), labor force (LF), and gross fixed capital formation (GFC) are used as independent variables. According to the findings, there is a long run cointegration relationship between the variables. Moreover, the positive effect of the AP variable is not statistically significant. On the other hand, the coefficients of TFP, LF and GFC variables are positive and show positive and significant effects on economic growth. These results suggest that certain components of the blue economy can contribute to Türkiye's economic growth.

Keywords: Blue economy, economic growth, total fisheries production, ARDL, Türkiye

Öz: Bu çalışma, Türkiye'de 1990-2022 dönemi için mavi ekonomi kapsamında yer alan bazı temel göstergelerin ekonomik büyüme üzerindeki etkilerini incelemeyi amaçlamaktadır. Bu inceleme için ARDL tekniği kullanılmıştır. Analizde bağımlı değişken olarak gayrisafi yurt içi hasıla (GSYH) kullanılırken, bağımsız değişkenler olarak su ürünleri yetiştiriciliği üretimi (AP), toplam balıkçılık üretimi (TFP), iş gücü (LF) ve sabit sermaye yatırımları (GFC) kullanılmıştır. Sonuçlara göre değişkenler arasında eşbütünleşme ilişkisi olduğu görülmektedir. Ayrıca AP değişkeninin pozitif yönlü etkisi istatistiksel olarak anlamlı bulunmamıştır. Buna karşılık, TFP, LF ve GFC değişkenlerinin katsayıları pozitif olup, ekonomik büyüme üzerinde pozitif ve anlamlı etkiler göstermektedir. Bu sonuçlar, mavi ekonominin belirli bileşenlerinin Türkiye'nin ekonomik büyümesine katkı sağlayabileceğini ortaya koymaktadır.

Anahtar kelimeler: Mavi ekonomi, ekonomik büyüme, toplam balıkçılık üretimi, ARDL, Türkiye

INTRODUCTION

Oceans, seas, and coastal regions make up the largest ecosystems, occupying two-thirds of the Earth's surface. These ecosystems are extremely important for the world and the global population. Because the oceans are home to millions of species and serve as a vital food source for millions of people. Many countries are therefore dependent on the oceans (Ahammed et al., 2024). This dependence increases the strategic importance of sea-based economic activities every day. The ocean economy plays a critical role in economic growth (EG) and environmental action through channels such as mining, fisheries, tourism, mariculture, transportation, and logistics. This sector employs 31 million people worldwide and provides an annual economic contribution of USD 1.5 trillion (Nham and Ha, 2023; Akhtar et al., 2025). Therefore, the resources of the oceans and their sustainable management have become a fundamental building block of global economies.

Especially in recent years, factors such as technological developments, which have made it more feasible to utilize the ocean environment, and the rapid depletion of terrestrial resources have drawn humanity deeper into the blue planet. In this context, the concept of "Blue Economy (BE)", which is widely used in the literature on the management of seas and oceans, has become one of the popular topics of recent years (Bădîrcea et al., 2021; Martínez-Vázquez et al., 2021).

Although there is still no clear universally accepted definition of the term BE, various definitions have been proposed by different researchers in the literature. In some studies, the BE is defined as the utilization of ocean and marine resources for economic purposes, with an emphasis on promoting sustainability; in others, it is interpreted more broadly to encompass all economic activities in the maritime sector, regardless of whether they are sustainable or not (WWF, 2018).

The BE is defined by Sarker et al. (2018) as an economic growth model based on the sustainable use of marine resources, supported by technological inputs, to meet the increasing demand for labour and improve livelihoods without compromising the health of the ocean ecosystem. According to the European Commission (2018), the blue economy is a set of interconnected economic activities encompassing both existing and emerging sectors associated with oceans, seas and coasts (Hossain et al., 2024).

Ahammed et al. (2024) define the blue economy as a concept that encompasses various industries such as

aquaculture, marine transportation, tourism, renewable energy, and marine biotechnology. Similarly, Liza et al. (2025) describe the blue economy as the responsible use of marine resources to improve livelihoods, create jobs, and stimulate economic growth. Considering all these definitions, it can be said that the blue economy is not limited to individual sectors, but rather represents a comprehensive, multidimensional framework that includes intersectoral relationships (Stephenson and Hobday, 2024). Moreover, these definitions show that the contribution of the blue economy and all sectors related to the blue economy to economic production and employment is undeniably important (Usluer, 2024).

The name blue economy was first used during the 2009 convention of the US Senate Committee on Commerce, Science, and Transportation. The International Symposium on the Blue Economy Initiative for Green Growth was held in Korea in the same year. Later on, the concept of blue economy started to be used more widely with Gunter Pauli's book, "The Blue Economy" published in 2010. In 2012, oceans were recognized as a priority area at the United Nations Conference on Sustainable Development in Rio de Janeiro (Scholaert et al., 2020; Voyer et al., 2018). There is no doubt that ocean resources provide significant benefits to the world economy (Martínez-Vázquez et al., 2021).

Although the blue economy has been conceptualized in different ways, it is generally associated with three key elements: First, to meeting the growing demands of the human population for food, energy and marine services; second, contributing to economic growth; and third, supporting environmental and social sustainability (Bădîrcea et al., 2021; Stephenson and Hobday, 2024). The importance of the blue economy can be evaluated from various perspectives. It has great potential for expanding the global economy and creating new employment opportunities, especially for developing countries in coastal areas. Sustainable ocean resource development offers significant opportunities to boost economic growth and employment. In this way, the blue economy can create new jobs and contribute to the diversification of coastal economies (Ahammed et al., 2024). At the same time, the blue economy supports food security, protects and manages the ocean ecosystem. It also offers a wide diversity of new resources to contribute to human well-being, such as energy, pharmaceuticals, chemicals, food and minerals (Ninawe, 2017). Thus, despite being a relatively new concept, the blue economy is of great importance, considering the economic contributions of oceans and the resources they provide for humanity (Sarker et al., 2018).

The blue economy has gained attention in the global literature in recent years as a new generation development model based on the sustainable use of marine and ocean resources. Although there are different interpretations of what this concept means, it has become increasingly prominent worldwide since it was first used (Ahammed et al., 2024; Silver et al., 2015). Although the conceptual framework of the blue economy is open to different interpretations, it is generally defined as a holistic approach that simultaneously aims to conserve marine resources, create employment, improve living standards, and foster economic growth. In this context, empirical studies have demonstrated the positive impact of blue economy components on economic growth across various countries and time periods. For instance, country-specific analyses conducted in Finland and Estonia (Ashyrov et al., 2018), Pakistan (Jawaid et al., 2019; Rehman et al., 2019), Türkiye (Eyüboğlu and Akmermer, 2023), China (Ahammed et al., 2024), and Bangladesh (Liza et al., 2025) have confirmed the contributions of fisheries, aquaculture, capital accumulation, and labor—key elements of the blue economy—to economic growth using ARDL and cointegration techniques. On the other hand, studies employing panel data methods on multiple country groups such as SAARC countries (Alharthi and Hanif, 2020), the European Union (Fratila et al., 2021), and Gulf countries (Sarwar, 2022) have emphasized the significant role of maritime transport and trade in driving economic growth.

In the case of Türkiye, most of the existing studies remain at the conceptual level, focusing on the theoretical foundations (e.g., Çoban and Ölmez, 2016, Eminçe Saygı, 2024) and practical applications (e.g., Toplu Yılmaz, 2021; Suluk, 2022; Tayyar, 2023) of the blue economy. Given the limited number of quantitative studies (e.g., Eyüboğlu and Akmermer, 2023), the present research aims to contribute to the literature both thematically and methodologically. However, there remains a significant gap in empirical research that quantitatively examines the macroeconomic implications of the blue economy within the context of Türkiye. Therefore, the concept of blue economy is very important for Türkiye, which has the status of a developing country. As a country surrounded by seas, Türkiye has significant potential in this field. Sectors such as fishing, maritime transportation, tourism, and maritime industry provide job opportunities for millions of people. As the blue economy develops these areas, it is an undeniable fact that both employment and economic contributions will rise. In summary, Türkiye's extensive sea territory and the close ties between its people and business make it an ideal candidate for the blue economy. Therefore, the aim of this study is to investigate the impact of blue economy factors on Türkiye's economic growth. Examining these relationships is important, as the results can provide valuable insights for researchers and policymakers. Accordingly, this study seeks to answer an important scientific question: How does the BE affect Türkiye's EG? This research employs an ARDL model to investigate the relationship between the components of Türkiye's blue economy and economic growth. Specifically, the study aims to: (i) explore the short-term effects of the blue economy on economic growth, (ii) analyse the long-term effects of the blue economy on economic growth, and (iii) formulate policy recommendations based on the empirical findings.

This study arose from the need to analyze the impact of the blue economy on the Turkish economy with numerical data, focusing on Türkiye's marine resources and the sectors directly or indirectly affected by these resources (fisheries, maritime

transportation, tourism, maritime industry, etc.). In this context, the study aims to help relevant policy makers create more holistic and sustainable development plans by examining both the short- and long-term dimensions of the impact of the blue economy on economic growth. This study makes three main contributions to the literature: First, it fills an important gap at the country level, as it is one of the rare studies that quantitatively analyze the relationship between the blue economy and economic growth in Türkiye. Second, the separation of both short- and long-term effects through the ARDL model contributes to the methodological diversity in the literature and provides a solid methodological basis for future studies. Third, the empirical findings obtained will contribute to both the development of local policy recommendations and a better understanding of the economic role of the blue economy in developing countries.

In the present study, GDP is the dependent variable and AP, TFP, LF and GFC are the independent variables. This variable selection is theoretically compatible with the Solow Growth Model, which forms the basis of neoclassical growth theory. The Solow economic growth model was first put forward in 1956. According to the Solow model, economic growth is a function of production factors such as capital accumulation, labor supply and exogenously assumed technological development. Accordingly, while fixed capital investments and labor supply included in the study represent the basic production factors in the Solow model, sector-based production components such as aquaculture and fisheries production are evaluated as elements contributing to the capital-labor interaction as economic activities that increase the productivity of sectors. Thus, the contribution of blue economy components to economic growth within the scope of the model has been empirically tested on the basis of Solow's production function approach (Dykas et al., 2023; He et al., 2025). Here, a comprehensive analysis is adopted, considering several blue economy components such as aquaculture and fisheries. Important implications for sustainable growth in Türkiye, a coastal and maritime country, are provided. This expands knowledge on the relationship between the blue economy and economic growth. In general, there are studies on the impact on the BE worldwide, but not enough empirical studies in Türkiye. To the author's knowledge, there has not been much research on the link between blue economy and economic growth. This study will be a small but important attempt to fill this gap.

MATERIALS AND METHODS

Dataset and model

This study aims to investigate the impact of blue economy factors on economic growth. GDP is employed as the dependent variable, while AP, TFP, LF and GFC are independent variables. Owing to data availability, the sample period spans from 1990 to 2022. Detailed variable definitions and descriptive statistics of the data are presented in Tables 1 and 2, respectively.

Table 1. Variables used in the model

Variable	Description	Source
GDP	GDP (constant 2015 US$)	World Bank (2017)
AP	Aquaculture production (metric tons)	
TFP	Total fisheries production (metric tons)	
LF	Labor force, total	
GFC	Gross fixed capital formation (annual % growth)	

Note: Except for GFC, all other variables are in natural logarithmic form.

A model that looks at both short-term and long-term interactions between these variables was developed in order to explain the relationship between economic growth and blue economy.

The functional form of the model is:

$$GDP = f(AP, TFP, LF, GFC) \quad (1)$$

The econometric form of the model is:

$$GDP_t = a_1 + a_2 AP_t + a_3 TFP_t + a_4 LF_t + a_5 GFC_t + \mu_t \quad (2)$$

The variables used in this study are based on the research conducted by Liza et al. (2025). Liza et al. (2025) used the case of Bangladesh in their study. The current study is of great importance for Türkiye. Because Türkiye is a coastal country, especially on the seas. For Türkiye, the BE holds many opportunities that can contribute to economic growth. Research in this field can help Türkiye to develop sustainable growth strategies by making the best use of its potential. In this context, this study will contribute to the literature.

GDP (constant 2015 US$): The value of all goods and services generated by all of a nation's producers, including product taxes but excluding subsidies, is its GDP. It is expressed in 2015 US dollars. GDP is utilised in this study as a stand-in variable for economic growth.

Aquaculture production (AP): Aquaculture refers to the cultivation of aquatic animals for human consumption, including fish, molluscs, crabs, and aquatic plants. It is typically measured in metric tonnes. The aquaculture sector not only generates income and profits but also supplies a significant portion of the world's protein demand. In addition, aquaculturists play a vital role in developing and implementing environmentally sustainable production methods, such as the formulation of aquafeed (Liza et al., 2025).

Total Fisheries Production (TFP): A country's total fisheries production, measured in metric tonnes, epresents the volume of aquatic species harvested for commercial, industrial, recreational, and subsistence purposes. This includes fish produced through aquaculture, mariculture, and other techniques (Liza et al., 2025).

Labor Force (LF): The annual impact of the labor force on Türkiye's GDP is measured using the labor force population expressed in millions.

Gross fixed capital formation (GFC): The impact of capital growth on Türkiye's GDP is measured by the annual gross fixed capital formation rate expressed as a ratio of GDP.

Table 2. Descriptive statistics

	GDP	AP	TFP	LF	GFC
Mean	11.7422	4.9687	5.7859	7.4081	6.7502
Median	11.7497	5.1117	5.7978	7.3722	7.3276
Max.	12.0771	5.7116	5.9293	7.5450	31.9186
Min.	11.4605	3.7620	5.5620	7.3055	-27.0099
Std.Dev.	0.1912	0.5391	0.0814	0.0732	13.8505
Skewness	0.1749	-0.7336	-0.7361	0.4848	-0.5806
Kurtosis	1.7382	2.5900	4.1733	1.8407	2.8748
Jarque-Bera	2.3573	3.1910	4.8740	3.1410	1.8758
Prob.	0.3076	0.2028	0.0874	0.2079	0.3914
Sum	387.4940	163.9699	190.9360	244.4699	222.7583
SumSq.Dev.	1.1705	9.3004	0.2121	0.1715	6138.822
Obs.	33	33	33	33	33

The central tendencies of the distributions of the variables are quite close to each other. Especially, GDP, AP, TFP, and LF variables seem to be symmetrically distributed. The highest volatility is observed in GFC (13.85). This indicates that fixed capital formation is much more volatile than other variables. The other variables have quite low standard deviations. TFP and AP are negatively skewed, indicating left-tailed distributions. GFC is also negatively skewed, but less pronounced. GDP and LF are positively skewed, but at a low level (close to zero). In terms of the assumption of a normal distribution, only the p-value of TFP is close to statistically significant at the 10% level (p=0.087), indicating the possibility of deviation from a normal distribution. The p-values for the other variables are above the 5% significance level, indicating that the assumption of normal distribution cannot be rejected.

Method

In this study, the long-term effects of some basic indicators of the blue economy in Türkiye on economic growth were analyzed with the ARDL model (Pesaran et al., 2001). However, before the model was established, the selection of variables used in the study was explained with theoretical foundations.

The theoretical background of the model is based on Solow (1956)'s neoclassical growth model and endogenous growth theories. According to the Solow model, economic growth is a function of capital accumulation, labor force and external technological progress. Endogenous growth models explain growth with the internal dynamics of the economy, which are human capital, productivity and sector-based production increases.

In this direction, GDP, which is included as the dependent variable, is the basic indicator of economic growth. The independent variables are theoretically based as follows: Aquaculture and total fisheries production, as natural resource-based production sectors, are productivity-oriented components of the blue economy. These activities contribute to growth both through output increase and foreign trade and employment. Labor force is the basic input that is directly included in Solow's production function. Fixed capital formation represents physical capital investments and is the main growth variable explaining capital deepening. Using these variables within the framework of the ARDL model allows the relationship between blue economy components and economic growth to be tested empirically, but also to present a theoretically justified model.

In this study, the long-run impact of blue economy factors on economic growth is analyzed with the ARDL test. In this approach, although it is not mandatory to test whether the variables in the specified regression model carry a unit root, none of the variables should be stationary at the I(2) level. Therefore, in this study, the stationarity of the series was analyzed using the ADF and PP unit root tests. The Augmented Dickey-Fuller (ADF) test, developed by Dickey and Fuller, is an improved version of the DF unit root test that measures whether time series contain a unit root. The PP test, developed by Phillips and Perron, differs from the ADF test in that the error terms are not statistically independent, there is weak dependence between them, and they have a heterogeneous distribution rather than a homogeneous distribution (Pata et al., 2016).

One of the most important advantages of the ARDL test developed by Pesaran et al. (2001) is that it can be applied regardless of whether the series used in the model are fixed at the I(0) or I(1) level, unlike Engle-Granger and Johansen cointegration. However, this test cannot be used for I(2) forms. The assumptions for determining the cointegration relationship in the ARDL method are as follows:

$H_0 : \beta_1 = 0$ (There is no cointegration),

$H_1 : \beta_1 \neq 0$ (There is cointegration).

One of the important advantages of this model is that it has better statistical properties than the Granger test and can be applied to small samples thanks to the unrestricted error correction model (UECM) used in the ARDL method. Compared to Engle-Granger and Johansen analysis, this test is reported to provide more reliable results (Narayan and Narayan, 2005). The ARDL test consists of a three-stage structure (Pesaran et al., 2001). In the first stage, cointegration between variables is tested using the bounds test method. In

this context, an unrestricted error correction model (UECM) is constructed. The UECM, represented by Equation 3, is subjected to the bounds test in this study.

$$\Delta \ln GDP = \alpha_0 + \sum_{i=1}^{j} \alpha_{1i} \Delta lnGDP_{t-i} + \sum_{i=0}^{k} \alpha_{2i} \Delta lnAP_{t-i} + \sum_{i=0}^{l} \alpha_{2i} \Delta lnTFP_{t-i} + \sum_{i=0}^{m} \alpha_{2i} \Delta \ln LF_{t-i} + \sum_{i=0}^{n} \alpha_{2i} \Delta GFC_{t-i} + \beta_0 lnGDP_{t-1} + \beta_1 lnAP_{t-1} + \beta_2 lnTFP_{t-1} + \beta_3 lnLF_{t-1} + \beta_4 GFC_{t-1} + \varepsilon_t \quad (3)$$

In Equation (3), Δ is the difference operator, α_0 is the constant term, ε_t is the random error term, $\alpha_{1\ldots4}$ and $\beta_{1\ldots4}$ are the coefficients. In addition, the ideal delay times selected by the information criterion are shown as j,k,l,m,n.

Using the level equations to estimate the long-run coefficients is the second step of the ARDL bounds test. In the last step, an error correction model is constructed. Thus, it is tested whether the deviations that occur in the short run stabilize in the long run. The error correction model is given below. In this equation, ϑECT_{t-i} is the error correction term and ϑ is the multiple of the error correction term. For the error correction model to work correctly, the coefficient of the error correction term should be negative, less than 1 and statistically significant.

$$\Delta lnGDP = \theta_0 + \sum_{i=1}^{a} \theta_{1i} \Delta lnGDP_{t-i} + \sum_{i=0}^{b} \theta_{2i} \Delta lnAP_{t-i} + \sum_{i=0}^{c} \theta_{2i} \Delta lnTFP_{t-i} + \sum_{i=0}^{d} \theta_{2i} \Delta \ln LF_{t-i} + \sum_{i=0}^{e} \theta_{2i} \Delta GFC_{t-i} + \vartheta ECT_{t-i} + \varepsilon_t \quad (4)$$

Analysis stages were carried out in line with the equations created. Information on the analysis results is explained in the next section of the study.

RESULTS

Economic series often exhibit a non-stationary structure. When analyzed with such series, the F and t statistical values obtained reveal misleading results. Therefore, it is very important to examine the stationarity of the variables before proceeding to time series analysis. In the literature, many unit root test methods are used to test stationarity. In particular, ADF (Augmented Dickey-Fuller) and PP (Phillips-Perron) unit root tests are frequently used to investigate the stationarity of macroeconomic variables (Dickey and Fuller, 1981). In this study, unit roots were tested with ADF and PP approaches before investigating the cointegration relationship between the series. In these tests, the null hypothesis (H_0: ρ=0) assumes that the variables contain unit root. The alternative hypothesis (H_1: ρ=1) rejects the unit root hypothesis.

Table 3. Findings on the stationarity level of the series

	Variables	ADF				PP				
		Level		First Difference		Level		First Difference		
		Test ist.	Prob	Test ist.	Prob	Test ist.	Prob	Test ist.	Prob	Result
Constant	GDP	0.5639	0.9863	-5.7336	0.0000	1.8208	0.9996	-6.7959	0.0000	I(1)
	AP	-3.8766	0.0057			-3.8766	0.0057			I(0)
	TFP	-2.5739	0.1087	-6.6346	0.0000	-2.4100	0.1470	-7.0787	0.0000	I(1)
	LF	0.4912	0.9837	-5.7445	0.0000	0.5664	0.9864	-5.7445	0.0000	I(1)
	GFC	-6.0548	0.0000			-6.0703	0.0000			I(0)
Const. + trend	GDP	-2.5952	0.2847	-5.7175	0.0003	-2.5075	0.3226	-7.6831	0.0000	I(1)
	AP	-2.4204	0.3626	-3.7311	0.0350	-2.5141	0.3196	-3.7311	0.0350	I(1)
	TFP	-3.4563	0.0617	-6.5931	0.0000	-3.2492	0.0932	-7.0280	0.0000	I(1)
	LF	-1.5411	0.7935	-5.9121	0.0002	-1.5093	0.8052	-5.9163	0.0002	I(1)
	GFC	-5.9710	0.0001			-5.9857	0.0001			I(0)

When the stationarity of the series is checked, according to the ADF and PP test results, the degree of integration of the series are I(0) or I(1) and there is no series with I(2) degree of integration. This result indicates that there is no problem in terms of using the autoregressive distributed lag (ARDL) bounds test approach. If the variable becomes stationary [I(2)] by taking the difference for the second time, this method cannot be used (Pesaran et al., 2001).

In the ARDL bounds test, as in unit root tests, AIC is used to determine the appropriate lag length for our limited number of observations. Accordingly, the most appropriate lagged model is the ARDL (2, 4, 3, 4, 4) model. Table 4 reports the estimation results of the ARDL (2, 4, 3, 4, 4) model and the diagnostic test results of the model.

Table 4 presents the diagnostic test results for the estimated ARDL (2, 4, 3, 4, 4) model. According to these results, the R2 value was found to be high in the context of the sample analyzed. This indicates that the independent variable has a high explanatory power for the dependent variable. In addition, (i) the Jarque-Bera test shows that the error terms in the model are normally distributed, (ii) the Breusch-Godfrey test shows that there is no autocorrelation problem in the model, (iii) the Breusch-Pagan-Godfrey test shows that there is no variance problem in the model, and (iv) the Ramsey Reset test shows that there is no model building error. These findings indicate that there is no statistical problem in the estimation results of the model.

Table 4. ARDL selected model: ARDL (2, 4, 3, 4, 4) estimation results

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
GDP(-1)	0.072975	0.226283	0.322497	0.7565
GDP(-2)	0.732882	0.218635	3.352076	**0.0122**
AP	-0.003694	0.031148	-0.118598	0.9089
AP(-1)	-0.025867	0.045493	-0.568598	0.5874
AP(-2)	0.119904	0.044524	2.692989	**0.0310**
AP(-3)	-0.050081	0.047425	-1.056001	0.3260
AP(-4)	-0.037793	0.031872	-1.185769	0.2744
TFP	0.021551	0.025023	0.861263	0.4176
TFP(-1)	0.064980	0.028774	2.258264	**0.0585**
TFP(-2)	0.069458	0.022298	3.114964	**0.0170**
TFP(-3)	0.039731	0.029764	1.334851	0.2237
LF	0.514766	0.138250	3.723437	**0.0074**
LF(-1)	0.115146	0.129930	0.886216	0.4049
LF(-2)	-0.023015	0.107109	-0.214873	0.8360
LF(-3)	-0.219119	0.152831	-1.433738	0.1948
LF(-4)	0.156806	0.123353	1.271200	0.2443
GFC	0.001293	7.79E-05	16.60493	**0.0000**
GFC(-1)	0.001467	0.000319	4.600418	**0.0025**
GFC(-2)	0.000396	0.000127	3.120172	**0.0168**
GFC(-3)	0.000137	0.000116	1.175198	0.2783
GFC(-4)	0.000194	9.85E-05	1.972431	**0.0892**
C	-2.899264	0.598565	-4.843693	**0.0019**
Diagnostic test results				
Normality (JB)			1.053662 (0.59)	
B-G Serial Cor. LM			2.561415 (0.17)	
Heteroskedasticity (Breusch-Pegan-Godfrey))			0.657846 (0.78)	
Ramsey RESET			0.094324 (0.76)	
F-stat			3398.933 (0.000)	
R2			0.99	

After analyzing the diagnostic test results of the estimated model, a bounds test was performed to determine whether the series are cointegrated. For cointegration to be established, the F value must exceed the upper critical value. Detailed information on the test results is presented in Table 5.

Table 5. ARDL bounds testing results

F-Bounds Test				
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	11.94368	10%	2.2	3.09
K	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

According to the results of the bounds test for the model with k=4 independent variables in Table 5, the F statistic is calculated as 11.94368. This value is greater than the upper bound critical values at all significance levels. According to this result, the null hypothesis of no cointegration is rejected. Therefore, it is seen that there is a cointegration relationship between the variables.

After determining the long-run relationship between the variables, the next stage of the ARDL model was started. In this stage, the short-run relationship between the variables is investigated within the framework of the error correction model (ECM). It is important to assess the functioning of the error correction mechanism, which indicates the speed at which deviations from the long-run equilibrium caused by any shock are corrected. The estimation results of the short-run error correction regression are presented in Table 6.

Table 6. Short-run error correction regression estimation results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP(-1))	-0.732882	0.148629	-4.930948	**0.0017**
D(AP)	-0.003694	0.018013	-0.205082	0.8433
D(AP(-1))	-0.032030	0.019893	-1.610080	0.1514
D(AP(-2))	0.087874	0.018307	4.799964	**0.0020**
D(AP(-3))	0.037793	0.018914	1.998180	**0.0858**
D(TFP)	0.021551	0.011994	1.796815	0.1154
D(TFP(-1))	-0.109189	0.014226	-7.675114	**0.0001**
D(TFP(-2))	-0.039731	0.017493	-2.271296	**0.0574**
D(LF)	0.514766	0.058525	8.795673	**0.0000**
D(LF(-1))	0.085328	0.057492	1.484156	0.1813
D(LF(-2))	0.062313	0.052964	1.176508	0.2778
D(LF(-3))	-0.156806	0.065282	-2.401970	**0.0473**
D(GFC)	0.001293	4.62E-05	28.01697	**0.0000**
D(GFC(-1))	-0.000727	0.000121	-6.016666	**0.0005**
D(GFC(-2))	-0.000331	7.04E-05	-4.700097	**0.0022**
D(GFC(-3))	-0.000194	5.11E-05	-3.806606	**0.0067**
CointEq(-1)*	-0.194143	0.017516	-11.08374	**0.0000**

According to the results in Table 6, while the AP variable affects economic growth negatively in the first and 1st lagged period, it affects it positively in the 2nd and 3rd lagged period. The effects in the 2nd and 3rd lagged period are statistically significant. This situation suggests that investments in aquaculture and production growth may create pressure on growth in the short term due to adaptation processes, infrastructure preparations or temporary costs. However, over time, this sector has positive and permanent effects on economic growth thanks to its contribution to productivity growth, employment creation and foreign trade revenues. On the other hand, TFP variable affects economic growth positively in the first period but negatively in the 1st and 2nd lagged periods. It is statistically significant in the negative periods. While the increase in production in the first period seems to support growth, the negative effects experienced in the later periods can be explained by the depletion of stocks, increases in production costs or the negative effects of environmental factors on fishing productivity. The LF variable affects economic growth positively until the 3rd lagged period and negatively in the 3rd period. However, it is statistically significant only in the first and 3rd lagged periods. These results suggest that the contribution of labor to economic growth is generally positive and significant, but short-term fluctuations or changes in labor quality and productivity over time can temporarily negatively impact growth. Finally, GFC variable affects economic growth positively in the first period and negatively in the 1st, 2nd and 3rd lagged periods. It is statistically significant in all periods. While the positive impact of the GFC in the first period may indicate that investments made an immediate contribution to growth, the negative effects observed in later lagged periods may be due to factors such as

investment expenditures causing temporary economic fluctuations, inefficiencies in capital use or short-term financing costs suppressing growth.

On the other hand, the ECM is found to be negatively signed and statistically significant, in line with expectations. According to this finding, the error correction mechanism works in the model. Accordingly, the ECT coefficient indicates that 19% of an imbalance caused by a shock to the system in the relevant period will be closed after one period. The findings of the long-run coefficients obtained by estimating the ARDL (2, 4, 3, 4, 4) model are shown in Table 7.

Table 7. Long-run error correction regression estimation results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AP	0.012714	0.073335	0.173367	0.8673
TFP	1.008127	0.391458	2.575311	0.0367
LF	2.805075	0.556944	5.036550	0.0015
GFC	0.017962	0.006610	2.717387	0.0299
C	-14.93368	5.812903	-2.569057	0.0371

The long-run results in Table 7 are as follows: (i) The coefficient value of aquaculture production is positive and statistically insignificant. According to this result, aquaculture production positively affects economic growth in the long run. (ii) The coefficient value of total fisheries production is positive and statistically significant at 5% significance level. This result indicates that total fisheries production positively affects economic growth in the long run. (iii) The coefficient of labor force variable is positive and statistically significant at 1% significance level. This proves that labor force has a positive effect on economic growth. (iv) The coefficient of gross fixed capital formation variable is positive. Moreover, this variable is statistically significant at the 5% significance level. Gross fixed capital formation variable positively affects economic growth. In this context, the following assessment is made.

- Although the coefficient of aquaculture production variable is positive, it is not statistically significant. This suggests that aquaculture production may have a positive effect on economic growth in the long run, but this effect is not econometrically reliable. The result may indicate the sector's potential contribution to economic growth; however, the data or model does not robustly confirm this association. It is possible that growth in the aquaculture sector has yet to be substantially reflected in overall macroeconomic growth.

- The positive coefficient of the total fisheries production variable and its statistical significance at 5% level of significance indicate that this type of production reliably contributes positively to economic growth in the long term. The fisheries sector contributes to economic growth through channels such as food supply, foreign trade (export), and employment creation in coastal areas. This finding, especially when evaluated in terms of total production volume, may indicate that the sector is integrated into the economic system and that increases in production are reflected in growth. For policy makers, it implies that supports for this sector may have positive effects on growth.

- The coefficient of the labor force variable was found to be positive and significant. This shows, with a high degree of reliability, that the increase in labor force directly and strongly supports economic growth. Because labor force is one of the basic inputs of the production process. An expanding labor force increases production capacity and potential growth (Mankiw et al., 1992). When evaluated specifically for Türkiye, it can be said that the young and dynamic population structure contributes to economic growth; however, in order for this contribution to be effective, the quality of the labor force (education, skills) must also be increased.

- The positive and significant coefficient of gross fixed capital formation indicates that this variable is one of the main determinants of long-term economic growth. This variable covers elements that increase production capacity such as infrastructure investments and machinery and equipment purchases. Fixed capital accumulation supports growth through means such as productivity increase and technological advancement in the production process (Solow, 1956). In addition, empirical studies have found positive and significant relationships between investment level and economic growth (Levine and Renelt, 1992). The contribution of investments to growth in the Turkish economy is confirmed by this finding and shows that investment incentives are an important tool in terms of sustainable growth strategies.

The empirical findings show that total fisheries production, labor force and fixed capital formation make significant contributions to economic growth in Türkiye. These results suggest that policy implementations for the sectors prioritized under Türkiye's Blue Growth Strategy can support economic growth. In particular, developing the fisheries and aquaculture sectors, creating sustainable employment and increasing infrastructure investments materialize the growth potential of the blue economy.

Furthermore, these findings emphasize the importance for Türkiye to develop strategies in line with maritime, environmental protection and sustainable economic development objectives within the framework of EU harmonization policies. Especially in line with the EU's Blue Growth policies and sustainable development goals, Türkiye's focusing its investments and regulations in these areas will both accelerate economic growth and contribute to environmental sustainability.

In conclusion, the empirical findings provide an important rationale for the effectiveness of Türkiye's blue economy policies and support the integration of these policies with sustainable growth objectives.

Finally, CUSUM and CUSUMSQ tests are used to investigate whether the ARDL model is stable or not, in other words, whether there is a structural break for the variables in the model. The findings obtained as a result of CUSUM and CUSUMSQ tests are presented in Figure 1.

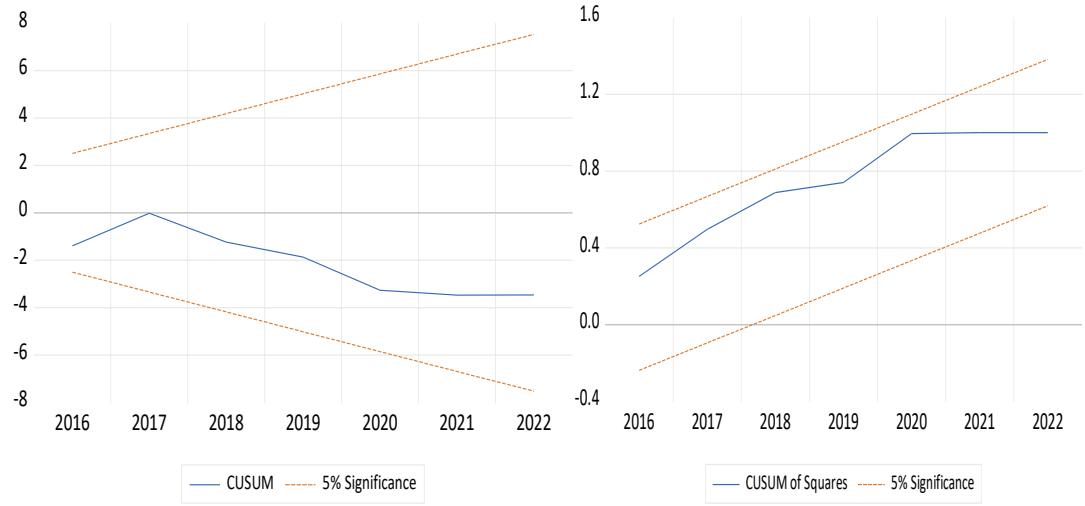

Figure 1. CUSUM and CUSUMSQ test results

In the graphs in Figure 1, the red dashed lines indicate the critical limits at the 5% significance level, while the blue solid lines represent the CUSUM and CUSUMSQ test values. The CUSUM and CUSUMSQ test values within the critical limits at the 5% significance level indicate that the estimated model is stable in the relevant period and there is no structural break in the model.

DISCUSSION

The ARDL test results reveal a long-run cointegration relationship between the independent variables and economic growth in Türkiye. This indicates that Blue Economy (BE) components are structurally intertwined with economic growth, not just in the short term but also over the long run. The Error Correction Model (ECM) further supports this by showing that approximately 19% of short-run disequilibria are corrected in the subsequent period. This suggests that the model has a robust dynamic structure and yields reliable predictions.

In the short-term analysis, the effects of aquaculture production (AP) on economic growth exhibit a time-varying nature. Negative effects are observed in the first two periods, but these transition into statistically significant positive effects in the second and third lagged periods. This implies that although AP investments may initially impose costs, they contribute to productivity and added value in the medium term. However, AP does not show a statistically significant long-run impact on economic growth, indicating its influence is more relevant in the short-term development dynamics.

The total fisheries production (TFP) variable demonstrates fluctuating short-term behavior, but its long-run impact is positive and statistically significant. This highlights the potential of the fisheries sector to foster economic growth through sustainable exploitation of marine and inland water resources. Particularly, the development of this sector in coastal regions can enhance regional growth, food security, and export capacity.

Labor force (LF) shows a consistently positive short-run effect, which becomes more significant in certain periods. In the long run, its effect on economic growth is both statistically significant and positive at the 1% level. This underlines the crucial role of labor market dynamics in supporting economic growth, and implies that employment policies, especially in BE sectors, are central to economic performance.

Gross fixed capital formation (GFC) fluctuates in the short term, showing both positive and negative but significant effects. In the long term, however, its coefficient is positive and statistically significant. This suggests that capital accumulation, particularly when efficiently used in BE-related infrastructure and innovation, contributes meaningfully to economic growth.

Overall, the study confirms that blue economy factors have a significant impact on Türkiye's economic growth, with varying effects in the short and long run. The short-run dynamics are influenced by transitional costs and adjustment mechanisms, whereas the long-run effects are primarily shaped by structural linkages within the economy. These findings align with existing literature, including studies by Alharthi and Hanif (2020), Fratila et al. (2021), Sarwar (2022), Eyüboğlu and Akmermer (2023), Ahammed et al. (2024), and Liza et al. (2025). In particular, the consistency with Eyüboğlu and Akmermer (2023)'s Türkiye-based study underscores the contextual validity of these results.

Although the present study shares methodological similarities with Liza et al. (2025), it offers a significant original contribution to the literature in terms of both its contextual focus and empirical findings. Specifically, the Turkish case not only represents a distinct country application but also provides empirical evidence for a nation with considerable blue economy potential—one that has yet to be addressed comprehensively at the policy level. In this regard, the study fills a gap in the literature by exploring the relationship between the BE and economic growth in a developing country with diverse and underutilized marine sectors such as Türkiye.

Secondly, the findings of this study differ from those of Liza et al. (2025) and offer a more nuanced structural distinction. While both aquaculture and fisheries production were found to have significant and positive effects on economic growth in their study, the present analysis reveals that only total fisheries production has a statistically significant and positive long-term effect on economic growth in Türkiye, whereas aquaculture production does not exhibit a statistically significant impact. This outcome indicates that the productivity levels of blue economy components vary across sectors in Türkiye, and these sectoral disparities are reflected in their respective contributions to economic growth.

As a result, this study differs from Liza et al. (2025) in terms of both its country-specific context and the differentiated effects of the variables, offering a robust, data-driven argument that blue economy policies should be tailored to national dynamics. In this regard, the study contributes not only to the diversification of the existing literature but also to evidence-based policymaking in Türkiye.

CONCLUSION

This study provides empirical evidence that components of the Blue Economy—namely aquaculture production, total fisheries production, labor force, and gross fixed capital formation—play significant roles in influencing economic growth in Türkiye. The results show that while some variables (like AP) have stronger short-term effects, others (like TFP, LF, and GFC) contribute significantly in the long run.

Based on these findings, several policy recommendations can be put forward. First, investments in blue economy sectors should be guided by a long-term strategic vision that recognises their structural contributions to economic growth. Developing integrated policy frameworks for fisheries, aquaculture, and coastal economies will enhance the effectiveness and sustainability of these sectors. Second, strengthening technological infrastructure and directing skilled labour towards BE sectors are critical steps to maximise the return on capital investments and improve overall productivity. Finally, all policy strategies should place environmental sustainability at the core to secure long-term socio-economic and ecological benefits.

In conclusion, the blue economy holds substantial potential to foster sustainable economic growth in Türkiye. With appropriately designed policies and effective strategic implementation, this potential can be harnessed to advance both national development objectives and global sustainability agendas.

Future studies can examine the sub-sectors of the blue economy in detail and reveal which areas contribute more to growth. Regional analyses to be conducted in different coastal regions of Türkiye will be guiding in terms of local development policies. In addition, the integration of environmental and social indicators into economic models will strengthen the sustainable development perspective. The use of more advanced econometric methods can provide a more accurate analysis of the complex relationships between the blue economy and economic growth. Studies to be conducted considering the effects of climate change on marine-based sectors are important in terms of risk management. Finally, empirical studies evaluating the effects of blue economy policies implemented in Türkiye will provide concrete contributions to the policy-making process.

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AUTHORSHIP CONTRIBUTIONS

Esra Soyu Yıldırım: Conceptualization, methodology, investigation, supervision, methodology, data collection, writing-reviewing and editing.

CONFLICT OF INTEREST

There is no conflict of interest.

ETHICS APPROVAL

No specific ethical approval was necessary for the study.

DECLARATION OF AI USE

We have not used AI-assisted technologies in creating this article.

DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author upon reasonable request.

REFERENCES

Ahammed, S., Rana, M.M., Uddin, H., Majumder, S.C., & Shaha, S. (2024). Impact of blue economy factors on the sustainable economic growth of China. *Environment, Development and Sustainability*, *27*, 12625-12652. https://doi.org/10.1007/s10668-023-04411-6

Akhtar, M., Xu, J., Kashif, U., Ali, K., Muhammad Naveed, H., & Haris, M. (2025). Bayesian neural network modelling for estimating ecological footprints and blue economy sustainability across G20 nations. *Humanities and Social Sciences Communications*, *12*(1), 1-14. https://doi.org/10.1057/s41599-025-04378-x

Alharthi, M., & Hanif, I. (2020). Impact of blue economy factors on economic growth in the SAARC countries. *Maritime Business Review*, *5*(3), 253–269. https://doi.org/10.1108/MABR-01-2020-0006

Ashyrov, G., Paas, T., & Tverdostup, M. (2018). The input-output analysis of blue industries: Comparative study of Estonia and Finland. University of Tartu, Working Paper 2018, ISBN: 978-9985-4-1104-9. http://dx.doi.org/10.2139/ssrn.3176955

Bădîrcea, R.M., Manta, A.G., Florea, N.M., Puiu, S., Manta, L.F., & Doran, M.D. (2021). Connecting blue economy and economic growth to climate change: Evidence from European Union countries. *Energies*, *14*(15), 4600. https://doi.org/10.3390/en14154600

Çoban, M.N., & Ölmez, Ü. (2017). The blue economy and the blue growth. *Electronic Turkish Studies*, *12*(3), 155-166. (in Turkish with English

abstract) https://dx.doi.org/10.7827/TurkishStudies.11122

Dickey, D.A. & Fuller, W.A. (1981). Likelihood ratio statistics for autoregressive time series with a unit root. *Econometrica*, *49*(4), 1057-1072. https://www.jstor.org/stable/1912517

Dykas, P., Tokarski, T., & Wisła, R. (2023). The Solow model of economic growth: Application to contemporary macroeconomic issues. Taylor & Francis, London. https://doi.org/10.4324/9781003323792

Eminçe Saygı, H. (2024). Growth prospects of the fisheries and aquaculture sector in Turkey in the context of the blue economy. *Menba Journal of Fisheries Faculty, 10*(3), 187-200. https://doi.org/10.58626/menba.1559413

European Commission (2018). The 2018 annual economic report on EU blue economy. *Publications Office of the European Union*. https://doi.org/10.2771/305342

Eyüboğlu, S., & Akmermer, B. (2023). The relationship between economic growth and fisheries production in Türkiye. *Aquaculture Studies, 24*(2). https://doi.org/10.4194/AQUAST1017

Fratila, A. Gavril, I.A. Nita, S.C. & Hrebenciuc, A. (2021). The importance of maritime transport for economic growth in the European Union: A panel data analysis. *Sustainability, 13*(7961), 1-23. https://doi.org/10.3390/su13147961

He, S., Alhamdi, F.M., Paramaiah, C., Hanif, S., & Nawaz, M.A. (2025). Role of blue economy and green economy in economic growth: Evidence from Pakistan. In Natural Resources Forum. Oxford, UK: Blackwell Publishing Ltd. https://doi.org/10.1111/1477-8947.70009

Hossain, M.A., Islam, M.N., Fatima, S., Kibria, M.G., Ullah, E., & Hossain, M.E. (2024). Pathway toward sustainable blue economy: Consideration of greenhouse gas emissions, trade, and economic growth in 25 nations bordering the Indian ocean. *Journal of Cleaner Production*, *437*, 140708. https://doi.org/10.1016/j.jclepro.2024.140708

Jawaid, S.T. Siddiqui, M.H. Atiq, Z. Azhar, U. (2019). Fish exports and economic growth: The Pakistan's experience. *Global Business Review, 20*, 279-296, https://doi.org/10.1177/0972150918825422

Levine, R., & Renelt, D. (1992). A sensitivity analysis of cross-country growth regressions. *American Economic Review*, *82*(4), 942–963. https://www.jstor.org/stable/2117352

Liza, J.I., Majumder, S.C., & Rahman, M.H. (2025). Scrutinizing the impact of blue economy factors on the economic growth in Bangladesh: An empirical study. *Marine Policy*, *173*, 106542. https://doi.org/10.1016/j.marpol.2024.106542

Mankiw, N.G., Romer, D., & Weil, D.N. (1992). A contribution to the empirics of economic growth. *The Quarterly Journal of Economics, 107*(2), 407–437. https://doi.org/10.2307/2118477

Martínez-Vázquez, R.M., Milán-García, J., & de Pablo Valenciano, J. (2021). Challenges of the blue economy: Evidence and research trends. *Environmental Sciences Europe*, *33*(1), 61. https://doi.org/10.1186/s12302-021-00502-1

Narayan, P.K., & Narayan, S. (2005). Estimating income and price elasticities of imports for Fiji in a cointegration framework. *Economic Modelling*, *22*(3), 423-438. https://doi.org/10.1016/j.econmod.2004.06.004

Nham N.T.H., & Ha, L.T. (2023). The role of financial development in improving marine living resources towards sustainable blue economy. *Journal of Sea Research, 195*, 102417. https://doi.org/10.1016/j.seares.2023.102417

Ninawe, A.S. (2017). Blue economy is the economic activities that directly or indirectly take place in the ocean and seas, use outputs, goods and services into ocean and land based activities. *Examines in Marine Biology & Oceanography*, 1-3.

Pata, U.K., Yurtkuran, S., & Kalça, A. (2016). Energy consumption and economic growth in Turkey: Ardl bounds test approach. *Marmara Üniversitesi İktisadi ve İdari Bilimler Dergisi*, *38*(2), 255-271. https://doi.org/10.14780/muiibd.281411

Pesaran, M.H., Shin, Y. & Smith, R.J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, *16*, 289-326. https://doi.org/10.1002/jae.616

Rehman, A., Deyuan, Z., Hena, S., & Chandio, A.A. (2019). Do fisheries and aquaculture production have dominant roles within the economic growth of Pakistan? A long-run and short-run investigation. British Food Journal, *121*(8), 1926-1935, https://doi.org/10.1108/BFJ-01-2019-0005

Sarker, S., Bhuyan, M.A.H., Rahman, M.M., Islam, M.A., Hossain, M.S., Basak, S.C., & Islam, M.M. (2018). From science to action: Exploring the potentials of blue economy for enhancing economic sustainability in Bangladesh. *Ocean & Coastal Management, 157*, 180-192. https://doi.org/10.1016/j.ocecoaman.2018.03.001

Sarwar, S. (2022). Impact of energy intensity, green economy and blue economy to achieve sustainable economic growth in GCC countries: Does Saudi Vision 2030 matters to GCC countries. *Renewable Energy, 191,* 30-46. https://doi.org/10.1016/j.renene.2022.03.122

Scholaert, F., Margaras, V., Pape, M., Wilson, A. & Kloecker, C. A. (2020). The blue economy: Overview and EU policy framework. European Parliament. https://coilink.org/20.500.12592/gjc0jg

Silver, J.J., Gray, N.J., Campbell, L.M., Fairbanks, L.W., & Gruby, R.L. (2015). Blue economy and competing discourses in international oceans governance. *Journal of Environment & Development*, 24, 135–160. https://doi.org/10.1177/1070496515580797

Solow, R.M. (1956). A contribution to the theory of economic growth. *Quarterly Journal of Economics*, *70*(1), 65–94. https://www.jstor.org/stable/1884513

Stephenson, R.L., & Hobday, A.J. (2024). Blueprint for blue economy implementation. *Marine Policy*, *163*, 106129. https://doi.org/10.1016/j.marpol.2024.106129

Suluk, S. (2022). Colors of the economy: an evaluation of Turkey in the context of the sustainable blue economy. *Dumlupınar University Journal of Social Sciences*, *74*, 132-150. (in Turkish with English abstract) https://doi.org/10.51290/dpusbe.1123257

Tayyar, A.E. (2023). The evil twin of global warming – blue economy and intra-industry trade: Ardl analysis for Turkiye, *Pamukkale University Journal of Social Sciences Institute*, *57*, 21-36. (in Turkish with English abstract) https://doi.org/10.30794/pausbed.1228128

Toplu Yılmaz, Ö. (2021). Evaluation of fisheries support in Turkey for sustainable blue economy. *Academic Review of Economics and Administrative Sciences*, *14*(3), 906-923. (in Turkish with English abstract) http://doi.org/10.25287/ohuiibf.788879

Usluer, H.B. (2024). Investigation of blue economy and its impact on global maritime transportation. *Journal of Management and Economics Research*, *22*(3), 50-66. http://dx.doi.org/10.11611/yead.1521413

Voyer, M., Quirk, G., McIlgorm, A., & Azmi, K. (2018). Shades of blue: what do competing interpretations of the blue economy mean for oceans governance?. *Journal of Environmental Policy & Planning*, *20*(5), 595-616. https://doi.org/10.1080/1523908X.2018.1473153

World Bank, (2017). The Potential of the Blue Economy: Increasing Long-term Benefits of the Sustainable Use of Marine Resources for Small Island Developing States and Coastal Least Developed Countries, World Bank Publications, https://www.studocu.com/row/document/universite-des-mascareignes/oceaneconomy/15434-blue-economy-jun-1/14483090 (accessed 07/4/2025).

WWF (2018). Principles for a Sustainable Blue Economy. 2018. Available online: https://wwfeu.awsassets.panda.org/downloads/wwf_marine_briefing_principles_blue_economy.pdf (accessed on 5 April 2025).