Pak. j. life soc. Sci. (2024), 22(2): 22570-22581 E-ISSN: 2221-7630;P-ISSN: 1727-4915

Pakistan Journal of Life and Social Sciences
www.pjlss.edu.pk

https://doi.org/10.57239/PJLSS-2024-22.2.001603

RESEARCH ARTICLE

The Development Prospects of Blue Economy of the Developing Nations: A case study of Pakistan

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ARTICLE INFO

Received: Jun 22, 2024

Accepted: Aug 31, 2024

Published: Sep 19, 2024

Keywords

Marine Economy

Economic Growth

Fisheries Production

Aquaculture Fisheries

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ABSTRACT

The blue economy is a new, alternative emerging sector which have potential to generate trillions of dollars through trade into the sea and marine resources. Especially when the world economies are facing increasing population and depleting earth's resources which have pushed the trend to resource substitution as a solution of severely scarcity. The research in hands is not only an empirical study on the subject but also unique in a sense that it has account and highlight the factors which are essential and important for the blue economy of a country by using the ARDL technique. The F-statistic shows that model determined a long-run relationship between total fisheries production, trade, Aquaculture fisheries, exchange rate, inflation and tax amnesty of Pakistan at 1% level of significant. The coefficient of error correction term exhibits 39 percent of the deviation that will occur in the short run will be corrected after a period of time and hence, approach the long-run balance.

INTRODUCTION

Planet Earth is rightly called the blue planet because more than 72% of its surface is covered with, oceans, Seas, and Rivers. More than 60 percent of world population on Earth depend on water for their economic survival. Oceans and Seas are nature's greatest gifts and have great importance in human history. Water was behind the settlement of Great civilizations, Egyptians, Babylonians, Indus, and, Mesopotamians, on the banks of rivers, Nile, Tigris and Euphrates. Moreover, it is considered an ancient, reliable and economical source of transportation and communication between the continents. More than 80 percent of world trade is based on sea–water through the Sea Lines Communication (Abihijit, 2023). The Portuguese (15th to 17th centuries), Scandinavians, French, and British (late 18th centuries) all experienced periods of significant maritime trade and power projection in different historical eras. Captain Mahan's[1] sea-based theory of geopolitics abetted the extensiveness of sea-power, which augmented first the French and then Great Britain to influence their outreach to other continents like India, Africa and Indochina. At presently, the United States of

[1] Captain Alfered T. Mahan, 1980, "The influence of Sea Power upon History".

America expended its navy to be converted into a Blue–Water Force[2] to elongate its influence and outreach from Caspian Sea to all strategic straits and channels and Particularly Sensitive Sea Area (PSSA)[3]. Therefore, the water is not only a source of life but also, it's a source of earning and trade. After the 19th century, it's got a Geo-strategic importance in the world.

The world is facing various challenges, among these the rapid increase in the population would be the big one. Since there is positive correlation between the population and the demand for goods and services. It will not only be caused to increase the unemployment in the economy but also push the demand for resources like food, shelter, water and other natural materials. To meet the current increase of demands of people, countries are now shifting from a brown economy[4] to a blue economy for sustainable economic growth.

The blue economy refers to sustainable use of ocean resources for economic growth, improved livelihoods, and generate employment opportunities while preserving the health of ocean ecosystem (World Bank, 2010). In fact, it is the regeneration of the ecosystem in a logic of abundance and autonomy which covers a wide range of sectors for instance, fisheries and aquaculture, marine-tourism, renewable energy, marine-biotechnology, coastal infrastructure development, and marine-transport, that are interlinked with each other.

Infect, the marine sector is not just a sector but it a parallel economy, where all other sectors of economy cross through. All these sectors of the marine-economy have great potential making oceans the 7th largest economy in the world and projected to potential contribution approximately US$24 trillion to the world economy out of which the share of goods and services specially, from the coastal and marine environment contributed about US$2.5 trillion in term of the gross marineproduct (6th GEF Assembly, 2018). The marine-fisheries alone contributed more than US$270 billion per year which highlights the importance of blue-economy. In 2018, revenue generation from the tourism sector related to the sea was US$1.71 trillion from the sea (Rao, 2020). Which includes the coastal tourism, marine-wildlife, diving and other recreational activities.

These figures underscore the economic significance of marine-related industries to the economy as well as its potential for further growth and development. The blue economy not only sustains the livelihoods of millions of populations but also provides substantial economic benefits. It represents a vast frontier of economic potential, offering opportunities for sustainable development while addressing global challenges such as food security, climate change, and economic competitiveness.

Many countries indeed recognize the interminable and stupendous potential of the blue economy because the oceans and seas offered vast resources and opportunities for sustainable development by addressing challenges of the world such as resource scarcity, food security and economic competitiveness. Investing in this sector lead to job creation (estimated 600 million livelihoods depend on fisheries and aquaculture), shipping accounts for trillions of dollars in international trade, sustainable and consistent economic growth (FAO, 2022). By Effective and Efficient use of marine resources a nation can become more competitive and gain sustainable economic development.

By the words of Robert (2010)[5], "The word Pakistan sums up the Indian Sub-continent". Pakistan is fortunate enough to not only have a diverse range of landscapes, mountains and coastal areas (Arabian Sea) but with also geo-political location. Geologically it not only overlaps Indian tectonic plates but also Iranian and Eurasian. It shares a long coastal-line over 1050 Km along the Indian Ocean with addition of maritime sovereignty includes Exclusive Economic Zones (EES) of 240,000

[2] The term "blue-water force" is a maritime geographical term in contrast with "brown-water navy" used for waters and near to shore and "green-water navy" mean near to shore and open oceans.

[3] Introduced by International Maritime Organization.

[4] Refers to an economic development that is highly dependent on the use of fossil fuel.

[5] Robert D Kaplan, (2010), South Asia's Geography of Conflict

Sq. Km and the Continental Shelf (approximately 50,000 Sq. Km). This vast swathe of sea area is rich of bio-productivity and bio-diversity and also serving as gateway for international maritime trade route.

Since long, the economy of Pakistan has been severely under strain. Pakistan's economy is vitiated of different crisis ranging from debt trap to deficit of trade along with high inflation (World Bank, 2023). To get rid of these crises Pakistan's economy needs to realign the traditional economy with opening new fronts of production and business by reaping the untapped maritime resources. Though, Pakistan recognized the blue economy as a parallel to traditional economy by considering 2020 as a year of blue economy and in compliance with Sustainable Development Goals (SDG-14), it has already taken the path of growth with blue economy. But it still needs to materialize all recognitions because the worldwide blue economy is valued at around US1.5 trillion per annum (Commonwealth report, 2024) and would be double by 2030. Pakistan shares is only US$ 250-300 millions per annum which is least in the region. The neighboring countries already undertaken the blue economy by sharing a handsome amount with their GDP from oceans. According to World Bank report-2024, Bangladesh earned $6 billion and India earned $7 billion from their maritime sector. It is also predicted that the Pakistan economy has the potential to earn up to US$2 billions annually. Pakistan can accelerate its ocean-based sector by exploring underwater resources, promoting fisheries and encouraging tourism in the coastal areas. The sector will transform the country's economy by creating job opportunities for the people in the shipping industry, tourism, fisheries, aquaculture, and energy production.

By considering the above fact this study will evaluate the relationship between marine resources and economic development of Pakistan by focusing on various aspects, for instance, total fisheries production, aquaculture fisheries, and trade to the economic growth of Pakistan.

First section is about the introduction of the topic and rest of the study organize as: section II is the description of literature review, section III is the conceptual framework and methodology, last section provides the conclusion of the study and further policies for the policymakers.

LITERATURE REVIEW

South Asian region lacks literature on monetary and social estimations of ocean-based industries. The unavailability of data has limited the expectations of ocean-related industries while complicating the true evaluation of the share of those enterprises in economic growth (Forbes, 1995). Fisheries is an important sector of the ocean-based economy and plays an important role in boosting economic sustainability. The revenue generation of the sector is around $1.2 billion, 0.4 percent of the GDP, and the sector also created almost 1.8 million jobs for the people. Safdar et al. (2021) and Babar S. et al. (2018) concluded that the aquaculture sector is shown some improvement but it still lagging behind when compared to other countries. It could be due to low production levels which might have contributed to the current gap in performance when compared internationally. Humayun et al. (2014) discussed the trade volume of Pakistan and was of viewed that more than 90% of trade is done through sea routes. Pakistan's exports were around $24.5 billion in 2007 and recorded 17% increase in every year but after 2008 the downward trend started. Pakistan's trade had potential to grow 32.9% annually with an amount US$ 66.5 billion approximately. Similarly, Syed et. al. (2021) emphasized that the marine economy has great potential to generate a revenue of around US$ 24 trillion to the world economy but countries are just getting benefits of hardly US$ 600 billion. Pakistan has potential to generate an additional US$ 100 billion from sea. It's neighboring countries like India, Bangladesh, China, are investing in their marine sector and harnessing the marine potential but Pakistan despite being ranked as 74th in terms of coastal length is only generating US$ 450-600 million.

Whereas Khawar S, et al (2019), discussed that Pakistan's over 90% trade is through Sea and its trade volume was US$ 84 Billion in 2018. Pakistan's cargo shipping share of import and export is 40% extendable to 60% as per United Nations Liner Code (1974) but it utilizing of this capacity is under 10%. By adhering to these provisions, Pakistan can leverage its own shipping resources more effectively, potentially reducing reliance on foreign carriers and retaining a greater share of the value generated from its trade activities. The Indian Sea provide an opportunity to boost economic growth by utilizing their natural and human resources but the region is still lagging behind (Patil et al. 2016, Parletta, 2019, Llewellyn et al. 2016, Ghani, 2011, Jayawardena et al. 2013). Alharthi et al. (2020) concluded that SAARC countries have great potential in marine sector and can speed up their economic growth if they use their marine resources in an efficient manner.

Gill et al. (2021) argued that the marine sector of Pakistan is generating millions of jobs every year but the labor force is not skilled for the ocean-based jobs.ng He emphases that the policy maker should marine-based job-oriented policy so that people living near to coastal area can get employment. Moreover, he disclosed that the political uncertainity is the main hurdle for investment of coastal area of Pakistan.

Barrech et al. (2021) concluded that Pakistan is located in the Indian Ocean which is an important geographical and strategic location. Water was the main reason behind World War I and II. They were over the Atlantic and Pacific oceans and now it seems that the next world war (III) would be on the Indian Ocean. According to them the China is strengthening its economic power and has dominated in the Indian Ocean. Sooner or later this domination would cause World War III. In the future if the US blocked Malacca Strait, the Gwadar port can serve as an alternate route for Chinese trade in the Indian Ocean and to West Asia. Ebarvia (2016) stated that in the EAS region, Oceans and seas are providing people with jobs and helping those industries which have shares in the GDP of countries. Askari et.al (2021) stated that Pakistan's future is strongly associated with the blue sector economy. The blue sector of Pakistan has significant importance in terms of trade as 100% of minerals and about 90% of trade is being done through sea routes. Whereas Hamzo et al. (2021) evaluated the mainstream difficulties affecting the economic growth of Pakistan and focused on how the marine economy plays an integral role in the economic sustainability of Pakistan by examining 20 years of data. The paper also concluded Pakistan's is using least its marine resources as compared to other South Asian countries. Sumaira et al. (2021) pointed out main purpose of marine sector, that is, the efficient usage of ocean resources can enhance the economic wellbeing of the countries by playing an integral part in the economy's GDP.

Ahmed, I (2024) pointed out the importance of blue economy and is of views that Pakistan's Fisheries sector contributes less than 0.4 percent to the GDP of the country. Around 0.39million people are directly and 0.90 million indirectly linked with this sector.

Malik, Y (2012) discussed the importance of Gwadar deep Sea-port which can plays a significant role in blue diplomacy by affecting economy, military and geopolitics. Through this sea-port Pakistan can build connection with all over the world. Pakistan has transit-shipment capacity is about 36,000 ships per annum with 38 million tons of trade volume in 2012 and projecting to rose the total trade volume of Pakistan 91 million tons by the year 2015, 130 million tons by 2020 and 200 million tons by the 2025. Hence, it is rightly said that the Gwadar would be transshipment port in the future and can become a main hub of commercial activity and can give a substantial rise to the economy of the country.

Though the plenty of literature is found for marine sector which only discussed the importance of blue economy and its potential but did not find even a single study which discuss the important variables which would be utilized with the marine economy like total fisheries production, aquaculture fisheries, and trade to the economic growth of Pakistan. Therefore, the aims of this study is to fill the crucial gap in the literature by focusing on the specifics variables which impact the blue

economy especially in the context of Pakistan. It is unique study which focus on these variables and provide a comprehensive analysis for different aspects of the marine sector contribution to economic growth of an economy.

RESEARCH METHODOLOGY

The study employed the autoregressive distributed lag (ARDL) model proposed by Pesaran et al. (2001) which allows us to test both short- and long-run relationships between the dependent and the explanatory variables in a multivariate framework. The ARDL model (bounds test) allows a mixture of I(1), I(0), or mutually cointegrated variables as regressors i.e. the order of integration of relevant variables may not be necessarily the same. However, the major limitation of the bounds test procedure is that it ineffective with presence of the I (2) series. The study constructed vector autoregression (VAR) model to analyse the short and long-rum relationship between economic growth and marine resources introduced by Pesaran et.al. (2001).

$$\rho_t = \alpha + \sum_i^n \gamma_i \rho_{t-i} + \mu_t \ldots\ldots\ldots 1.3.1$$

Where ρ_t is the vector quantity of both independent variables Y_t and dependent variable x_t. Economic Growth is defined by Y_t. The vector matrix represents a set of explanatory variables x_t which represents (Y_t), (tf_t), $(\mathrm{T}r_t)$, (Af_t), (Inf_t), $(\mathrm{E}x_t)$, (Pg_t) and (Z_t). Where (Y_t) is the economic growth, tf_t is the total fisheries production, $\mathrm{T}r_t$ is trade, Af_t denoted aquaculture fisheries, Inf_t is the inflation rate, $\mathrm{E}x_t$ is the exchange rate, pg_t is the population growth rate and Z_t defines tax amnesty provided by the government from time to time to boost up the output of fisheries and aquaculture. α is the intercept capturing the combine effect of $\alpha Y$and αx, t is the time trend and γi is the matrix of VAR parameters for lag *i*.

To capture the short-term and long-term relationships between the dependent and the explanatory variables the study utilizes actual values of the independents and dependent variables instead of their growth rates. In addition according to Pesaran et al (2001), the ARDL model Y_t must be an I(1) while the x_t regressors can be either I(0) or I(1) level. The equation 1.3.1 can be further specified as a Vector Error Correction Model (VECM)

$$\Delta\rho_t = \alpha + \vartheta t + \pi\rho_{t-i} + \sum_i^n \omega_i \Delta Y_{t-i} + + \sum_i^n \omega_i x_{t-i} + \mu_t \ldots\ldots 1.3.2$$

Where Δ is the first difference, capturing the short-term component of the model and ϑ is the coefficient of time trend, ωi are coefficient of dependent and explanatory variables in the model, and the long run multiplier matrix π can be separated as follows:

$$\pi = \begin{bmatrix} \pi_{YY} & \pi_{Yx} \\ \pi_{xY} & \pi_{xx} \end{bmatrix}$$

The selected series can be either I(0) or I(1) due to diagonal elements of the matrix which is unrestricted. For example, if $\pi_{YY} = 0$ then Y is I (1) while if $\pi_{YY} < 0$ then Y is I (0). By taking these values to test for the presence of almost one co-integrating vector between a dependent variable and the explanatory variables.

By assuming unrestricted intercepts and no trends and to drive the preferred ARDL model we imposed some restrictions πxY = 0, $\alpha \neq 0$ & ϑ = 0. Following unrestricted error correction model (UECM) the preferred marine resources–led growth function can be written as represents,

(Y_t), (tf_t), $(\mathrm{T}r_t)$, (Af_t), (Inf_t), $(\mathrm{E}x_t)$, (Pg_t) and (Z_t)

$$\Delta Y_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 tf_{t-1} + \beta_3 Tr_{t-1} + \beta_4 Af_{t-1} + \beta_5 Inf_{t-1} + \beta_6 Ex_{t-1} + \beta_7 Pg_{t-1} + \beta_8 Z_t + \varepsilon_t$$

$\ldots\ldots\ldots\ldots\ldots\ldots\ldots$ 1.3.3

A desirable ARDL model. Where, $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7$ & β_8 are unknown and scalar parameters. ε_t is a white noise disturbance term and all variables are expressed in natural logarithm.

For estimation UECMs, the long-run elasticities are the coefficient of one lagged explanatory variable divided by the coefficient of the one lagged dependent variable i.e. $\beta 1$, $\beta 2$ and so on while the short-run effects are captured by the coefficients of the first difference variables in equation (iii). Both hypotheses (null and alternative) are tested in the analysis

H_0: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = \beta_8 = 0$ (Variables are not Co-integrated)

H_1: $\beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6 \neq \beta_7 \neq \beta_8 \neq 0$ (Variables are Co-integrated)

The critical values for lower bound assumed that the explanatory variables x_t are integrated at order zero while the upper bound critical values assumed to be integrated of order one.

DATA COLLECTION

Secondary data from 1992 to 2020 have been used for analysis. The data is available on the World Bank (World Development Indicators (WDI)) and the Global Economy database.

RESULTS AND DISCUSSION

The Autoregressive Distributed Lag (ARDL) model is a famous method to use for analyzing the long-run relationship between dependent and independent variables for the time series analysis. The key aspect of using ARDL is the testing of stationarity at level or first difference to avoid misleading results.

The ARDL model is frequently used to account for both time periods i.e. short-term and longterm. The short-term estimates capture mostly the immediate impact of changes in the variables while long-term estimates reflect the equilibrium relationship after all adjustments have taken place. It also suggests that while the instant effect of changes in the variables might be modest but their impact is significant over time as the system converge to the new equilibrium.

The coefficient of ECM is - 0.10 which is negative and statistically significant (table-ii) resulting in the stability of the model. In case of any disequilibrium in the economy, the policies will play an important role in converging it towards equilibrium at the rate of 10% per annum.

The total fisheries production has a significant impact on economic growth of the country as it causes to increases 0.15 percent (table-ii) if there is one percent improvement in the total fisheries

Table I: Results of Unit Root Test

Variable	**ADF**		**Phillips – Perron**	
	Constant; No Trend	**Constant; Trend**	**Constant; No Trend**	**Constant; Trend**
Y	– 1.5811	– 2.9206	– 1.8855	– 2.5496
tfp	– 0.9447	– 1.2870	– 0.7499	–1.1364
trd	– 0.5390	– 1.0214	– 0.2195	– 2.0314
Af	– 2.3265	– 0.2135	– 0.1254	–2.95178
Er	– 1.2931	– 2.2322	– 0.9708	–1.7177
Inf	– 2.2539	– 2.3000	– 2.0396	–1.9293
Pg	– 0.0687	– 1.5870	– 0.1375	–1.8681
At First difference				
Variable	ADF		Phillips – Perron	
	Constant; No Trend	Constant; Trend	Constant; No Trend	Constant; Trend

Y	– 3.8269***	– 3.9333**	– 4.2934	–4.2837***
tfp	– 4.2934***	– 4.2837**	– 3.8336*	–3.9333**
trd	– 1.2268***	– 1.1865***	– 4.2565***	–4.4505***
Af	– 4.42078***	– 4.6021***	– 4.3954***	–4.5948***
Er	-3.1177**	-2.9948	-2.9226*	-2.8711
Inf	-4.5366***	-4.3514***	-4.4785***	-4.2798***
Pg	-3.1177**	-2.9948	-2.8913	-3.1216**

(***, **, *) 1%, 5% and 10%. The p-value is suggesting that the relationship between dependent and independent variables statistically significance level.

Production in the short run but it shows higher effect in the long-run i.e. 0.40 percent (table-iii). The greater impact in the long-run indicates that improvement in total fisheries production have substantial benefits for economic growth over time. These results are consistent with Alharthi et all (2020), Dong and Su (2020), Zhao et.al (2022), Ahammed et.al (2024).

The contribution of trade for the economic growth is very crucial and not only work as a powerful engine for the economies to leverage their comparative advantages and integrate more fully into the global economy but also diversify the economies more resilient to external shocks. The study verifies the theoretical relationship between trade and economic growth. The impact of trade on economic growth records more in the long-run as compare to short-run, for instance, by increasing one percent of trade activities will boost the economic growth by 0.40 percent in the long-run compared to 5 percent in the short-run. The higher impact of trade reveals, with the passage of time, the improved trade reflects the cumulative and compounding benefits of trade i.e. more resource allocation, adoption of technology, investment in the market and stronger business linkages.

Aquaculture fisheries indeed are a significant water resource which provides substantial share of the World's seafood and supports livelihoods of millions of individuals worldwide particularly for coastal and rural areas. The immediate effect of growth in the economy observed by 0.22 percent (table-ii) if the aquaculture fisheries increase by one percent which would be considers modest but its impacts are significant over time i.e. 0.75 percent in the long-run (table-iii). The statistically significant (*p-value*) indicates that the estimated effects of aquaculture fisheries are robust and not due to chance.

In essence, the exchange rate fluctuations have a substantial, reliable and robust impact on economic growth. The estimates of the study proved this strong relationship by one percent increase in the exchange rate leads to a 0.56 percent (table-ii) boost the economic growth in the short-run but the long- run impact are unusual and not reflecting the true relationship. The standard error (0.014) indicates precision of the estimate because smaller the SE relative to magnitude suggests the reliability and vigorous. The short-run relationship is consist with various studies like Kkhondker et al (2012),

Table II: Short–run estimates of ARDL

Variable	Coefficient	Standard Error	t-value	probability
Y	6.8694	0.0502	136.85	0.0000
Tfp	0.1512	0.005	30.53	0.0000
trd	0.052	0.0112	4.66	0.0000
Af	0.2258	0.0085	26.49	0.0000
Er	0.5652	0.0143	39.42	0.0000
Inf	0.1006	0.0072	1.04	0.3329
Pg	0.129	0.0088	14.86	0.0000
Z	0.1203	0.0001	1.04	0.3329
Model Criteria/Goodness of Fit				

ECM (-I)	-0.0997	0.0051	-19.51	0.0000
R^2	0.8423			
F-Statistic			4.919	[0.0017]**
log- likelihood	159.049			
DW	2.08			
F-Statistics	7.2245			0.0000
Critical Value	Lower Bound Value		Upper Bound Value	
1%	3.12		6.76	
5%	3.86		4.5	
10%	2.35		3.55	

Pramanik, S. (2021), Jayathilaka et al (2023), Herrera et al (2023). The inflation and economic growth have a very complex relationship. The inflation (high and persistent) is not suitable for the economy because it creates uncertainty in the economy, reduced purchasing power of the consumer as well as lead to increase the cost of businesses and resulted slowdown the economic growth of the country. The results of the study are aligned with the theory that the inflation immediate effect the economic growth by reducing 10 percent in the short-run while for long-run it has substantial effect i.e. – 0.47 on economic growth when inflation increased by one person. Abdo, H (2024), Ezako, j. T. (2023), Ahmad T. (2022), Kinci et al (2020), Kasidi et al. (2013),

Carlos et all (2003), Ayyoub et all (2011) reported similar results. Pakistan's economy negatively affected by inflation which is beneficial in the short run while high level or doubledigit figure inflation harmful for Pakistan economy.

The economic theories and empirical literatures revealed that the relationship between population and economic growth is controversial and indecisive. There is no long-run relationship between population and economics growth (Johansen 1988, Hansen1996), particularly for developing economics (Wong, 2005). The study exhibits positive relation between population and economic growth by increasing one percent of population resulted 0.13 percent of economic growth in the short-run and with one percent addition in the long-run. These results are consistent with the previous study like Jan (2021) who found that the population has positive effect on economic growth in the short and long run in the Pakistan. Whereas our results are contrary with Ahmed et al (2016) who concluded that the population has negative impact on economic growth in the Pakistan and creates a lot of problems like unemployment and etc.

Tax amnesty is a program which enables people to repay their taxes with lowered fines and interest and/or even protect legal actions. Mostly these options are opted to encourage individuals and business to facilitate settle their tax liabilities voluntarily. The tax amnesty theoretical has positive relationship with economic growth. The study verifies this relationship by increasing one percent facility of tax amnesty pushed up 0.12 percent the rate of economic growth in the short-run. Whereas the tax amnesty have higher impact in the long-run which is more than 0.67 percent. The small value of SE indicating high precision in the estimation about the tax amnesty and economic growth. Similar results are reported by Malik et al (1991), Winastyo (2010), Mahestyanti et al. (2018), Sayidah and Assagaf (2019) and Kanca et al (2024) reported that the tax amnesty policy succeeded in achieving the targets of increasing revenue in the short-run and increasing the economic growth of the country.

The p-value of the F-statistic shows that the model is statistically significant overall. Which implies that the predictors have collectively significant effect on economic growth. Where the high value of R^2 (the goodness of fit) reveals that the substantial (84 percent) portion of the variation in the dependent variable (economic growth) can be explained by the model. The calculated value of Durban-Watson test (2.08) suggests that there is no autocorrelation in the model predicting that the residuals are independent which supports the reliability of the model's estimates.

Bound test approach was developed by Pesaran and Shin (2001) and the basic purpose of conducting bound test is to check the long-run relationship among the variables. It is widely used in the field of econometrics where time series data may have non-stationarity and cointegration exists among the variables. The upper bound and lower bound values are reported in bottom of the table. The F-statistic at 1% level of significance is 7.22 which is higher than the upper bound value 6.76, confirming the existence of a long-run relationship among the variables.

The table-iii shows the long-run relationship of coefficient, error corrections and diagnostic test statistics. The F-statistic shows that model determined a long-run relationship between *total fisheries production, trade, Aquaculture fisheries, exchange rate, inflation and tax amnesty* of Pakistan at 1% level of significant. After establishing the long-run relationship between the variables, long-run coefficient is estimated by using ARDL model. All variables are found to be

Table III: Long–Run Estimates of ARDL

Variable	Coefficient	Standard Error	t-value	Probability
C	1.2304	0.0450	33.58	0.0000
tfp	0.4613	0.0114	35.67	0.0000
trd	0.4079	0.0139	57.25	0.0000
Af	0.7971	0.0040	38.45	0.0000
Er	0.1530	0.0106	4.5	0.0000
Inf	- 0.0478	0.0087	- 26.67	0.0000
Pg	- 0.1422	0.0011	- 1.24	0.214
Z	0.6750	0.0135	49.89	0.0000
Model Criteria/Goodness of Fit				
ECM (t-I)	- 0.393		- 5.575	0.0000
R^2	0.855			
F-Statistic			6.9941	[0.0000]**
log- likelihood	159.049			
DW	2.08			
F-Statistics		7.2245		0.0000
Breusch-Pagan-Godfrey				
CUSUM			Stable	
CUSUMQ			Stable	

statistically significant at the 1% level of significant except inflation. The results show that total fisheries production, trade, aquaculture fisheries, population growth and tax amnesty have increasing effect on economic growth while inflation and exchange rate have negative impact on economic growth. In addition, the model reports that the error correction term coefficient is negative and statistically significant at the 1% level. The error correction term has the value the 0.393 which is possible that approximately 39 percent of the deviation that will occur in the short run will be corrected after a period of time and hence, approach the long-run balance.

Figure 1 presents the CUSUM and CUSUMQ test results of the ARDL model for the variables. The CUSUM test or cumulative sum test is used to check the stability of the coefficient of the model in the time series modeling by plotting the cumulative sum of the residuals and verify whether it stays within the critical region or not. The CUSUMQ test is the test of cumulative sum

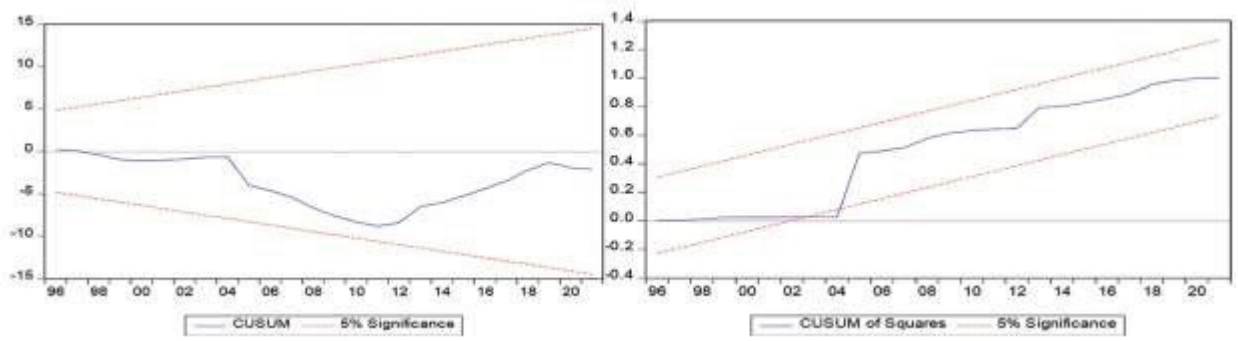

Figure I: CUSUM and CUSUM SQUARE test

of square of residuals which is used assess whether there is any instability in the sum of square of cumulative residuals. Since both test (CUSUM and CUSUMQ tests) are observed within the critical region i.e. 5% significant level which suggests that short-term and long-term coefficient of the ARDL model are stable and consistent over the study period.

CONCLUSION

The study in hands summarize this discussion by exhibiting the importance of blue economy for the country. The blue economy is a new alternative emerging sector which have potential to generate of trillions of dollars through trade into the sea and marine resources. Especially when the world economies are facing increasing population and depleting earth's resources which have pushed the trend to resource substitution as a solution of severely scarcity. It is not only an empirical study on the subject but also unique in a sense that it has account and highlight all factors which are essential and important for the blue economy of a country.

The study analyze the marine and its related resources which can impact the economic growth of Pakistan by using the ARDL technique. The findings of the study reveal that there is positive correlation between economics growth of the country and marine resources for both periods (short-term as well as long-term), which suggests that investment in blue sector could contribute to sustainable economic growth of Pakistan. For instance, total fisheries production has a significant impact on economic growth in the long-run indicates improvement in total fisheries production have substantial benefits for economic growth over time. The impact of trade on economic growth records more in the long-run as compare to short-run which proves that more resource allocation, adoption of technology, investment in the market and stronger business linkages. The aquaculture fisheries indeed are having modest impacts on economics growth in the short-run but substantial i.e. 0.75 percent in the long-run. The exchange rate, inflation and population can lead the economy more than a half percent in the short-run as well as long-run in the Pakistan. Tax amnesty an option which are opted to encourage individuals and business to facilitate settle their tax liabilities voluntarily. It play a significant impact on the Pakistan economy by incorporating more than 60 percent in the long-run.

All variables are found to be statistically significant at the 1% level of significant except inflation. The results show that total fisheries production, trade, aquaculture fisheries, population growth and tax amnesty have increasing effect on economic growth while inflation and exchange rate have negative impact on economic growth. In addition, the model reports that the error correction term coefficient is negative and statistically significant at the 1% level. The error correction term exhibits that approximately 39 percent of the deviation that will occur in the short run will be corrected after a period of time and hence, approach the long-run balance.

Based upon above findings, the prosperity and development of a country can indeed be significantly influenced by both terrestrial and marine resources. The synergy between these areas can drive substantial economic benefits and support sustainable development. By leveraging both terrestrial

and marine resources effectively, countries can achieve not only balanced growth through utilizing marine resources as the substitute but also resilience against environmental challenges.

POLICY AND IMPLICATIONS:

- To take maximum benefits from the blue economy, there should be comprehensive implementable national ocean policy that not only outlines the rules and regulations but also have a roadmap for investment.
- To evaluate economic benefits, the government should conduct comprehensive survey and assessments of Pakistan's marine resources.
- A coordination body should be established at national level to oversee blue economy initiatives, creates a favorable investment environment and effective collaboration among stakeholders.
- Foster public private partnership by developing infrastructure and facilitation center. GoP should introduce tax holiday, amnesty, grants and financial incentives to encourage foreign investors.
- By following the above foundations, Pakistan can drive economic growth by unlocking the full potential of its marine resources in the short-run and ensures sustainability and consistency in the growth in the long-run.

WAY FORWARD

The subject in hands "Blue Economy" provides a rich and multifaceted framework for researchers to delve into and explore its environmental and social dimensions to evaluate the potential of the blue economy.

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