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DRIVERS OF BLUE ECONOMY IN ASIA AND PACIFIC ISLAND COUNTRIES: AN EMPIRICAL INVESTIGATION OF TOURISM AND FISHERIES SECTORS

Poulomi Bhattacharya and
Aruna Kumar Dash

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Poulomi Bhattacharya is an associate professor at the School of Livelihoods and Development of Tata Institute of Social Sciences in Hyderabad, India. Aruna Kumar Dash is an associate professor at the Department of Economics of IBS Hyderabad, IFHE University, India.

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Please contact the authors for information about this paper.

Email: bpoulomi@gmail.com

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Asian Development Bank Institute
Kasumigaseki Building, 8th Floor
3-2-5 Kasumigaseki, Chiyoda-ku
Tokyo 100-6008, Japan

Tel: +81-3-3593-5500
Fax: +81-3-3593-5571
URL: www.adbi.org
E-mail: info@adbi.org

Abstract

This study examines the determinants of blue economy activities, namely tourism and fisheries, in 21 Asia and Pacific island countries during the period 1996 to 2016. Using a panel data model, it was found that the size of the blue economy positively depends on the gross fixed capital formation and access to electricity in Asia and Pacific island countries. We find that the size of the blue economy has responded positively to sustainable ocean management policies. Hence, our findings support the need for, and effectiveness of, the implementation of sustainable ocean governance policies in the Asia and Pacific island region, which can further strengthen the growth of these island countries.

Keywords: blue economy, tourism, fisheries, sustainability, island countries, panel data model

JEL Classification: Q22, O56, C33

Contents

1. INTRODUCTION

The importance of promoting the "blue economy" has been recognized since the Rio +20 conference in 2012, which was mainly prompted by coastal countries. As defined by the World Bank, the "blue economy" implies "sustainable use of ocean resources for economic growth, improved livelihoods, and jobs while preserving the health of the ocean ecosystem" (World Bank 2017). The components of the blue economy, as identified by the World Bank (2017), include fisheries, tourism, maritime transport, aquaculture, seabed extractive activities, marine biotechnology and bioprospecting, etc. The concept of the blue economy is also recognized by the United Nations Sustainable Development Goals in SDG 14, which sets a target that by 2030 the economic benefits will be increased to small island developing states (SIDS) and least developed countries (LDCs) from the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture, and tourism (Spalding 2016).

In this paper, we focus on the growth of Asia and Pacific island countries with reference to two blue economy sectors, namely fisheries and tourism. This study also examines whether and how factors like investment, environmental quality, trade openness, and ocean management policies influence the size of the blue economy with special reference to fisheries and tourism in Asia and Pacific island countries. Asia and Pacific countries assume a central place in the world economy today. The share of the Asia and Pacific region in the total world GDP increased from 28.4% in 1995 to 33.3% in 2016 (World Bank, World Development Indicators 2018). According to the Asian Economic Integration Report, the region's growth in trade increased by 1.7% in 2016 from 1.4% in 2015, while world trade decelerated (ADB 2017). Despite an impressive overall growth performance in this region, many island countries belonging to the Asia and Pacific region have been declared LDCs and in most cases the real GDP growth rate in these island countries is lower than in other countries in this region (International Monetary Fund 2018). A recent list of countries based on ocean area as a percentage of total sovereign area published by the World Economic Forum reveals that for most of these Asia and Pacific island countries the ocean area as a percentage of land is more than 80% (Degnarian and Stone 2017). Thus, the development of the blue economy as a driver of economic growth is immensely important for these countries. Most of the existing studies on the blue economy deal with the conceptualization of the blue economy, with an emphasis on the need for valuation of ocean ecosystem services and the role of ocean governance (see Section 2). This paper contributes to the existing literature by empirically examining determinants of blue economy activities, namely fisheries and tourism, in the context of Asia and Pacific island countries over two decades from 1996 to 2016. To the best of our knowledge, no previous study has made any such attempt.

In order to identify the driving factors behind the blue economy, we use a panel data model and our analysis encompasses three sets of estimates. The first set considers the overall size of the blue economy, while the second and third sets take into account the production of the fisheries and tourism sectors separately. In order to check the robustness of our results, we use alternative model specifications for the aforementioned sets of estimates and find consistent results with the benchmark models. Our analysis reveals that gross fixed capital formation, the availability of electricity, a higher degree of trade openness, and exports influence blue economy activities favorably. Moreover, the results also indicate that sustainable ocean management policies catalyze blue economic activities.

The paper is organized into six sections. Section 2 delineates a review of the relevant literature. Section 3 describes the justification for selecting relevant variables for empirical analysis. Section 4 discusses the data and methodology used for the study. Section 5 presents the empirical results, and finally Section 6 concludes and provides some policy recommendations.

2. REVIEW OF LITERATURE

As the concept of the blue economy is a recent one, there are quite a few studies (Smith-Godfrey 2016; World Bank 2017; Keen, Schwarz, and Wini-Simeon 2018; Attri 2016) that engage in identifying a working definition and framework for understanding the "blue economy." Using a qualitative framework and applying cluster analysis, Smith-Godfrey (2016) identified five activities, namely extraction of living resources, extraction of nonliving resources, new resource generation, trade in resources including tourism and recreation, and ocean health, as the components of the blue economy. A similar classification is extended by the World Bank report on understanding the potential of the blue economy (World Bank 2017). Keen, Schwarz, and Wini-Simeon (2018) emphasized the need to digress from an activity-based approach and stressed the need to integrate ecological economic concepts along with the production and allocative efficiency of economic activities linked to oceans. They defined ecosystem resilience, economic sustainability, community engagement, institutional integration, and technical capacity as the five components required to conceptualize the blue economy. Attri (2016) identified good governance, vision, technology, blue management and monitoring, and institutional and regulatory reforms as the main pillars for the blue economy of a country. Until now, apart from the conceptualization of the blue economy, a few attempts have already been made to measure the size of the blue economy. But the scope of such studies is limited and mainly confined to the developed countries and a few Asian countries (see, for instance, Mohanty et al. 2014; Mohanty 2018; Carvalho, Guillen, and Santos 2018).

Apart from the conceptualization and measurement of blue economies, a few studies have emphasized the importance of the blue economy in creating jobs. For example, Pauli (2010) described the potential of the blue economy for innovation and predicted that the blue economy has the potential to create 100 million jobs by 2030. Several studies have identified the importance of the blue economy in improving the livelihoods of Asia and Pacific countries. For example, Hasan et al. (2019) and Sarker et al. (2018) explained the job creation potential of blue economy activities in the context of Bangladesh while Pranathi and Gonchkar (2019) addressed this in the context of India. A number of scientific studies and policy papers mainly emphasize the importance of maintaining sustainability in the context of the blue economy (Kathijotes 2013; Spalding 2016; Golden et al. 2017; Moolna and Thompson 2018; McKinley et al. 2019). While Spalding (2016) and Moolna and Thompson (2018) emphasize the need for valuation of the marine ecosystem in order to assess the sustainability of blue economy activities, McKinley et al. (2019) recognize the importance of stakeholders' participation in the development of a sustainable blue economy. Studies like Ehlers (2016) and Barbesgaard (2018) have identified a few strategies to enhance ocean governance mechanisms in order to improve the growth of the blue economy. They suggested that international cooperation, the establishment of a financing system for conservation, and sustainable use of seas are major strategies that need to be adopted to ensure blue economic growth. Similarly, Voyer et al. (2018) suggests that maritime security is one of the major contributors to the blue economy by providing security for navigation routes, and providing marine data. Techera (2018) emphasized the importance of legal resource management in order to promote the goals of obtaining a blue economy.

However, none of the aforementioned studies have tried to conduct an empirical investigation of the drivers of the blue economy, especially in the context of island countries, which the present study has attempted to do. Such an empirical investigation of the determinants of the blue economy will help policy makers to identify the major driving forces behind the growth of blue economy activities, namely tourism and fisheries, in the Asia and Pacific island countries and hence design the major areas for policy interventions.

3. FRAMEWORK FOR SELECTION OF VARIABLES AND MEASUREMENT

This study considers 19 island countries located in the Asia and Pacific region for our analysis. The list of island countries is sourced from the list produced by the World Population Review.[1] Island countries are defined as countries that are made up of one or more islands, or land that is surrounded completely by water. In this analysis we have included Indonesia, the Philippines, Sri Lanka, Papua New Guinea, New Zealand, Timor-Leste, Solomon Islands, Fiji, Brunei Darussalam, Maldives, Vanuatu, Samoa, Tonga, the Federated States of Micronesia, Kiribati, the Marshall Islands, Palau, Nauru, and Tuvalu. We chose the time period 1996–2016 based on the availability of data on an annual basis for all variables used in the study. The analysis is divided into three sets of estimates. First, we attempt to examine the factors determining the size of the blue economy. The standard definition of blue economy encompasses a range of economic sectors and policies that jointly determine sustainable use of ocean resources (World Bank 2017). The World Bank and the United Nations have identified various sectors, including traditional sectors like fisheries, tourism, and maritime transport, along with emerging activities such as offshore renewable energy, aquaculture, seabed extractive activities, and marine biotechnology and bioprospecting. However, time series data on all the aforementioned indicators are not available for the Asia and Pacific countries we have taken into consideration. For most of the island countries under our consideration, blue economy estimates are not available for each year. The available resources to gauge the size of the blue economy comprise some scattered reports for these countries. A comprehensive report by Seidel and Lal (2010)[2] published by the IUCN has been helpful for us to gauge the size of the blue economy in the Pacific island countries. This report provides data on the share of the marine offshore capture fisheries, coastal tourism, mariculture, and the collection of fees for providing ocean rights in total GDP for the year 2008 for the countries of Vanuatu, Samoa, Tonga, the Federated States of Micronesia, Kiribati, Palau, Nauru, Tuvalu, Solomon Islands, Fiji, and Papua New Guinea. Some countries like Fiji and the Marshall Islands also have a minimal amount of coastal mining but the information available for that is limited. Hence, we have extracted the share of the blue economy for the aforementioned countries from this report. For the other countries also, we have sourced the share of the blue economy from other official sources and recorded the figures.[3] In

[1] http://worldpopulationreview.com/countries/island-countries/.

[2] Seidel, H. and Lal, P.N. (2010). Economic Value of the Pacific Ocean to the Pacific Island Countries and Territories. Gland, Switzerland IUCN, 74 pp.

[3] For details please see Annex 1. Out of the 19 countries under consideration, for Brunei Darussalam we did not get the share of the blue economy and for Palau, Nauru, and Timor-Leste we did not get a consistent data series for real GDP and hence excluded these countries from the first set of estimates.

the next step, we have estimated the size of the blue economy for these countries by multiplying the real GDP of these countries by their respective share of the blue economy. This size of the blue economy is taken as the dependent variable in the first estimation set.

Investment is one of the major variables in determining output as per the standard macroeconomic theory. The gross capital formation of a country[4] is an indicator of the investment and a major determinant in the production of economic output. Theoretically it is expected that the higher the gross capital formation, the higher the output will be. Several empirical studies have emphasized the effect of gross capital formation on agricultural output (Gulati and Bathla 2001; Fan, Zhang, and Zhang 2002; Marimuthu 2013), on tourism (Eugenio-Martin, Martín-Morales, and Sinclair 2008; Zaman et al. 2016), and on the overall GDP (Ding and Knight 2011). Hence, we have taken the share of gross capital formation as a percentage of GDP as an explanatory factor in determining the factor of blue economy output. The higher the share of investment, the higher the blue economy output will be. The use of electricity is one of the major indicators of the infrastructure availability in a country and its linkage with the economic performance of a country has also been studied (Best and Burke 2018). Electricity is an important input for most blue economic activities, such as post-harvest activities in fisheries, and the shipbuilding industry is heavily dependent on access to electricity. Hence, we have taken electricity as an explanatory variable as a determinant of blue economic activities. The role of ICT in economic growth has been studied by various authors (Schreyer 2000; Avgerou 2003; Vu 2011). The favorable role of ICT has also been examined in the context of fisheries and tourism, two major sectors under the blue economy (Joshi and Ayyangar 2010; Omar et al. 2011). In order to capture the role of ICT in the size of the blue economy we have incorporated mobile cellular subscriptions per 100 people. Since ICT is considered to be a productivity enabler, we expect that these two variables will have a positive impact on the size of the blue economy.

The main idea of the concept of the blue economy is to drive ocean-based activities in a sustainable manner. In order to examine whether and how environmental quality influences blue economic activities in island countries we have included CO_2 emissions per person as one of the independent variables. The increased concentrations of CO_2 in the atmosphere have also led to CO_2 absorption in the oceans, altering ("acidifying") the chemistry of the top layers. Ongoing ocean acidification may harm a wide range of marine organisms and the food webs that depend on them, eventually degrading entire marine ecosystems (McMullen and Jabbour 2009). Ocean acidification has been described as "other CO_2 problem" for the oceans. The global surface ocean pH has decreased over the last 100 years due to the increased atmospheric CO_2 (World Tourism Organization 2012). As is evident from the literature, we expect that CO_2 emissions will have a negative effect on both tourism and indirectly on fisheries production via ocean uptake of human-produced CO_2 (Cheung and Law 2001; Sullivan and Lindsey 2018; Dong, Xu, and Wong 2019).

[4] The gross capital formation includes expenditure on land improvements, plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings.

Trade openness calculated as exports plus imports as a percentage of GDP is another explanatory variable we have considered. The theoretical literature on the contribution of trade openness to economic growth propounds that trade openness can contribute to economic growth through access to goods and services, efficient allocation of resources, and improvement in total factor productivity through technology diffusion (Grossman and Helpman 1991; Romer 1990). However, the effect of trade openness may also dent economic growth by increasing inflation and lowering exchange rates (Cooke 2010; Samimi et al. 2012). The impact of open trade policies and the degree of trade openness on overall economic growth is country-specific and empirical studies have observed mixed evidence of the effect of trade openness on economic growth (Yanikkaya 2003; Dar and Amirkhalkhali 2003; Musila and Yiheyis 2015).

Similarly, in the empirical and theoretical literature on blue economic activities, the evidence on the impact of trade openness is not conclusive. Theoretically, the linkage between international trade and tourism is based on three principles (Chaisumpunsakul and Pholphirul 2018). International trade boosts business travel and stimulates the network effect (White 2007), trade promotes product advertisements that attract consumers' attention and create awareness of both a product and its country of origin, which in turn may have a positive effect on tourism (Kulendran and Wilson 2000) and trade may lead to better infrastructure. Some empirical studies exploring the linkage between trade openness and tourism demand have found that trade openness has positively impacted tourism demand, which supports the theoretical literature (see, for instance, Chaisumpunsakul and Pholphirul 2018; Habibi and Ahmadzadeh 2015). However, studies like Shahbaz et al. (2017) have found a negative relationship between tourism and trade openness in the short run. Though trade openness according to the theory of export-led growth may have a positive impact on overall economic growth, its impact on fish catch and fisheries produce might be negative since trade liberalization may lead to overfishing and hence a negative impact on fish production (Abe et al. 2017; Erhardt 2018). It has also been argued that this relation depends on the quality of fisheries management and ocean governance.

The size of the blue economy also depends on international fisheries governance initiatives. In 2002, the Pacific Island Regional Ocean Policy[5] was endorsed by the leaders of Pacific island countries with a vision of understanding the ocean, sustainable use of ocean resources, managing the health of the ocean, and creating cooperation. In order to understand whether such policies have facilitated blue economy activities, we have taken a dummy for Pacific island countries that assumes 1 for Pacific island countries from 2003 onwards and assumes a value of zero for the period 1996–2002. Similarly, in 2003, the Sustainable Development Strategy for the Seas of East Asia was adopted and various coastal zone management programs were implemented in Asian countries. So, the policy dummy for Asian countries assumes a value of 1 from 2004 onwards and assumes 0 for the period 1996–2003. Moreover, we have also examined the impact of the global financial crisis and general slowdown of world economic activities on the blue economy of Asia and Pacific countries by introducing a dummy that assumes a value equal to 1 from the year 2007 onwards and 0 for 1996–2006.

After considering determinants of the blue economy as a whole, in the next step we examine the growth of blue economic activities separately and hence we have examined the macroeconomic factors affecting major blue economic activities, namely tourist arrivals and fisheries production. The second set of estimates considers fisheries production (in metric tonnes) as a dependent variable. Fisheries production is expected

[5] Secretariat of the Pacific Community (2005). Pacific Island Regional Ocean Policy and Framework for Strategic Action, Noumea, New Caledonia.

to be affected by the price of fish. Following the law of supply, producers will respond to higher prices and increase production often with a lagged effect. In this case, we have considered the global price of fish as an independent variable. Previous years' fish export is expected to have a lagged effect on fish production, since the possibility of better export opportunities may induce fishers to produce more output. As mentioned in the discussion about the choice of explanatory variables in the first set of analyses, the overall access to, and availability of, electricity (a proxy for infrastructure) and gross fixed capital formation are expected to have a positive effect on fish production. The only difference is that in the first step we had taken the share of gross fixed capital formation to GDP of the economy as a whole, but in the equation specific to fish production we have considered the gross fixed capital formation of the country in agriculture, forest, and fisheries in order to represent the availability of physical capital in fisheries production. A better indicator of capital in the context of fisheries production would have been country-wise data on the number of fishing boats/fishing vessels. But due to a lack of availability of consistent time series data we had to use gross capital formation in agriculture, forestry, and fisheries as a proxy for investment in our estimation and this is a limitation of this study. Though a body of literature exists on higher fisheries production coming at the cost of higher emissions of greenhouse gases (Tyedmers, Watson, and Pauly 2005; Vivekanandan, Singh, and Kizhakudan 2013; Parker et al. 2018), recent literature has also tried to capture the impact of climate change on fisheries production. The major argument given in this literature is that the emission of CO_2 leads to ocean acidification and hence may dent fisheries production (Cooley and Doney 2009; Narita, Rehdanz, and Tol 2012). Hence, as discussed earlier, we have taken CO_2 emissions per person as an explanatory variable in the second estimation and we believe that a higher CO_2 emission level may affect fisheries production negatively. Like the many economic activities, fisheries production is also expected to be favorably influenced by the facilities provided by information and communication technology (ICT). The use of mobile phones facilitates access to marketing, price, and weather information for fishermen and hence is expected to boost fisheries production. There is empirical evidence supporting the positive impact of mobile phones on fishermen's income and fish production (Ifejika et al. 2009; Evoh 2009). Sustainable ocean management policies like the Sustainable Development Strategy for the Seas of East Asia and Pacific Island Regional Ocean Policy have components conducive to sustainable use of fisheries resources and intergovernmental cooperation. Hence, the dummy for sustainable ocean management policy is expected to yield a positive impact on fish production and the dummy for crisis is expected to reflect a declining demand and hence a negative impact on blue economic activity, namely fisheries.

The third set of estimates in our analysis is to examine the factors affecting tourist arrivals. To measure tourist arrivals, we use countries' number of arrivals (inbound visitors). International inbound tourists (overnight visitors) are the number of tourists who travel to a country other than that in which they have their usual residence, but outside their usual environment, for a period not exceeding 12 months and whose main purpose in visiting is other than an activity remunerated from within the country visited. The data on inbound tourists refer to the number of arrivals, not to the number of people traveling. Thus, a person who makes several trips to a country during a given period is counted each time as a new arrival. If a country's currency devalues/depreciates, international tourism becomes less expensive, and consequently should result in increased travel flows to that country. So we expect the coefficient of the exchange rate to be positive. The choice of exchange rate is crucial in terms of whether one should take the nominal or effective exchange rate. The effective exchange rate does not provide much information about the direction of a country's currency. It is possible for a country's currency to be depreciating against one country while appreciating against another. Hence, in this situation, the direction of tourist arrivals due to exchange rate changes is undetermined. The choice to include the nominal exchange rate as a determinant is obvious, since a depreciation of a given currency relative to others (i.e., an increase in the nominal exchange rate) can increase the demand for tourism, as domestic prices become relatively cheaper. The nominal exchange rate better captures the volatility-driven uncertainty faced by would-be tourists. The nominal exchange rate is defined as the number of units of local currency per US dollar. Prices at the destination relative to prices at home are an important determinant of tourism choices. The Consumer Price Index (CPI) measures the price level of a basket of consumer goods and services purchased by households. The relative price is defined as each Pacific island country's CPI with respect to the world price (for instance Indonesia's CPI/world CPI and so on). Theoretically, better connectivity and a decline in the relative price of a home country relative to a foreign country makes the domestic goods more competitive than foreign goods, which would result in increased inflow of foreign tourist arrivals and vice versa. The role of ICT in promoting tourism is expected to be favorable since better ICT facilitates better information and connectivity, and attracts more tourists (Kim and Kim 2017; Hughes and Moscardo 2019). We expect the coefficient of relative price to be negative, which implies that consumers do care about price comparison when they purchase goods or services at the destination. The reason for using the relative price variable is as follows. We believe sustainability and competitiveness go hand in hand as destinations and businesses are becoming more competitive through the efficient use of resources, and the Internet era. Hence, from the sustainability point of view, the ocean Pacific island countries should make their prices very competitive. The income in the country of origin affects positively the ability and inclination of people to travel abroad. The world GDP (world income) is one of the key determinants of tourist arrivals. It is believed that the tourist inflow to a country will be more if their income is more and vice versa. As tourist arrivals depend on the foreign country's income, we expect a positive sign for the coefficient of world income/foreign income. Growth in spending power is one of the main factors behind this increase in international tourism. CO_2 emissions stemming from burning fossil fuels are perceived as the main source of environmental degradation such as air and/or water pollution, climate change, and soil erosion. Thus, in a country where tourism makes major contributions to economic activity, one might also expect CO_2 emissions to affect tourism. There is a consensus that tourists will not travel back to polluted and dirty destinations if there are alternative destinations available at comparable prices. Literature says that tourist arrivals are active contributors to pollution and higher pollution hinders tourist arrivals as well. As tourism is the main source of revenue in the ocean Pacific island countries, these countries should take more precautions to reduce CO_2 emissions so they can attract more tourist arrivals and achieve sustainable economic growth. Climate change, along with other sources of environmental degradation, can have an adverse impact on the sustainability of the tourism industry in small island developing countries. The United Nations World Tourism Organization is committed to accelerating progress towards low-carbon tourism development and the contribution of the sector to international climate goals. In order to reduce CO_2 emissions and to drive down operational costs, the cruise sector should invest heavily.

4. METHODOLOGY AND DATA SOURCES

The present study investigates determinants of the size of the blue economy and blue economy activities in the Asia and Pacific region using panel data analysis. We have used a panel data model since panel data blend inter-country differences and intra-country dynamics and have several advantages over cross-sectional regression. Panel data provide more degrees of freedom and more sample variability than cross-sectional data and improve the efficiency of econometric estimates.[6]

Algebraically the panel data model can be written as:

$$lnY_{it} = \alpha + X_{it}\beta' + \mu_i + \delta_t + \varepsilon_{it} \quad (1)$$

lnY_{it} is the logarithm of size of the blue economy of country i in time period t (lnY_{1it}), total fisheries production of country i in time period t (lnY_{2it}), and the number of tourist arrivals in country i in time period t (lnY_{3it}). X_{it} is a set of explanatory variables that determine the size of the blue economy. β' is the slope coefficient vector associated with the explanatory variables, μ_i is an unobserved country-specific effect, and δ_t is the time trend. ε_{it} is the error term that is independently and identically distributed among countries and years. Equation 1 is further expanded in three models as described below. The justification behind including the set of explanatory variables (X_{it}) and their expected signs has already been discussed in detail in Section 3.

The first set of estimations considers lnY_{1it} as the dependent variable. The equation is specified as:

$$lnY_{1it} = \alpha + \beta_1 lnGFCF_{it-1} + \beta_2 lnELC_{it} + \beta_3 lnCO2_{it} + \beta_4 lnICT_{it} + \beta_5 lnTOT_{it} + \beta_6 CRISIS_{it} + \beta_7 POLICY_{it} + \mu_i + \delta_t + \varepsilon_{it} \quad (2)$$

where $lnGFCF$ is the natural logarithm of gross fixed capital formation as a percentage of GDP. $lnELC$ is the access to electricity as a percentage of the population. $lnCO2$ is the logarithm of per capita CO_2 in metric tons, and $lnICT$ is the mobile subscription rate measured as the number of mobile cellular subscriptions per 100 people. $lnTOT$ is the logarithm of trade openness calculated as exports plus imports as a percentage of GDP, and *CRISIS* is a dummy variable that assumes a value of 0 for the period 1996–2007 and is equal to 1 from 2008 onwards. $POLICY$ is a dummy variable assuming a value equal to 1 from 2003 onwards and zero otherwise for Pacific island countries, and equal to 1 from 2004 for Asian island countries and 0 otherwise. The coefficients of ln*GFCF*, *lnICT*, *lnTOT*, *lnELC*, and *POLICY* are expected to have a positive impact on lnY_1 while *lnCO2* and *CRISIS are* expected to have a negative impact on lnY_1.

In the second set of estimations we try to identify the determinant of fisheries production in Asia and Pacific island countries under consideration and hence lnY_2 is taken as a dependent variable. The rationale behind the choice of explanatory variables and the expected signs of the coefficients has already been explained in Section 3. This equation is specified as follows:

$$lnY_{2it} = \alpha + \beta_1 lnFPRICE_{it-1} + \beta_2 lnEXPORT_{it-1} + \beta_3 lnCO2_{it} + \beta_4 lnELC_{it} + \beta_5 lnICT_{it} + \beta_6 lnGFCFA_{it-1} + \beta_7 POLICY_{it} + \beta_8 CRISIS + \mu_i + \delta_t + \varepsilon_{it} \quad (3)$$

[6] For details refer to Hsiao, C. (2007). Panel data analysis—advantages and challenges. *Test*, *16*(1), 1–22.

where $lnFPRICE$ is the logarithm of global fish price (in US$ per metric ton). $lnEXPORT$ denotes the logarithm of fisheries exports in metric tons. $lnGFCFA$ is the logarithm of gross fixed capital formation in agriculture, forestry, and fishing, and $lnCO2$ is the logarithm of CO_2 metric tons per capita. $lnELC$ is the access to electricity as a percentage of the population. $lnICT$ is the mobile subscription rate measured as the number of mobile cellular subscriptions per 100 people. *CRISIS* is a dummy variable that assumes a value of 0 from 1996 to 2007 and is equal to 1 from 2008 onwards. $POLICY$ is a dummy variable assuming a value equal to 1 from 2003 onwards and 0 otherwise for Pacific island countries, and equal to 1 from 2004 for Asian island countries and 0 otherwise. The coefficients of *lnGFCFA*, *lnICT*, *lnFPRICE*, *lnEXPORT*, *lnELC*, and *POLICY* are expected to have a positive impact on lnY_2 while *lnCO2* and *CRISIS are* expected to have a negative impact on lnY_2.

In our third set of estimations, in order to understand the determinants of tourist arrivals in the Asia and Pacific island countries, lnY_3 is taken as the dependent variable. The equation is specified as follows:

$$lnY_{3it} = \alpha + \beta_1 lnWORLD\_IN_{it} + \beta_2 lnRP_{it} + \beta_3 lnEXG_{it} + \beta_4 lnTOT_{\ it} + \beta_5 lnCO2_{it} + \beta_6 ICT_{it} + \beta_7 POLICY_{it} + \beta_8 CRISIS_{it} + \mu_i + \delta_t + \varepsilon_{it} \quad (4)$$

where $lnWORLD\_IN$ is the world income, and $lnRP$ is the logarithm of relative price. $lnEXG$ is the logarithm of exchange rate. $lnTOT$ is the logarithm of trade openness calculated as exports plus imports as a percentage of GDP. All other explanatory variables used in Equation (4) are the same as in Equation (2). As explained in Section 3, we expect the coefficients of *lnWORLD_IN*, *lnTOT*, *lnICT*, *lnEXG*, and *POLICY* to be positive whereas the coefficients of *lnRP*, *lnCO2*, and *CRISIS* are expected to be negative.

The data for gross fixed capital formation (GFCF) as a share of GDP; gross capital formation in agriculture, forestry, and fisheries; fisheries exports (in US$); CO_2 emissions (per capita metric tons); access to electricity (% of population); the number of mobile cellular subscriptions per 100 of people; world income; trade openness as a percentage of GDP; and official exchange rate (LCU per US$, period average) have been collected from the World Development Indicators (WDI) and Food and Agricultural Organization (FAO) database. For some island countries, data on gross fixed capital formation as a percentage of the CPI for Pacific island countries are also collected from the World Bank. World CPI data are not directly available and hence it is calculated as the average of all countries' CPI. Instead of directly using the domestic CPI as the covariates in the models, we use the relative price since it is more appropriate from the tourist's perspective, and it is with respect to the world price level, which is used as the proxy for the "world CPI." The data on the number of tourist arrivals (inbound visitors) are collected from the World Tourism Organization (UNWTO).

5. EMPIRICAL RESULTS

This section describes the empirical results of this paper. Table 1 starts by describing the annual growth rate of blue economy activities over two periods: period I: 1996–2007; and period II: 2008–2016.

Table 1: Growth Rates of Blue Economy Activities in Asia and Pacific Island Countries

	Tourist Arrivals		Fisheries Production	
Country	**Period I**	**Period II**	**Period I**	**Period II**
Indonesia	–0.3	7.7	4.2	11.0
Philippines	3.0	6.8	4.1	–1.0
Sri Lanka	5.8	15.0	0.7	5.8
Papua New Guinea	2.3	6.7	18.8	2.4
New Zealand	4.5	2.5	1.4	–1.3
Timor-Leste	14.0	11.6	–0.2	3.7
Fiji	4.5	6.0	5.9	–0.6
Solomon Islands	1.0	4.7	–2.2	8.8
Brunei Darussalam	1.4	2.0	–6.6	16.2
Maldives	5.4	6.6	5.2	–1.1
Vanuatu	3.6	15.8	15.0	–14.6
Samoa	3.8	2.2	9.9	–4.6
Tonga	3.4	6.5	–0.2	–4.6
Federated States of Micronesia	0.7	3.4	5.2	15.5
Kiribati	0.7	4.9	–2.0	17.5
Marshall Islands	–0.6	–1.0	28.6	0.6
Palau	1.6	4.6	–0.9	–3.2
Nauru	–	–	–1.9	–7.5
Tuvalu	0.9	8.6	20.7	7.4

Note: Period I and period II refer to the periods from 1996 to 2007 and 2008 to 2016, respectively.

Source: The figures are based on compound annual growth rate; authors' own calculation.

It can be observed from Table 1 that most of the Asia and Pacific island countries exhibited a stronger growth rate in tourist arrivals in period II (2008–2016) than in period I (1996–2007). The reason for dividing the entire time span into two subperiods is to assess the growth rates of key indicators pre and post the global financial crisis. The figures indicate that apart from bigger countries like Indonesia and Sri Lanka, it is interesting to note that small island countries of the Pacific region like Kiribati, Tuvalu, and Vanuatu have shown a higher growth rate of tourist arrivals in period II than in period I. However, in terms of growth of fisheries production, many countries have faced deceleration in period II compared to period I. Less developed island countries of the Pacific region like Samoa, Tonga, and Vanuatu have faced a severe reduction in fisheries production in period II. However, countries like Indonesia, Sri Lanka, Fiji, Solomon Islands, and Kiribati observed a high growth of fisheries production during period II.

Table 2: Descriptive Statistics

	lnY₁	*lnY₂*	*ln Y₃*	*lnFPRICE*	*lnEXPORT*
Mean	19.85	10.38	4.10	1.49	9.27
Median	19.06	10.62	4.18	1.53	10.20
Maximum	25.62	16.95	9.35	1.96	15.31
Minimum	15.50	5.7	–0.10	1.06	0.00
Std. Dev.	2.37	2.85	2.65	0.26	3.73
Skewness	0.47	–0.16	–0.02	0.05	–1.02
Kurtosis	2.65	3.61	2.01	1.98	3.68
Jarque-Bera	14.22	8.43	16.86	18.22	82.09
Obs.	315	418	418	418	418
	lnGFCF	***lnCO₂***	***lnELC***	***lnICT***	***POLICY***
Mean	2.49	0.30	3.48	2.24	0.63
Median	1.95	0.00	4.38	2.87	1.00
Maximum	10.12	3.20	4.60	5.14	1.00
Minimum	–2.39	–1.76	0.000	–4.86	0.00
Std. Dev.	2.96	1.12	1.66	2.19	0.48
Skewness	0.70	0.90	–1.43	–0.63	–0.54
Kurtosis	2.72	3.11	3.36	2.27	1.29
Jarque-Bera	36.31	57.54	145.34	37.38	71.20
Obs.	418	418	418	418	418
	CRISIS	***lnWORLD_IN***	***lnRP***	***lnEXG***	***lnTOT***
Mean	0.45	9.09	–0.02	1.63	3.39
Median	0.00	9.11	0.00	0.58	4.39
Maximum	1.00	9.25	0.63	9.50	5.21
Minimum	0.00	8.90	–0.90	–0.03	0.00
Std. Dev.	0.49	0.10	0.18	2.31	1.97
Skewness	0.18	–0.16	–1.00	1.86	–1.09
Kurtosis	1.03	1.73	8.13	6.01	2.29
Jarque-Bera	69.68	29.82	52.13	40.84	91.84
Obs.	418	418	418	418	418

Note: (1) Authors' own calculation. (2) For the reasons described in Section 3 we have estimated Equation (2) for 15 countries, however for the other two equations we have taken into consideration 19 countries.

After discussing the growth rates of the key blue economy activities of fisheries production and tourist arrivals, in the next step the descriptive statistics are presented in Table 2. Table 2 explains key descriptive statistics like mean, median, standard deviation, skewness, kurtosis, Jarque-Bera normality test, etc. of both dependent variables and explanatory variables. The log mean size of the blue economy (lnY_1) for the sample of Asia and Pacific countries is 19.85 and the standard deviation seems to be 2.37. The log mean size of the blue economy is also negatively skewed. Similarly, the Jarque-Bera normality test statistic is 14.22, which implies that the series is not normally distributed. But typically, the JB test statistic does not follow a normal distribution pattern for a small sample size. Table 2 also presents the descriptive statistics of other explanatory variables used in this study. The figures are self-explanatory in nature.

Table 3: Determinants of Size of Blue Economy in Asia and Pacific Island Countries

Variable	Coefficient	Std. Error	t-Statistic
lnGFCF (-1)	0.034**	0.017	1.990
lnELC	0.002	0.007	0.298
lnCO2	0.027	0.027	1.009
lnICT	0.043*	0.007	6.117
lnTOT	0.010***	0.006	1.678
CRISIS	0.138*	0.021	6.383
POLICY	0.052**	0.025	2.089
Intercept	19.51*	0.630	30.93
Overall R^2	0.68		
Hausman Test	Chi-square 6.87 (0.44)	Random Effect Model	

Note: Authors' own calculation. *, **, and *** indicate 1%, 5%, and 10% level of significance, respectively.

The estimation results of Equation 2 are presented in Table 3. We have estimated both fixed and random effect models but have presented the results of the model that is supported by the Hausman test. The Hausman test conducted for Equation (2) supports the random effect model. The results presented in Table 3 reveal that the coefficient of *lnGFCF* is positive as expected and statistically significant. This indicates that a 1% increase in the share of gross fixed capital formation as a percentage of GDP on average increases the size of the blue economy by 0.03% in Asia and Pacific island countries. This finding implies that an increase in investment through better availability of roads and other infrastructural facilities would boost the blue economic activities in Asia and Pacific island countries. The results presented in Table 3 also reveal that the coefficient for *lnICT* is positive and statistically significant. This finding indicates that a 1% increase in mobile connectivity on average increases the size of the blue economy by 0.04%. The estimation results for determinants of size of the blue economy indicate that the coefficient of *lnTOT* is statistically significant and positive as expected. Hence, this finding suggests that the higher the trade openness of a country, the higher the size of the blue economy. So, a policy to promote trade in these countries will also boost the blue economy activities. Interestingly, we also observe that ocean management policies like the Pacific Island Regional Ocean Policy and Sustainable Development Strategies for the Seas in East Asia have helped to enhance the size of the blue economy. The size of the blue economy in Asia and Pacific island countries on average is 0.05% higher after implementation of these sustainable ocean management policies than before. Our results also indicate that the global financial crisis did not hamper the size of the blue economy on the whole in Asia and Pacific island countries. This could be because of the fact that Asia and Pacific island countries, especially the developing ones, were less affected by the 2008 global financial crisis (Isgut 2014). Though the initial impacts were quite significant (Kida 2009; Kumar and Singh 2011, many of the Asia and Pacific countries proved to be resilient to the global financial crisis and recovered from the shock over time (Colmer and Wood 2012; Isgut 2014). Hence, on the whole, for our sample we have not observed any adverse impact of the crisis.

In order to check the robustness of our results, we employ alternative model specifications for estimating determinants of the size of the blue economy, fisheries production, and tourist arrivals. The results obtained from alternative model specifications are presented in Annex 2 (Tables A1, A2, and A3). We found that these results corroborate the results reported for our benchmark models specified as Equations (2), (3), and (4).

Table 4: Determinants of Fisheries Production in Asia and Pacific Island Countries

Variables	Coefficient	Std. Error	t-Statistic
lnFPRICE(-1)	–0.058	0.184	–0.318
lnEXPORT(-1)	0.373*	0.034	10.997
lnGFCFA(-1)	0.128***	0.074	1.738
lnCO2	–0.010	0.062	–0.160
lnELC	0.108*	0.023	4.556
lnICT	–0.027	0.028	–0.969
POLICY	0.109	0.094	1.157
CRISIS	–0.140	0.122	–1.142
Intercept	6.458*	0.389	16.567
Overall R^2	0.97		
Hausman Test	Chi-square 16.83 (0.03)	Fixed Effect Model	

Note: Authors' own calculation. *, **, and *** indicate 1%, 5%, and 10% level of significance, respectively.

As discussed in Section 4, next we have estimated Equation (3) for understanding the determinants of fisheries production in the Asia and Pacific island countries. The results of this estimation are displayed in Table 4. We have estimated the equation using both fixed and random effect models, however the Hausman test supports the fixed effect model. Hence, in Table 4 we report the results of the fixed effect model. The results presented in Table 4 indicate that an increase in the previous year's export of 1% on average boosts the fisheries production by 0.37%. This implies that if the country's fish export is higher, the production of fisheries will also be higher in order to satisfy future export demand. Table 4 reveals that the coefficient of gross capital formation has a positive and statistically significant effect on fisheries production. The results indicate that a 1% increase in the previous year's gross capital formation in the agricultural and fisheries sector on average leads to about a 0.13% increase in the size of the blue economy. Table 4 also reveals that access to electricity (*lnELC*) has a positive impact on fisheries production. This finding is linked to powering the blue economy concept. It has been observed that in coastal areas many marine industries are shifting towards the inland areas since the availability of electricity is greater in the inland region, and hence the "Powering the Blue Economy" initiative has emerged to assess the *power* requirement of emerging coastal and maritime markets and invent technologies that could integrate marine renewable energy to relieve these *power* constraints and promote economic *growth.*

Table 5: Determinants of Tourist Arrivals in Asia and Pacific Island Countries

	Fixed Effect Model		
Variables	**Coefficient**	**Std. Error**	**t-Statistic**
lnWORLD_IN	2.770**	1.302	2.126
lnRP	–2.555*	0.333	–7.657
lnEXG	0.781*	0.162	4.813
lnCO2	0.083	0.105	0.791
lnTOT	–0.022	.034	–0.670
lnICT	–0.010	0.051	–0.202
POLICY	0.321***	0.180	1.780
CRISIS	0.260***	0.172	1.684
Intercept	–22.68	11.641	–1.948
Overall R^2	0.87		
Hausman Test	Chi-square 7.02(0.53)	Random Effect Model	

Note: Authors' own calculation. *, **, and *** indicate 1%, 5%, and 10% level of significance, respectively.

Table 5 presents the estimation results of Equation (4), which examines factors determining tourist arrivals in the Asia and Pacific island countries. The Hausman test conducted for Equation (4) supports the random effect model. The results derived from the panel fixed effect model presented in Table 5 show that the coefficient world income carries a positive sign and is statistically significant, which implies that a 1% increase in world income on average increases the number of tourist arrivals by 2.77%. The relative price (*lnRP*), which is a major determinant of competitiveness, also shows a negative sign as expected and is statistically significant at the 1% level, which indicates that a 1% decrease in the relative price of the home countries compared to other competing countries increases the number of tourist arrivals by 2.55%. These Asia and Pacific island countries are prone to the pressure and competition for limited resources (land, human resources, natural resources, and local produce), economic diversity, ability to adapt, and cultural sensitivity. We believe that competitiveness and sustainability move hand in hand. Integration of sustainability into tourism policies is the fundamental step towards the development of a sound and long-lasting tourism industry. For the sustainability of these island countries, prices should be very competitive.

The coefficient of the nominal exchange rate (*lnEXG*) also holds a positive sign and is statistically significant. That means that a 1% decrease in domestic currency as compared to the US dollar on average increases tourist arrivals by 1.78%, which is pretty consistent with empirical studies. The *POLICY* dummy signifying the sustainable ocean management policy implemented by governments of Asia and Pacific islands is positive and statistically significant, which indicates that on average these policies can boost the number of tourist arrivals by 0.32%. This finding reiterates the importance of sustainable ocean management policies in enhancing tourism in Asia and Pacific island countries. The *CRISIS* dummy, which is used to capture the global financial crisis and its effects on tourist arrivals, carries a positive sign and is statistically significant at the 1% level, which shows that the global financial crisis didn't hamper the tourist arrivals in these island countries. Basically, during the period 2007–2008, the crisis started in the US and spilled over across the globe. These island countries weren't affected, perhaps because of their strategic location compared to other tourist destinations. This is also consistent with our results presented in Table 1. Holidays, leisure, and recreation are the main purposes of tourist arrivals in ocean Pacific island countries followed by business and other professional purposes. On the other hand, if many tourists come to ocean Pacific island countries for business and professional purposes, then the global financial crisis may hit these countries due to the conservative policy implemented by many governments to reduce their spending during the crisis period.

To tackle the reverse causality issue in our estimation, we included the lag of key explanatory variables and performed a panel Granger causality test (pooled OLS technique) for the variables used in the estimation of Equations (2), (3), and (4). However, no evidence of reverse causality has been found.[7]

6. CONCLUSIONS AND POLICY IMPLICATIONS

The blue economy and its sustainability have emerged as one of the key research issues in recent decades and has become a buzzword among policy makers in this field. Although a reasonable number of studies have made attempts to assess the blue economy from different perspectives, to the best of our knowledge no study has empirically examined the factors that drive the size of the blue economy. Thus, the present study made an attempt to identify the factors that determine the blue economy activities by considering Asia and Pacific island countries. To do so, we used annual data from 19 island countries spanning from 1996 to 2016. By employing panel fixed effect and random effect models, it was found that the size of the blue economy in Asia and Pacific island countries positively depends on the gross fixed capital formation and availability of ICT. This calls for higher investment in physical capital in terms of transport, storage, etc. and the promotion of ICT by the governments of these island countries. The role of ocean governance is often described as an important factor behind blue economy activities. We have tried to capture the impact of ocean governance policies like the Pacific Islands Regional Ocean Policy and the Sustainable Development Strategy for the Seas of East Asia by introducing a policy dummy in our analysis, which exhibited a positive impact on the size of the blue economy. Further, we have explored factors determining the output of two major blue economy sectors, namely fisheries and tourism. Our findings reveal the importance of more investment in the fisheries and agricultural sector, better access to electricity, and better export opportunities as the major determinants of fisheries output. The findings further revealed that world income, relative price, depreciation in the nominal exchange rate between domestic currency and the US dollar, along with policy and financial crisis dummies positively affect the size of the tourism sector. Thus, the size of the blue economy has positively responded to these sustainable ocean management policies. Hence, our findings support the need for, and effectiveness of, the implementation of sustainable ocean governance policies in the Asia and Pacific island region, which can further strengthen the growth of these island countries.

[7] The results of the Granger causality test are not reported here but are available upon request from the authors.

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ANNEX 1

Country	**Share of Blue Economy** (as percentage of GDP)	Source
Indonesia	13%	PMSEA Report, available at http://pemsea.org/sites/default/files/1475203802713042.pdf
Philippines	4.49%	PMSEA Report, available at http://pemsea.org/sites/default/files/1475203802713042.pdf
Sri Lanka	9.4%	Kumara (2017)
Papua New Guinea	6.6%	Seidel and Lal (2010)
New Zealand	3%	MEC (2019)
Fiji	41.01%	Seidel and Lal (2010)
Solomon Islands	13.3%	Seidel and Lal (2010)
Maldives	36%	FICCI (2017)
Vanuatu	32.7%	Seidel and Lal (2010)
Samoa	25.45%	Seidel and Lal (2010)
Tonga	11.6%	Seidel and Lal (2010)
Federated States of Micronesia	26.2%	Seidel and Lal (2010)
Kiribati	36.2%	Seidel and Lal (2010)
Marshall Islands	62.4%	Seidel and Lal (2010)
Tuvalu	23.2%	Seidel and Lal (2010)

Note: Compiled from different sources.

ANNEX 2

A1: Determinants of Size of Blue Economy in Asia and Pacific Island Countries – Alternative Model Specifications

Variables	Model 1	Model 2	Model 3	Model 4	Model 5
lnGFCF	+(**)	+(**)	+(**)	+(**)	–
lnELC	NS	NS	NS	NS	NS
lnCO2	NS	NS	NS	NS	NS
lnICT	+(*)	+(*)	+(*)	+(*)	+(*)
lnTOT	+(***)	+(**)	+(***)	–	+(***)
CRISIS	+(**)	–	+(*)	+(*)	+(*)
POLICY	+(**)	+(*)	–	+(**)	+(**)

Note: a) Model 1 is the benchmark model. b) *, **, and *** indicate significance at the 1%, 5%, and 10% level. c) NS implies that the coefficient is not statistically significant. (d) "+" and "–" denote the signs of the estimated coefficients.

Source: Authors' own calculation.

A2: Determinants of Fisheries Production in Asia and Pacific Island Countries – Alternative Model Specifications

Variable	Model 1	Model 2	Model 3	Model 4	Model 5
lnFPRICE(-1)	NS	NS	NS	NS	NS
lnEXPORT(-1)	+(*)	+(*)	+(*)	+(*)	–
lnGFCFA(-1)	+(***)	+(***)	+(***)	+(***)	+(**)
lnCO2	NS	NS	NS	NS	NS
lnELC	+(*)	+(*)	+(*)	–	+(*)
lnICT	NS	NS	NS	NS	NS
POLICY	NS	NS	–	+(***)	+(*)
CRISIS	NS	–	NS	NS	NS

Note: a) Model 1 is the benchmark model. b) *, ** and *** indicates significance at 1%, 5% and 10% level. c) NS implies the coefficient is not statistically significant. (d) "+" and "–" denote the signs of the estimated coefficients

Source: Authors' own calculation.

A3: Determinants of Tourist Arrivals in Asia and Pacific Island Countries – Alternative Model Specifications

Variable	Model 1	Model 2	Model 3	Model 4	Model 5
lnWORLD_IN	+(**)	+(*)	+(*)	+(**)	–
lnRP	–(*)	–(*)	–(*)	–(*)	–(*)
lnEXG	+(*)	+(*)	+(*)	+(*)	+(*)
lnCO2	NS	NS	NS	NS	NS
lnTOT	NS	NS	NS	–	NS
lnICT	NS	NS	NS	NS	NS
CRISIS	+(***)	–	+(***)	+(***)	+(*)
POLICY	+(***)	+(***)	–	+(***)	+(*)

Note: a) Model 1 is the benchmark model. b) *, **, and *** indicate significance at the 1%, 5%, and 10% level. c) NS implies that the coefficient is not statistically significant. (d) "+" and "–" denote the signs of the estimated coefficients.

Source: Authors' own calculation.