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The Effect of the Blue Economy on Philippine Economic Growth

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***Abstract*: The ocean is one of the significant sources of livelihood in the Philippines. The blue economy refers to ocean sustainability, from biodiversity to ecosystem health maintenance. With the motive to generate income, the blue economy coincides with the concept of good stewardship of ocean resources. The blue economy is said to have the potential to boost economic growth. The study aimed to examine the effect of the blue economy on Philippine economic growth through the use of the following variables: the Fisheries sector, Maritime Transportation sector, and Tourism sector. In addition, the researchers utilized a descriptive-quantitative approach to observe the annual time series data that covered the period from 2000-2021. Using GretL as the statistical tool, the relationship between the variables was measured and correlated through an Ordinary Least Squares (OLS) regression analysis. The researchers determined that only one of the three sectors positively affect Philippine economic growth. The fisheries (F) and maritime transportation (MT) have no positive effect on Philippine economic growth, regardless of the fisheries sector being statistically significant to the real GDP. Meanwhile, the tourism sector (T) has a significant and positive correlation with Philippine economic growth.**

***Keywords*: blue economy, economic growth, fisheries sector, maritime transportation sector, ocean sustainability, Philippines, real GDP, total fisheries production tourism sector, tourists.**

1. Introduction

The Philippines comprises 7,641 islands and is at the coral triangle - exposed to the global center of marine biodiversity with nearly 60% of the world's known fishes. 78% of the Philippines' 80 provinces and 56% of its 1,634 cities and municipalities are along the coastline. Its 36,300 km of coastline is surrounded by the waters of the Philippine Sea on the east coast, the South China Sea in the west, and the Celebes and Sulu Seas to the south. And as an archipelago, the distribution of goods and services to the islands depended heavily on the sea transportation system (Barnuevo & Sadaba, 2014). The maritime sector includes a wide range of activities from shipping and ports, fisheries and aquaculture, recreational activities and tourism, and many related economic services (Virola, 2009; Philippine Ocean Economy Satellite Accounts or POESA, 2022). As one of the most significant contributors to the Philippines' economy, the fisheries sector had remained problematic in specific areas - such as the poverty incidence of one of the most vulnerable, fishermen, with 34% in 2015 and an average daily wage of ₱ 178.43 (Philippines Statistics Authority or PSA, 2017). Nevertheless, the same source had indicated that the ocean economy grew by 6.7% in 2021, accounting for 3.6% of the Gross Domestic Product (GDP) at current prices in 2021. Ocean Fishing had the most significant contribution of 33.9% of the total ocean economy. Sea-based Transportation and Storage contributed 14.8%. Employed persons in ocean-based industries accounted for 1.99 million in 2021, higher by 4.8% in 2020.

The notion of the blue economy originated at a 2012 Nations Conference on Sustainable Development in Rio de Janeiro. However, the term 'blue economy' was coined by the UN University in 1994. According to Pauli (2010) its related tags like 'marine economy' and 'ocean economy' have been used in diverse ways before, but have no accurate and natural definition. In 2017, the World Bank's definition of the blue economy covered a range of aspects of ocean sustainability, from sustaining biodiversity to maintaining ecosystem health and preventing pollution. Based on a UN project report (2014), the blue economy intended to improve human well-being and social equality while significantly minimizing environmental threats and ecological scarcities. Most importantly, the blue economy propounded the relationship and conflicts between growth and development and protecting ocean resources (Lee et al., 2020). The three leading sectors of the blue economy were the following: Fisheries, Marine Transportation, and Tourism.

Kathijotes (2013) described the blue world as a cornucopia for humanity, meaning oceans and coasts give abundant good things. A switch to the blue economy can open an enormous potential for the marine-based economy while lowering ocean degradation and poverty (UNEP, 2012). The importance of the blue economy in the sustainable development of the national economy contributed considerably to the conservation of the environment and climate (Biuksane, 2022). Hasan et al. (2018) mentioned the ocean as a critical factor in Sustainable Development Goals (SDG). The blue economy must be normalized in being included in creating future SDGs and should be wider than the previous Millennium Development Goal 7B (fish stocks and protected marine areas). The importance of the ocean economy became noticeable in the proposed SDG 14, which is to conserve and use marine resources for development sustainably. Moreover, the blue economy's sustainability depends on using endemic resources

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and carbon footprints. Therefore, suitable scientific technologies and relevant conservation policies must overcome threats to the blue economy (Mitra, 2022).

The fisheries sector of the Philippines has been growing at a decreasing rate since the 1990s, yet it is a significant contributor to the economy. This industry provided Filipinos food and employment (Macusi et al., 2017). Azanza et al. (2017) mentioned in their study that an estimate of 1.53 million people was employed in the maritime sector in 2009, 4.35% of the total employed labor force in the Philippines. Based on the Southeast Asian Fisheries Development Center (SEAFDEC), the Philippines' fisheries sector comprised of Municipal, Commercial, and Aquaculture. The primary location for commercial fishing is Palawan, Negros, Mindanao, and Panay. In 2018, the total fishery production (TFP) from the municipal fishery contributed to 1,106,072 in quantity. In 2019, TFP from the commercial fishery contributed to 2,054,891 in quantity, and from the aquaculture fishery, a contribution of 2,358,238. The Philippines then became one of the top fishing producers in the world in 2019. As one of the significant sources of Filipino livelihood, the fisheries sector accounted for about 1.99 million fishers and 0.35 million farmers (2019). However, per the Philippines Statistics Authority (PSA), the growth rate of some sub-sectors had declined in the year 2022. The commercial fisheries sector declined by 8%, and the marine-municipal fisheries sector by 0.9%. On another note, the inland municipal fisheries sector grew by 4.7% and the aquaculture by 2.6%.

According to the Maritime Industry Authority (MARINA), based on the data gathered on March 10 to 16, 2023, the Philippines had the following passenger and cargo shipping Quantity: 389 Shipping Operations Recorded, 180 Passenger Ships Operated, 209 Cargo Ships Operated, 378 Ships Operated Normally, and 11 Operations Delayed. Amid the obstacles that COVID-19 brought, 100% of the cargo ships operated, ensuring the transport of goods. However, the same externality caused 6% of the passenger ships to cancel or delay. Both instances depicted that the Philippines' maritime transport industry had a stronghold regarding its operational system. Meanwhile, the Department of Tourism stated that the Philippines breached 2.65 million international visitor arrivals in 2022 – translating to PhP 208.96 billion in tourism revenue, a 2,465.75 percent from last year. In 2021, the Asian Development Bank Institute (ADBI) stated that coastal and marine tourism contributed an estimated $3 billion in value-added, with around 900,000 employees.

However, according to the Ocean Health Index Framework, the Philippines needed to be more sustainable in maximizing its oceans and marine resources. With that, the Department of Environment and Natural Resources (DENR) prepared resiliency roadmaps and Investment Portfolios for Risk Resilience (IPRRs) in 2022. In pursuit of UN SDG 14 for the blue economy, the DENR started to monitor 50 priority water bodies. Furthermore, to monitor, protect, clean up, and rehabilitate the bodies of water draining to Manila Bay, 2,365 river rangers were hired. As for the beach tourist spots in the Philippines, such as Boracay, 40 Boracay Environmental Lawin patrollers and 22 support staff have been hired for the Boracay Action Plan. Moreover, to protect beaches designated as Green Economy Model sites in Siargao, 19 personnel were hired.

Organizations such as the Partnerships in Environmental Management for the Seas of South Asia (PEMSEA) provided solutions to effectively manage coasts and oceans across the shared seas of East Asia, of which the Philippines is a part. This organization has highlighted ocean governance through the Sustainable Development Strategy for Seas of East Asia (SDS-SEA) 2015. Each participating country has been provided a framework for policy and program development and implementation at the regional, national, and local levels. Using Integrated Coastal Management (ICM), countries have stepped forward to reduce issues affecting our environments and natural resources, such as pollution and wastage, habitat destruction, and exploitation of natural resources. For instance, the Philippines could practice habitat protection, restoration, and management through this. In Batangas, 14 coastal municipalities have a network of marine protected areas to manage and protect fisheries resources, coral reefs, seagrass beds, and mangrove forests. These resulted in increased fish catch and abundance and the return of important fish species.

A. Statement of Objectives

The objective of this study is to identify how the Blue Economy, measured by its sectors, affects the growth of the Philippines economy. The following are the main objectives of the study:

1. To identify the effect of the Fisheries Sector to Philippine Economic Growth.
2. To identify the effect of the Maritime Transport Sector to Philippine Economic Growth.
3. To identify the effect of the Tourism Sector to Philippine Economic Growth.

B. Scope and Limitations

This research is focused on analyzing the effect of the blue economy to Philippine economic growth through its sectors: Fisheries, Maritime Transportation, and Tourism. The study covers the country's historical yearly total fisheries production, volume of passenger, containers, and cargos through sea-based transportation, and number of foreign and domestic travelers.

C. Significance of the Study

This research aims to provide additional information on the effect of the blue economy, particularly in the Philippines' economic growth. The researchers attempted to explore if there is a positive and significant relationship between the following variables: fisheries sector, maritime transportation sector, and tourism sector to the Philippines' economic growth.

2. Review of Related Literature

A. Blue Economy

There have been concepts of the blue economy studied to identify a framework for understanding this topic. According to Smith-Godfrey (2016), who used a cluster and qualitative comparative analysis, the blue economy comprised five

activities: trade in resources, including tourism and recreation, extraction of non-living resources, extraction of living resources, new resource generation, and ocean health. As per the United Nations Conference on Trade and Development (2017), a blue economy is a simultaneous promotion of economic growth, environmental sustainability, social inclusion, and the strengthening of ocean ecosystems. Attri (2016) identified that there are five main pillars of the blue economy, and these are Good Governance, Vision, Technology, Blue Management, Monitoring, and Institutional and Regulatory Reforms. Meanwhile, according to Keen et al. (2018), the five components of the blue economy were ecosystem resilience, economic sustainability, community engagement, institutional integration, and technical capacity. On another note, China's traditional marine industries, particularly, marine fisheries, marine transport, and tourism in coastal areas, has accounted for an increasing proportion of major marine industries in recent years (Kedong et al., 2022).

Selamoglu (2021) stated that the idea of the blue economy was created when attention on economics and regulations was demanded because of the increase in behavioral patterns of the functions in the interaction between land and water; since oceans are prominent in promoting global trade by connecting suppliers and consumers. Similar to the green economy, the blue economy aimed to minimize environmental risks and ecosystem scarcities while advancing consumer welfare and social equity (Smith-Godfrey, 2016). It encompassed more than just business opportunities; it also helped cope with the disastrous effects of climate change by safeguarding and advancing intangible "blue" resources (Mi, 2015) thus, to guarantee the current and future health of the blue economy's environment and society, countries should use their resources sustainably (Urban et al., 2022).

Wuwung et al. (2022) stated that it remained a challenge in international governance when effectively developing, implementing, and operationalizing policies of the blue economy. Despite the term's prevalence in international and regional political discourse, levels of blue economy governance remained low worldwide. The difficulties with ocean governance and the blue economy governance were likely to be the contributory factors. Rayner et al. (2019) studied the importance of adequate observation systems in sustaining blue economies and that buildings for science and observations be built mainly in countries that rely on blue economies. In addition, Graziano et al. (2022) argued that there are variations in performances within regions, not just between countries, because the blue economy is still conceptualized and operationalized heterogeneously.

1) Blue Economy to Economic Growth

The blue economy contributed approximately 3 to 5% to the global GDP (Patil et al., 2016). The most gainful biological systems on earth were the economy's marine resources since they were practical resources that strengthen financial and economic development (Voyer & Van Leeuwen, 2019). Forty percent of South Asian countries' businesses are held responsible by their coastal areas, therefore, serving as a financial foundation for their economy. As no government wanted to waste potential growth opportunities, the blue economy is essential for countries with coastal regions. Many regions from various countries heavily relied on marine resources for poverty reduction and economic growth (Mussa et al., 2021).

For instance, the proportion of China's Gross Ocean Product increased year-on-year, with an average of 20.5% and 17.6% of the total regional product (Kedong et al., 2022). The blue economy improved the living standard of people through the sustainable use of marine resources and eventually promoted economic growth (Karim & Islam, 2022). Each sector of the blue economy significantly contributed to strengthening a nation's GDP (Mitra, 2022). The ecosystem services of natural resources offered jobs and livelihood opportunities related to the blue economy, which impacted economic security. Such activities significantly developed job creation (Hasan et al., 2018). However, To & Lee (2018) studied that the maritime economy rapidly increased over time and had an anticipated slow growth rate in the long run.

B. Fisheries Sector to Economic Growth

Fish is the most demandable animal for food consumption of the overall population in developing countries (Islam et al., 2018). Alharthi & Hanif (2020) stated that fisheries contributed hugely to the individuals' livelihoods in coastal areas by improving livelihood opportunities and food security, alleviating poverty, and promoting economic growth. The researchers emphasized the potential of the blue economy as one of the significant contributors to economic growth as long as the blue resources are mapped and appropriately integrated within an institutional framework with adequate policies and research. Similarly, Jaime-Muñiz et al. (2022) highlighted the fish sector's importance to GDP growth as it provided vital food subsistence worldwide, hence, a motivation for exports. It was measured that fisheries have a robust positive effect and potential contribution to the long-run economic growth process (Jobarteh & Salamani, 2020).

Naufal & Rindayati (2019) and Kusdiantoro et al. (2019) studied the importance of the fisheries sector in a region, particularly to gross regional domestic product (GRDP). Kusdiantoro et al. labeled the fishery sector as a "primary sector" because of its highly competitive market characteristic, making this the regional economy's foundation. Investing in fishery cooperatives, such as by improving the fisheries and non-fisheries sector, help increase local economic growth, consequently improve and develop a sustainable environment and economy (Sari & Rahmayanti, 2022). The researchers discussed that capture fisheries contributed significantly to household income and state revenue, which later played a substantial role in the economy and development. Same with Naufal & Rindayati, who stated that the AFF consistently contributed to the growth of the economic gross regional domestic product. However, over-reliant on blue resources for food and jobs can lead to excessive fishing (Macusi et al., 2017; Parsyak et al., 2023).

Fisheries have earned its significance because of its potential for large numbers of exports, and revenue (Shamsuzzaman et

al., 2020). The fisheries sector is a significant contributor to the Philippine food security (Santos et al., 2011) and Philippine national economy, measured through income and employment (Suh & Pomeroy, 2020). In contrast to these findings, Ilyas et al. (2021) argued that there is an insignificant and negative relationship between fisheries and economic growth. In addition, Murray (2014) mentioned that the fisheries sector both has positive and negative effects on economic activities.

H1: The Fisheries Sector positively affects the Philippine Economic Growth

C. Maritime Transport Sector to Economic Growth

Rodrigue (2017) described that the physiography of maritime transportation comprised marine and river circulation systems. Maritime transportation provided physical support for the world economy's freight flows. Therefore, it was considered a vital part of the global economy. Statistically, Ntamwiza (2020) concluded a solid positive relationship between transport services and GDP in the short and long run. Transportation significantly contributed to the growing world demand for energy and national and regional GDP formation. Also, it had a significant environmental footprint. Transport played a significant role in meeting society's basic needs, accommodating the community's economic and social activities, and facilitating the system of production and investment - positively impacting the economy.

Maritime transport is a significant component of the global economy, which accounted for up to 80% of worldwide trade (UNCTAD, 2017); this sector was highly affecting economic development (Psaraftis, 2021). Marine transport was also mentioned to have a significant influence on many industries — direct and indirect. Fratila et al. (2021) stated that maritime transport comprised a wide range of activities. Port activities and logistic nodes alone significantly influenced the growth of the maritime industries and trade, as it accounted for 40% value-added and 24% employment within the blue economy – which led to economic expansion and job creation.

More than 80% of the global trade volume is facilitated by marine transportation (Shan et al., 2014). According to Lane & Pretes (2020), maritime trade is an essential factor in measuring a country's economic success hence, an important element of a global economy. The researchers' findings stated that as maritime dependency (ability of a nation to participate in maritime trade) increases, the GDP increases as well. Munim & Schramm (2018) argued the necessity of marine transport to the developing countries as it resulted in better performance in logistics, which led to higher seaborne trade & economic growth.

Olteanu & Stinga (2019) concluded that the maritime trade through global transport activity such as global shipments of bulk cargo, the volume of goods transported, and the type of goods transported directly impacted the economy's GDP in the long run. Similar to the study of Hutajulu & Ratang (2016), the maritime transport sector had an increasing growth rate, which positively affected economic growth. The research result estimated that the economic potential of sea transportation was about 14.78 billion US dollars per year. In addition, maritime transport was one of the crucial sectors in the worldwide transport economy, providing high income, easy entry to businesses, and several job opportunities.

H2: The Maritime Transport Sector positively affects the Philippine Economic Growth

D. Tourism Sector to Economic Growth

According to Mudrikah (2014), tourism is one of the sectors that mainly contributed to economic growth because of facilities, namely: transportation, accommodation, entertainment, services, and others. It stimulated foreign exchange earnings, created jobs, and improved the economy. Tourism alone contributed up to 40% of a nation's blue economy (UNWTO, 2022). Salihin (2021) briefly explained the tourism sector's positive impact on economic growth and its absorption of labor employment. The study emphasized that development in the tourism sector boosts economic activities by creating demand for both consumption and investment. Eventually, it produced more goods and services. Subsequently, it triggered tourist arrivals-which positively impacted economic growth as it required more accommodation facilities to satisfy the needs and wants of the tourists. In addition, Hariyani (2018) studied that this positive impact had contributed significantly to the short and long run of a country's economic growth. The researcher emphasized the need for strategic measures to consistently support the tourism sector's development to see its economic contribution further.

Similar studies have concluded the positive relationship between the two variables (Lee & Brahmasrene, 2013; Govdeli & Direkci, 2017; Paramati et al., 2017; Islam et al., 2018). Not only did the tourists benefit from these coastal destinations but also the locals (Miller & Auyong, 1991) - making tourism facilities and infrastructures grow constantly. In addition, Tegar & Gurning (2018) analyzed that developing tourism means generating economic growth and ecological and social sustainability.

Papageorgiou (2016) mentioned that tourism facilities and infrastructures were constantly growing. The European Commission (2014) stated that tourism is the largest component among the marine economic activities with an essential role in national economies (Hall, 2001; Moreno & Amelung, 2009) and, with growing opportunities for development (Orams, 1999). Islam et al. (2018) stated that marine and coastal business enterprises were significant to several developing economies. However, according to Purnomo (2022), though tourism had a positive impact on economic growth, the contribution of tourism is still low compared to other sectors. Hence, it is encouraged to be increased.

Despite tourism being one of the largest contributors to the maritime economy sector (Tegar & Gurning, 2018), contrary to the findings mentioned previously, some studies have shown that tourism is not positively correlated to economic growth and did not have a significant relationship to tourism. An empirical study based on Korea showed an invalid relationship between tourism revenue and economic growth in the long-run (Oh, 2005). Oh mentioned that tourism policies for economic development were not fully effective in attaining economic

expansion which could possibly lead to growth in the tourism industry. Webster & Ivanov (2014) statistically concluded that there is no direct relationship between tourism and economic growth in China, India, America, Japan, France, Spain, Italy, Norway, Iceland, and Qatar. Figini & Vici (2010) also argued that tourism is not the best solution in solving economic growth and development problems, and contradicted the usual results between the relationship of the variables. Furthermore, in a research conducted in Boracay, Philippines, the tourist arrival figures indicated an inconsistent growth affected by environmental and social impacts (Carter, 2004).

H3: The Tourism Sector positively affects the Philippine Economic Growth

E. Synthesis

The leading drivers of the blue economy are the fisheries sector, marine transportation sector, and tourism sector. Majority of the related studies conclude that these sectors positively influence a nation's economic growth. Therefore, in this paper, these sectors should directly influence Philippine economic growth.

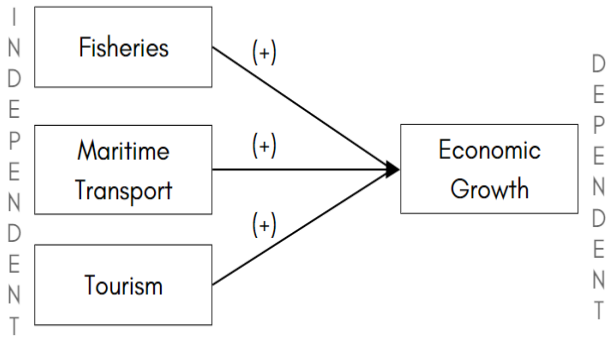

Fig. 1. Conceptual framework

3. Methodology

A. Research Design

A quantitative approach was utilized in conducting this research. This study applied a multivariable regression analysis, measuring the relationship of the three independent variables of the Blue Economy: Fisheries, Maritime Transportation, and Tourism to the dependent variable: Economic Growth.

In this regard, with the use of GretL (an econometric analysis software) as the statistical tool, the researchers utilized an Ordinary Least Squares (OLS) regression analysis, and to test the validity of the OLS, this is determined by the following diagnostic tests: Unit Root, Heteroskedasticity, Autocorrelation, Specification Error, Multicollinearity, Normality of Residuals, and Stability tests.

B. Study Site

This paper used a national time series data that covered the period of 2000-2021. The paper aims to observe the variables of the blue economy within the Philippines.

C. Data Collection Procedure

This research contains secondary data from Philippine Statistics Authority, International Monetary Fund (IMF), and Department of Tourism (DOT). These data cover the years 2000 to 2021.

The variables used in the estimation are as follows:

- The fisheries sector was measured by the annual TFP as done by Nishimizu & Hulten (1978) and Shamsuzzaman et al. (2020). Data of annual TFP was obtained from the Philippine Statistics Authority.
- The maritime transportation sector was measured by the total volume of passengers, cargos, and containers transported by sea, as studied by Akbulaev & Bayramli (2020). Data for this sector was obtained from the Philippine Statistics Authority.
- The tourism sector was measured by the number of foreign and domestic travelers, as done by Salihin (2021). Both data were taken from the Department of Tourism.
- The Economic growth was measured through the Real GDP of the Philippines with the base year of 2018. This data was derived from the International Monetary Fund.

D. Data Analysis

1) Economic Growth

The GDP, an indicator of whether the country's economy is rising or falling (Gonzalez et al., 2022), directly influences economic growth. According to Saymeh & Orabi (2013), increased GDP is the most basic definition of economic growth.

Schepelmann et al. (2010) pointed out three "crossing points of the economy," which are the well-known approaches to calculating the GDP: The expenditure approach, the Production approach, and the Income approach. Despite having three approaches, Ivković (2016) mentioned that the calculation will always be equivalent in any approach where the GDP is computed.

2) Econometric Model

According to the United Nations, Economic Commission for Africa or UNECA (2016), the blue economy includes the following: fisheries, aquaculture, tourism, and transport. However, per SEAFDEC, the Philippines' fisheries sector comprises Commercial, Municipal, and Aquaculture, which narrows down to three main objectives, as aquaculture becomes a subsector of the fisheries sector.

In order to conduct the objectives of the study, the researchers used the specification formulated below as the econometric model in assessing the results of the multivariable regression model. This will serve as the basis on which the hypothesis will be accepted.

$$RGDP = \beta_0 + \beta_1 F + \beta_2 MT + \beta_3 T + \mu \quad (1)$$

Whereas:
RGDP = Real GDP
F = Total Fisheries Production
MT = Total Volume of Passengers, and Cargos & Containers of Imports & Exports transported by Sea
T = Total of Foreign and Domestic Travelers

β_0 = Constant term or intercept
β_1 = Beta Coefficient of Fisheries
β_2 = Beta Coefficient of Maritime Transportation
β_3 = Beta Coefficient of Tourism
μ = Standard error term

E. Diagnostic Tests

1) Unit Root Tests

Through the unit root test, the validity of the time series data lies within the stationarity or the constancy of the data through time. The test is an approach to see if the variables are distributed normally.

2) Heteroskedasticity

Heteroskedasticity is often used in datasets with an extensive range between observed values. With this, it seeks if the dependent variable changes significantly from the beginning to the end of the series.

3) Autocorrelation

Autocorrelation analyzes the relationship between the observations at different points in time. It summarizes the correlation of the residuals at their own lagged values.

4) Specification Error

The alignment of the data representation should be relevant. The specification error, such as the Ramsey RESET, could validate if the data is correctly specified. Specification error makes the data valid as it requires a commitment between variables. In addition, researchers can identify if the functional form of the regression is appropriate.

5) Multicollinearity

Multicollinearity defies the statistical significance of an independent variable. The multicollinearity test identifies if there is an existence of a correlation between the independent variable and its coexisting variables.

6) Normality of Residuals

The normality of residuals identifies if the data is symmetrically or normally distributed. It implies no skewness or kurtosis once the data is visualized or represented.

7) Stability Tests

The stability test, like the Chow Breakpoint, identifies deficiencies in the structure of the observations. It identifies if the data set is achieving stability or not.

4. Results and Discussion

A. Descriptive Results

The graphs show the annual time series observations that cover the period of 2000 to 2021. The real GDP exhibited an upward trend from 2000-2018 and significantly dropped in 2019-2020 due to the pandemic, then recovered in 2021. The same goes for the marine transport and tourism sectors, which significantly declined in 2019; however, maritime transport showed a stable state from 2000-2009 and increased afterward. The fisheries sector displayed an upward trend from 2000-2009 and a downward trend from 2010-2021.

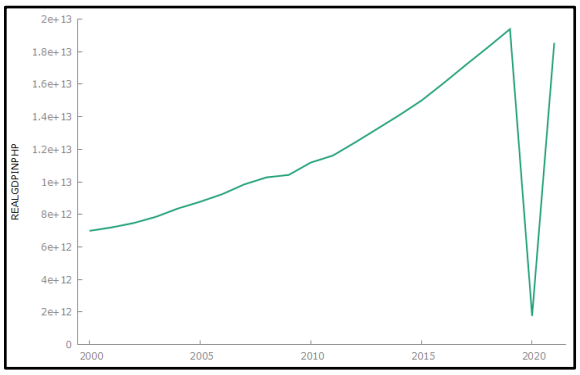

Fig. 2. Real GDP

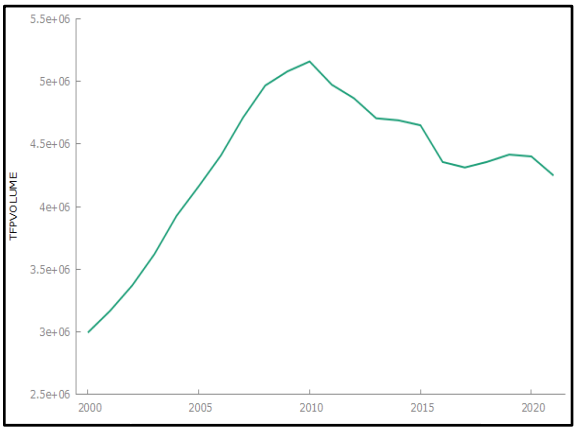

Fig. 3. Fisheries

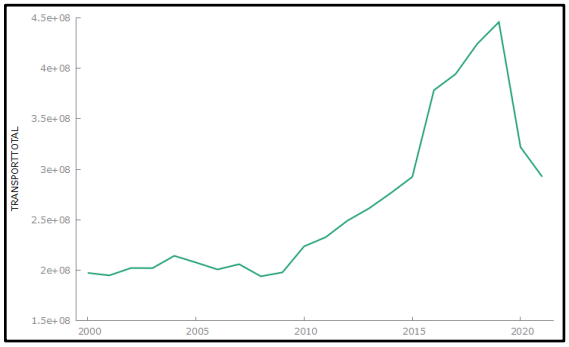

Fig. 4. Maritime transport

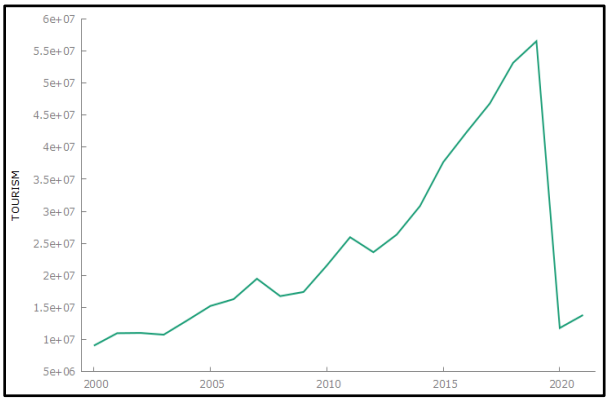

Fig. 5. Tourism

B. Ordinary Least Square (OLS) Regression Results

Table 1
Regression result

Dependent variable: RGDP
Method: Least Squares
Observations: 2001-2021 (T=21)

Variable	Coefficient	Std. Error	t-ratio	P-value
const	1.26E+13	7.07E+11	17.89	1.84E-12 ***
F	−1.38083e+07	3.93E+06	−3.511	0.0027 ***
MT	−16066.9	35714.8	−0.4499	0.6585
T	303828	121000	2.511	0.0224 **

Mean dependent var	1.18e+13	S.D. dependent var	4.48e+12
Sum squared resid	1.43e+26	S.E. of regression	2.90e+12
R-squared	0.644685	Adjusted R-squared	0.581982
F(3, 17)	10.28162	P-value(F)	0.000429
Log-likelihood	−630.1868	Akaike criterion	1268.374
Schwarz criterion	1272.552	Hannan-Quinn	1269.280
rho	0.543208	Durbin-Watson	0.822938

Table 1 presents the independent variables affecting the Real GDP from 2000-2021, a total of 21 observations. With a p-value (F) of 0.000429, the overall significance of the regression is statistically significant since it is less than the significance level of 0.05. The variables fisheries (F) and tourism (T) are statistically significant at 5% significance level. This leads to the acceptance of the alternative hypothesis that the fisheries and tourism sectors significantly affect Philippine economic growth. Meanwhile, maritime transportation (MT) was statistically insignificant at any level of significance, which leads to accepting the null hypothesis that maritime transport has no significant effect on Philippine economic growth.

Econometric model based on the regression results:

$$RGDP = 1.26E+13 - 1.38083e+07\ (F) + 303828\ (T) + \mu \quad (2)$$

The model shows that the real GDP will increase by 1.26E+13 for every unit increase in the constant. As total fisheries production increases by one unit, the real GDP decreases by 1.38083e+07. Meanwhile, the real GDP will increase by 303,828 for every unit increase in the number of foreign & domestic tourists. The marine transport sector is no longer included in the econometric model since the regression result shows that it is insignificant. The estimated econometric model concludes that the researchers rejected the hypothesis that fisheries and maritime transport sectors have a positive effect on the Philippine economic growth, and accepted the hypothesis that the tourism sector has a positive effect on Philippine economic growth.

C. Diagnostic Tests

1) Unit Root Test

Table 2
Unit root test results

Variable	Passed Level	ADF p-value
RGDP	At Level	0.01581
F	2nd Difference	1.96E-06
MT	2nd Difference	0.00287
T	2nd Difference	9.92E-13

At level, the stationary test shows that only the RGDP and fishery sector (F) are stationary because their p-values are less than 0.05 significance level. At first difference, the fishery sector is non-stationary, while the other three variables are stationary. An ADF Test was conducted again for the second difference to overcome this. Results show that RGDP, fisheries, maritime transport (MT), and tourism (T) became stationary at second difference, thus accepting the null hypothesis that each variable is normally distributed or is stationary. The independent variables, therefore, were regressed at the first difference, while RGDP was regressed at level.

2) Other Diagnostic Tests

The table 3 shows the result and interpretation of other diagnostic tests.

5. Conclusion

This paper focused on how the Blue Economy, measured by its sectors, affects the growth of the Philippine economy. With fisheries supporting 2.2 million local fishermen in our country, maritime transport assisting our country from trade, transportation, and storage (PSA, 2017), and tourism continuously boosting the use of facilities and accommodations that directly affect income and employment, these sectors have shown notable changes in the country's development. However, based on the statistical results, the fisheries and maritime transport sectors have no positive effect on the economic growth regardless of the fisheries sector being statistically significant to the real GDP, and only the tourism sector has a

Table 3
Result and interpretation of other diagnostic tests

Diagnostic Test	P-value Result	Interpretation
Heteroskedasticity (White's test)	0.764582	The p-value (0.764582) is greater than alpha 0.05 thus, accept the null hypothesis. Ho: There is no heteroskedasticity in the model and that the observations from 2000-2021 are homogenous.
Autocorrelation (Breusch-Godfrey LM Test)	1.17, 4.082, and 3.914	The p-values: 1.17, 4.082, and 3.914 are all greater than alpha 0.05 thus, accept the null hypothesis. Ho: There is no serial correlation in the presented model hence, valid conclusions can be drawn.
Specification Error (Ramsey's RESET)	0.241, 0.807, and 0.56	The p-values: 0.241, 0.807, and 0.56 are all greater than 0.05 alpha thus, accept the null hypothesis. Ho: There is no specification error in the data set. The independent and dependent variables, measurements, and transformations in the model were all properly specified.
Multicollinearity (Variance Inflation Factors)	1.17, 4.082, and 3.914	The VIF values 1.17, 4.082, and 3.914 are all less than 10 thus, accept the null hypothesis. Ho: There is no collinearity problem in the presented model.
Normality of Residuals	0.176	The p-value (0.176) is greater than alpha 0.05 thus, accept the null hypothesis. Ho: There is normality or the residual of the model is normally distributed at 0.05 alpha.
Stability (Chow Breakpoint)	0.1611	The p-value (0.1611) is greater than 0.05 alpha thus, accept the null hypothesis. Ho: There is no structural break at observation 2010, and have achieved the stability of the data set.

Table 4
Hypotheses results

Hypothesis	Accepted Result
H1. The Fisheries Sector positively affects the Philippine Economic Growth.	Rejected
H2. The Maritime Transport Sector positively affects the Philippine Economic Growth.	Rejected
H3. The Tourism Sector positively affects the Philippine Economic Growth.	Supported

significant and positive correlation with the Philippine economic growth.

The researchers have drawn inferences from the 21 annual observations (2000-2021) from PSA, DOT, and IMF. Using OLS for regression analysis, a descriptive-quantitative approach was applied. The effect of the fisheries, maritime transport, and tourism sector was measured through its passed stability test variable (1st difference), and all diagnostic tests were statistically significant; therefore, the regression model and results are reliable and present no issues. Moreover, the researchers regarded the Breusch-Godfrey result instead of the Durbin-Watson value of 0.82 for autocorrelation test - because it is a more reliable test for detecting serial correlation for multiple time lags. This paper accepts the null hypothesis of H1 and H2 and the alternative hypothesis of H3.

A. Fisheries Sector to Economic Growth

Based on the Ordinary Least Squares (OLS) regression results, the relationship of the Fisheries Sector to Real GDP is negative. Similar to Ilyas et al. (2021), who concluded that the fisheries sector had a negative effect on economic growth, such results concern creating policies that should promote this sector. Murray (2014) also concluded that fisheries indirectly affect economic growth; this is caused by the industry's transportation, storage, marketing, and distribution being dependent upon its sales. These added sales are referred to as the indirect impacts. Numerous other forms of manufacturing and trade are among these indirectly dependent sectors; this includes containers and packaging, and freight and shipping. Furthermore, negative externalities undermine capture fisheries' contribution to the national economy (Suherman et al., 2020).

Despite the different fishing methodologies introduced, developed value-added goods, enhanced per capita fish consumption, and fisheries department uplifting the fishermen's standard of life (GoP, 2017), Philippines has become one of the countries that face Illegal, Unreported, and Unregulated (IUU) fishing practices. IUU fishing practice has become a global problem (Kasim & Widagdo, 2019). IUU indirectly affects economic growth in various ways. It affects job opportunities and federal employment in the fisheries sector as it decreases the supply of fish raw materials. Likewise, IUU fishing practices hinder the progress toward a sustainable ocean economy. To address such issues, the Bureau of Fisheries and Aquatic Resources (BFAR) introduced the Philippine IUU Fishing Index and Threat Assessment Toolkit, or I-FIT, to strengthen the Fisheries Management Area's enforcement system. However, a new bill in Congress threatened the approach, seeking to allow domestic commercial vessels within municipal waters, a practice banned under the prevailing fisheries law (Fabro, 2021).

Regardless of the negative effect, the regression result showed a significant relationship between the fisheries sector and economic growth. According to Sari & Rahmayanti (2022), this is caused by the significant correlation of fisheries to household income and state revenue, which later played a substantial role in the economy and development. In addition, Santos et al. (2011) stated that the fishing industry is a significant contributor to the Philippine food security and Philippine national economy.

B. Maritime Transport Sector to Economic Growth

90% of the trade in the Philippines is moved through the sea - making the maritime transport sector a considerable part of the Philippines' economy. The extensive network of ports in the Philippines includes 23 major and 100 minor ports.

The OLS results in a negative relationship between the Maritime Transport Sector and Real GDP. Igberi & Ogunniyi (2013) concluded that even if maritime transportation is a vital aspect of social and economic life, its contribution may seem insignificant to growth. This could be due to existing externalities that have a direct, indirect, or induced effect. Clarke and Huseyinoglu (2019) discussed that the maritime transport sector's environmental effects affect its contribution to economic growth.

C. Tourism Sector to Economic Growth

Zafra (2021) stated that ocean tourism contributes as much as 25% to the Philippines' blue economy. Furthermore, beach activities remain the most significant revenue stream among ocean tourism pursuits, while diving is a growing segment. Beach tourism is the primary tourism product for the Philippines due to its geographical profile. With these conclusions, we can accept using the count of international and domestic tourists as measurements.

The OLS resulted in a positive relationship between the tourism sector and Real GDP. Tourism is one of the sectors that mainly contributes to economic growth (Mudrikah, 2014). Several studies support a positive relationship between these variables (Lee & Brahmasrene, 2013; Govdeli & Direkci, 2017; Paramati et al., 2017; Islam et al., 2018). Despite tourism's colossal contribution, studies still contradict the statement above due to the influence of several internal and external factors (Asa et al., 2022). Nevertheless, it is vital to note that for marine tourism's contribution to last in the long run, a nation must maintain sustainable practices that help protect marine resources (Wang & Han, 2018).

D. Policy Implications

Being at the coral triangle, the Philippines enjoys abundant marine resources - which became a root of job and trade opportunities. Its blue economy consists of the Fisheries Sector, Maritime Transport Sector, and Tourism Sector - all of which have internal and external factors that influence it directly or indirectly. This paper's policy implication suggests that

comprehensive development plans, sustainable practices, corporate social responsibilities, and material capital investments are critical factors for improving and sustaining biodiversity and marine life - which may further boost long-term economic growth. Our study can support existing government policies, projects, and programs:

1) The Philippine Fisheries Development Authority or PFDA's Regional Fish Ports Program. This program aims to provide provision and operation to fish landing centers nationwide. These ports are supported with services such as landing facilities (pier, fish unloading), market facilities (fish trading), fish processing facilities, refrigeration facilities (cold storage, freezers, and ice plants), and auxiliary facilities (fuel depots, ship repair yards, fishing supplies shops, fishing net repair areas, and food stalls). This program benefits eight fish port complexes: Navotas, Sual, Lucena, Camaligan, Iloilo, Davao, Zamboanga, and General Santos.

By projecting the port usage of regional fishing ports in the Philippines, Israel (2000) analyzed that underutilization of fishing port complexes existed specifically with Iloilo, Camaligan, Lucena, Sual, and Davao. Meanwhile, Zamboanga port overutilized its facilities. This study recommends that PFDA should create an updated analysis of the fishing ports in the Philippines to specify which ports nowadays lack support in their facilities, as this directly affects the efficiency of fisherfolks and their production of goods and services. In addition, the analysis could also recognize which ports overutilize their facilities that should be handled so that losses from oversupply will be minimized. Provinces with high fisheries production should be implemented with better distribution policies, while regions with low production should be prioritized by investing in their facilities.

2) The Seaport Proposals under the Build, Better, More Infrastructure Program of the Marcos Administration (2022-2028) aim to reduce business costs, expand market opportunities, and promote high-quality job creation and innovation. Investment in the transport infrastructure promotes trade flows (Matekenya & Ncwadi, 2022). The Philippines Port Authority (PPA) has 30 new seaport projects under this program - 11 completed in the year 2022, 6 projects completed early in 2023, and 13 ongoing. More investments in technical and operational improvements are needed to cut maritime transport's carbon footprint (UNCTAD, 2022). Subsequently, to reduce environmental risks, this study calls for a meticulous assessment of the old ports to help accurately track the potential changes in shipping demands and connections as the new ports come into existence.

3) The Maritime Industry Development Plan (MIDP) targets to achieve a nationally integrated and globally competitive Philippine maritime industry by 2028. This study can help with the efficiency of identifying which factors are most considerable to prioritize in achieving a better and more sustainable blue economic state. A sustainable blue economy only emerges when economic activities align with its resiliency (Esade Business & Law School, 2021). Therefore, present activities must significantly reduce environmental risks of ecological damage and illegal activities—all under the proposed plan 2028. The MIDP primarily involves the modernization and expansion of the domestic and overseas shipping, shipbuilding, and ship repair industries to promote a highly skilled and competitive maritime workforce. Moreover, this plan encompasses enhancing maritime transport safety and security, promoting an environmentally sustainable maritime industry, and implementing sustainable maritime innovation, transformation, and digitalization. Investing in improved governance in the blue economy will create investable opportunities that will help promote economic growth while protecting resources for future growth (World Bank, 2016).

4) The Government assistance programs on MSMEs in the provinces that potentially boost tourism should be publicized more through seminars and forums, as travelers nowadays rely heavily on infrastructures, attractions, and businesses. According to Yang (2022), aesthetics significantly and positively impacts tourist involvement. By utilizing the government assistance programs, Filipinos can provide the necessary services that tourists could be looking for, which might be done via a survey. At the same time, it will boost income and employment in the provinces. These government assistance programs include Kapatid Mentor Me - a 12-week program comprised of 10 modules that helps aspiring entrepreneurs build their brand; Pondo sa Pagbabago at Pag-Asenso - a loan assistance program to launch small businesses; Small and Medium Enterprise Roving Academy - seminars for entrepreneurs; Go Lokal! - a channel for MSMEs to gain access to the market; and Barangay Micro Business Enterprise - establishment of microbusinesses with incentives and benefits, particularly in remote and suburban areas.

6. Appendix

A. Unit Root Test Results

1) Real GDP

```
Augmented Dickey-Fuller test for RGDP
testing down from 7 lags, criterion AIC
sample size 21
unit-root null hypothesis: a = 1

  test with constant
  including 0 lags of (1-L)RGDP
  model: (1-L)y = b0 + (a-1)*y(-1) + e
  estimated value of (a - 1): -0.759115
  test statistic: tau_c(1) = -3.2805
  asymptotic p-value 0.01581
  1st-order autocorrelation coeff. for e: -0.170
```

2) Fisheries

```
Augmented Dickey-Fuller test for d_d_FISHERIES
testing down from 7 lags, criterion AIC
sample size 19
unit-root null hypothesis: a = 1

  test without constant
  including 0 lags of (1-L)d_d_FISHERIES
  model: (1-L)y = (a-1)*y(-1) + e
  estimated value of (a - 1): -1.15339
  test statistic: tau_nc(1) = -4.79577
  asymptotic p-value 1.964e-06
  1st-order autocorrelation coeff. for e: -0.022
```

3) *Marine Transport*

```
Augmented Dickey-Fuller test for d_d_MARITIMETRANSPORT
testing down from 7 lags, criterion AIC
sample size 15
unit-root null hypothesis: a = 1

  test without constant
  including 4 lags of (1-L)d_d_MARITIMETRANSPORT
  model: (1-L)y = (a-1)*y(-1) + ... + e
  estimated value of (a - 1): -5.31556
  test statistic: tau_nc(1) = -2.97339
  asymptotic p-value 0.00287
  1st-order autocorrelation coeff. for e: 0.004
  lagged differences: F(4, 10) = 5.450 [0.0136]
```

4) *Tourism*

```
Augmented Dickey-Fuller test for d_d_TOURISMTOTAL
testing down from 7 lags, criterion AIC
sample size 19
unit-root null hypothesis: a = 1

  test without constant
  including 0 lags of (1-L)d_d_TOURISMTOTAL
  model: (1-L)y = (a-1)*y(-1) + e
  estimated value of (a - 1): -1.87011
  test statistic: tau_nc(1) = -7.4923
  asymptotic p-value 9.924e-13
  1st-order autocorrelation coeff. for e: -0.063
```

5) *OLS Regression Result*

```
Model 1: OLS, using observations 2001-2021 (T = 21)
Dependent variable: RGDP

                      coefficient       std. error      t-ratio   p-value
  ---------------------------------------------------------------------------
  const                1.26460e+013      7.06915e+011  17.89     1.84e-012 ***
  d_FISHERIES         -1.38083e+07       3.93333e+06   -3.511    0.0027    ***
  d_MARITIMETRANSP~   -16066.9           35714.8       -0.4499   0.6585
  d_TOURISM            303828            121000         2.511    0.0224    **

Mean dependent var   1.18e+13   S.D. dependent var   4.48e+12
Sum squared resid    1.43e+26   S.E. of regression   2.90e+12
R-squared            0.644685   Adjusted R-squared   0.581982
F(3, 17)             10.28162   P-value(F)           0.000429
Log-likelihood      -630.1868   Akaike criterion     1268.374
Schwarz criterion    1272.552   Hannan-Quinn         1269.280
rho                  0.543208   Durbin-Watson        0.822938
```

B. *Diagnostic Test Results*

1) *Specification Error (Ramsey's RESET)*

```
RESET test for specification (squares and cubes)
Test statistic: F = 1.567624,
with p-value = P(F(2,15) > 1.56762) = 0.241

RESET test for specification (squares only)
Test statistic: F = 0.061380,
with p-value = P(F(1,16) > 0.0613803) = 0.807

RESET test for specification (cubes only)
Test statistic: F = 0.353918,
with p-value = P(F(1,16) > 0.353918) = 0.56
```

2) *Heteroskedasticity (White's test)*

```
White's test for heteroskedasticity
OLS, using observations 2001-2021 (T = 21)
Dependent variable: uhat^2

                      coefficient    std. error   t-ratio   p-value
  ---------------------------------------------------------------------
  const                1.43508e+025  9.64612e+024   1.488    0.1649
  d_FISHERIES         -3.35149e+019  5.29600e+019  -0.6328   0.5398
  d_MARITIMETRANSP~   -2.44499e+017  4.86621e+017  -0.5024   0.6253
  d_TOURISM           -8.14709e+016  1.51856e+018  -0.05365  0.9582
  sq_d_FISHERIES      -4.70500e+013  1.61464e+014  -0.2914   0.7762
  X2_X3                8.73164e+011  1.57340e+012   0.5550   0.5900
  X2_X4                3.11839e+012  1.36657e+013   0.2282   0.8237
  sq_d_MARITIMETRA~   -5.98404e+09   9.24008e+09   -0.6476   0.5305
  X3_X4                2.11709e+011  2.14031e+011   0.9891   0.3438
  sq_d_TOURISM        -5.66408e+011  5.77959e+011  -0.9800   0.3481

  Unadjusted R-squared = 0.273845

Test statistic: TR^2 = 5.750745,
with p-value = P(Chi-square(9) > 5.750745) = 0.764582
```

3) *Normality of Residuals*

```
Frequency distribution for residual, obs 2-22
number of bins = 7, mean = -0.000744048, sd = 2.89966e+012

      interval          midpt   frequency    rel.     cum.

           < -3.820e+012 -4.792e+012       1     4.76%    4.76% *
-3.820e+012 - -1.878e+012 -2.849e+012       3    14.29%   19.05% *****
-1.878e+012 -  6.498e+010 -9.064e+011       9    42.86%   61.90% ***************
 6.498e+010 -  2.008e+012  1.036e+012       4    19.05%   80.95% ******
 2.008e+012 -  3.950e+012  2.979e+012       2     9.52%   90.48% ***
 3.950e+012 -  5.893e+012  4.922e+012       1     4.76%   95.24% *
          >=  5.893e+012  6.865e+012       1     4.76%  100.00% *

Test for null hypothesis of normal distribution:
Chi-square(2) = 3.475 with p-value 0.17600
```

4) *Stability (Chow Breakpoint)*

```
Augmented regression for Chow test
OLS, using observations 2001-2021 (T = 21)
Dependent variable: RGDP

                      coefficient        std. error      t-ratio   p-value
  ---------------------------------------------------------------------------
  const                8.67660e+012       3.61850e+012   2.398    0.0322  **
  d_FISHERIES          911249             1.53330e+07    0.05943  0.9535
  d_MARITIMETRANSP~   -34395.4            134233        -0.2562   0.8018
  d_TOURISMTOTAL      -66114.3            597530        -0.1106   0.9136
  splitdum             5.67502e+012       3.73220e+012   1.521    0.1523
  sd_d_FISHERIES       839590             1.70203e+07    0.04933  0.9614
  sd_d_MARITIMETRA~    24695.7            138379         0.1785   0.8611
  sd_d_TOURISMTOTAL    373291             608057         0.6139   0.5499

Mean dependent var   1.18e+13   S.D. dependent var   4.48e+12
Sum squared resid    8.92e+25   S.E. of regression   2.62e+12
R-squared            0.778154   Adjusted R-squared   0.658699
F(7, 13)             6.514189   P-value(F)           0.001925
Log-likelihood      -625.2411   Akaike criterion     1266.482
Schwarz criterion    1274.838   Hannan-Quinn         1268.296
rho                  0.460970   Durbin-Watson        1.038591

Chow test for structural break at observation 2010
  F(4, 13) = 1.9553 with p-value 0.1611
```

5) *Autocorrelation (Breusch-Godfrey LM Test)*

```
Breusch-Godfrey test for autocorrelation up to order 6
OLS, using observations 2001-2021 (T = 21)
Dependent variable: uhat

                      coefficient        std. error      t-ratio   p-value
  ---------------------------------------------------------------------------
  const               -3.17471e+011       6.97505e+011  -0.4552   0.6579
  d_FISHERIES         -548531             4.10236e+06   -0.1337   0.8960
  d_MARITIMETRANSP~    -23844.0           45829.4       -0.5203   0.6132
  d_TOURISM            129962             120291         1.080    0.3031
  uhat_1                 0.614964           0.287875     2.136    0.0560  *
  uhat_2                 0.354219           0.341617     1.037    0.3220
  uhat_3                -0.654494           0.469179    -1.395    0.1905
  uhat_4                 0.437839           0.450817     0.9712   0.3523
  uhat_5                -0.0483720          0.486682    -0.09939  0.9226
  uhat_6                -0.638664           0.432672    -1.476    0.1680

  Unadjusted R-squared = 0.574246

Test statistic: LMF = 2.472748,
with p-value = P(F(6,11) > 2.47275) = 0.0918

Alternative statistic: TR^2 = 12.059156,
with p-value = P(Chi-square(6) > 12.0592) = 0.0607

Ljung-Box Q' = 12.1337,
with p-value = P(Chi-square(6) > 12.1337) = 0.0591
```

6) *Multicollinearity (Variance Inflation Factors)*

```
Variance Inflation Factors
Minimum possible value = 1.0
Values > 10.0 may indicate a collinearity problem

        d_FISHERIES    1.170
d_MARITIMETRANSPORT    4.082
          d_TOURISM    3.914

VIF(j) = 1/(1 - R(j)^2), where R(j) is the multiple correlation coefficient
between variable j and the other independent variables

Belsley-Kuh-Welsch collinearity diagnostics:

  variance proportions

    lambda      cond     const d_FISHER~ d_MARITI~ d_TOURISM
     1.858     1.000     0.004     0.003     0.065     0.066
     1.325     1.184     0.299     0.292     0.000     0.000
     0.689     1.642     0.552     0.504     0.002     0.024
     0.127     3.826     0.146     0.202     0.932     0.910

  lambda = eigenvalues of inverse covariance matrix (smallest is 0.12696)
  cond   = condition index
  note: variance proportions columns sum to 1.0

According to BKW, cond >= 30 indicates "strong" near linear dependence,
and cond between 10 and 30 "moderately strong".  Parameter estimates whose
variance is mostly associated with problematic cond values may themselves
be considered problematic.

Count of condition indices >= 30: 0
Count of condition indices >= 10: 0

No evidence of excessive collinearity
```

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