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Analysis of Indonesia Marine Fisheries with Economic Growth, Population and Effort Effectiveness

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Abstract

Fisheries, as part of the human food chain, have an environment that affects fisheries resources. The view of slowing the number of fish catches in the sea due to factors that drive such as economic growth, population and effort effectiveness will decrease the power of fish in the sea. This study carried out the circumstance of fisheries in sea Indonesia and analyzed empirically the relationship between economic factors, population, and effort effectiveness on the catch volume. We apply the random effect (RE) estimator method which is reviewed for 33 provinces for the period 2000-2015. We use catch as a proxy for marine ecosystems. Our results confirmed that the growth of fish catchment in the sea Indonesia experienced a positive trend and the relationship between economic factors, population and effort effectiveness positive and significant on the volume of catch thus we conclude that catch fisheries in Indonesia is sustainable

Keywords: Indonesia marine catch, Fish stock, Fisheries

Introduction

The oceans provide a vast amount of vital resources not only to provide the basic human needs, but also to support human wealth. However, the ocean abilities to provide sustainable benefits for human well-being is limited by its regeneration capacity, which is currently deteriorating due to over-exploitation, pollution and coastal development (Halpern et al., 2012). Pontecorvo and Schrank (2012) utilization of global fisheries resources by humans experienced a fluctuation growth trend during the period 1950 to 1989 with a linear trend of 1.67 million metric tons per year. It rose from 16.8 million metric tons in 1950 to 81.9 million metric tons in 1989. However, the annual catch rate growth slowed in the early 1990s. In the early 1990s seen a slowdown in world catches. This slowdown occurs with considerable

variation from year to year. Annual catch decreased by more than 9% from 1996 to 2009.

The impact of an ongoing marine exploitation has been found by experts will affect the sustainability of sustainable fisheries, thereby reducing sea harvest. Olson (2009) states that the interactions between fish, climate and fishery populations deserve a thorough investigation. There is a growing sense that we have no objective to utilize fishery resources in a sustainable way. Olson provides a review of the scientific uncertainty about the complexity of the marine environment and its impact on fish stocks. Meanwhile, Beverton (1990) states that the rate of reproduction adjusts as a very deep stock measure so that stock collapse is not possible.

The reduction of fish resources in this case for the catch rate will be influenced by some of the key market demand factors for fish that respond to the increasing demand for fish products that mainly arise from the steadily rising incomes of the world and the human population, both of which have risen dramatically since the middle centuries ago and is expected to continue in the medium and long term (Westlund, 2005; Godfray et al., 2010), increasing the effectiveness of fishing effort due to increased capital and labor used. In the world's fisheries, as well as the continuing advantages in labor and capital productivity over the years, for instance, better vessels and equipment, and the use of expanded electronic equipment (Jin et al., 2002; Hannesson, 2007).

Indonesia is the largest archipelagic country in the world with 17,504 islands and a coastline of 104,000 km (Bakosurtanal, 2006). The total sea area of Indonesia is about 3.544 million km2 or about 70% of the Indonesian territory. Based on FAO Year Book 2009 report, Indonesia's fishery production up to 2007 is holding 3rd ranked in the world. So research about how the condition of fish stock at sea in Indonesia is very interesting which in this case will be proxy with the catch volume. This is interesting because some of the most important issues in Indonesia's marine fisheries are the degradation and pollution of the Indonesian sea in some areas resulting in decreased fish productivity. Economic pressures in some coastal areas often trigger myopic (short-thinking) catching fish in destructive ways such as bombs and toxins, so these methods will damage ecosystems such as coral reef which has a direct impact on fish production process.

The study aims to learn about fishery conditions at the sea of Indonesia and analyze the relationship between fish stocks at sea by using proxy the number of catches affected by economic growth, population and effort effectiveness in fishing in Indonesian seas.

This paper will be arranged as follows: part 2 literature review. Section 3 discusses about the use of research methodology and estimates. Section 4 results and analysis. Section 5 presents the study's conclusions and policy implications.

Literature Review

Experts differ on the state of global marine fisheries in the last two decades. Some scientists believe that marine fisheries are not tend to be sustainable and the fish stocks at sea are threatened by depletion. This is marked by a decrease in catch rate. Pontecorvo and Schrank (2012) The Changes in fishing rate are borne out by revenue growth, population and fishing technology and increasing fishing efforts resulting in overall catches of fish decreasing indicating that marine ecosystems are declining.

Zeller and Pauly (2005) find that the global catch of fishes is declining faster than before, this is due to waste and garbage, thus indicating a decrease in the total availability of marine fish.

Myers and Worm (2003) states that the ecological effect of fishing on the ocean by using industry deception lowers biomass by 80% within 15 years of exploitation. In this study saw rapid growing potential species as well as large predatory fish species. Globally Myers and Worm (2003) concluded that the decline in the number of large predators in coastal areas has spread across the global ocean and has serious consequences for existing ecosystems at sea.

Pauly et al. (1998) suggest that unsustainable exploitation patterns are characterized by stagnant or declining fish catches. In a study conducted in 1950-1994. The trophic level of the species reflects a gradual transition in landings from long-lived, high trophic levels, piscivorous bottom fish toward short-lived, low trophic levels of invertebrates and planktivorous pelagic fish. This effect, also found to be occurring in inland fisheries, is the most pronounced in the Northern Hemisphere. Fishing down food webs (leads at first to increase catches), then to a phase transition associated with stagnating or declining catches. Pauly and Palomares (2005) use indicators The mean trophic level (TL) fisheries catch explains the finding that global trends towards catches are increasingly dominated by low-TL species. This illustrates no sustainability in the fishing process at the sea.

Merino (2012) in his research states that the expansion of human population and world economic development will increase demand for fish production in the future. Because fish productions are limited by productivity. The productivity of ecosystem management is endangering future aquaculture production and availability of fish products. On the other side, the argument concerns of the global oceanic collapse are a bit exaggerated and misleading. At this point, they argue that current catching practices are sustainable (Hilborn, 2007; Murawski et al., 2007).

Sugiawan et al. (2017) in his research explores global marine fisheries analyzing it with economic factors. Using the average group estimator for 70 countries in the period 1961-2010 using catch data and stock estimates as a proxy for marine ecosystems. The results show that the initial stage of economic growth, the level of income that leads to a decrease in the rate. Population growth puts continuous pressure on the catch level, further economic growth causes a decrease in catch. At the stage of

economic development, the composition of the economic effects resulted in the creation of new environmental regulations and clean industry that preserve the environment and cancel the damage of the previous stage of development.

Methodology Data

This research will use panel data with some annual series from provinces in Indonesia from 2000 to 2015. The volume of fish harvest is measured in a ton matrix. Economic growth measured from the GDP per capita per share is expressed in thousands of rupiah at constant prices in 2010. Population density is measured in people per square kilometer of land area and the effectiveness of the effort is seen from total boats or ships for marine fisheries in units. The data of fish production volume panels, real GDP per capita, population density data and total boats or ships are obtained from Indonesian Central Bureau of Statistics.

Estimation

This paper will look at the relationship between economic growth marked by per capita income, population, and fishing effort on Indonesian marine resource catches based on the parametric model:

$$lnC_{i,} = \beta_{\blacklozenge} + \beta_{\blacklozenge} lnY_{it} + \beta_{\blacklozenge} lnP_{it} + \beta_{\blacklozenge} lnE_{it} + \varepsilon_{it}$$

Where C_{it} is the volume of fish catch region *i*, for period t; Y_{it} is gross regional domestic product per capita region *i*, for period t: $P_{i,t}$ is population density region *i*, for period *t*: $E_{i,t}$ is total boat or ship region *i*, for period *t*; ε_{it} is *error term*.

The data analysis used in this research is a form of regression analysis of data panel. The data panel is a combination of cross section and time series data. Using a data panel means doing an analysis on an observation on some units with a certain time range. According to Klevmarken (1989) and Hsiao (2003) in (Baltagi, 2005) using panel data provides several advantages: controlling individual heterogeneity, providing more informative data, more variability, reduced collinearity between variables, degrees of freedom and better efficiency. According to (Widarjono, 2013), when using the data panel, a combination of estimations such as intercepts and slopes of different coefficients will be produced. The approach used in panel data model in this research is Fixed Effect and Random Effects.

Approach that can be used in data panel model that is Fixed Effect and Random Effects, hence more according to (Widarjono, 2013), about model panel data can be explained as follows.

Fixed Effect Model

The characteristics of each cross section in the common effect model can not be captured by the model because it assumes the same intercept and slope across the entire cross section. In the fixed effect model, the differences between individuals can be accommodated by different intercept. To estimate Fixed Effects model panel data,

a dummy variable technique is used to capture the differences between intercept companies, different intercepts can occur due to differences in work, managerial, and incentive cultures. Nevertheless, the parts are same between companies. This estimation model is also called the technique of Least Squares Dummy Variable (LSDV).

Random Effect Model

In the fixed effect model, the addition of variables with dummy variables will give consequences in degrees of freedom (degree of freedom). it will reduce the efficiency of parameters. This random effect model will estimate panel data where interference variables may be interconnected between time and individuals. In the random effect model, the intercept difference is accommodated by the error terms of each cross section.

The model specification test on the data panel is required to obtain the best model that represented the condition of the data. In the model panel, the model specification test data is done through Hausman Test. According to (Widarjono, 2013), in the Hausman test, there are two things into consideration. Firstly, whether or not correlation available between error term and independent variables, if it is assumed that there is a correlation between error term and independent variable then random effect model is more appropriate. Secondly, with the number of samples in the study. If the taken sample is only a small part of the population, then it will get random error conditions. So that the random effect model is more appropriate.

Result and Discussion

Analysis of the development of Indonesian marine fishery, in this case fish stock at sea can be represented by Proxy of catch this thing can be seen in figure 1.

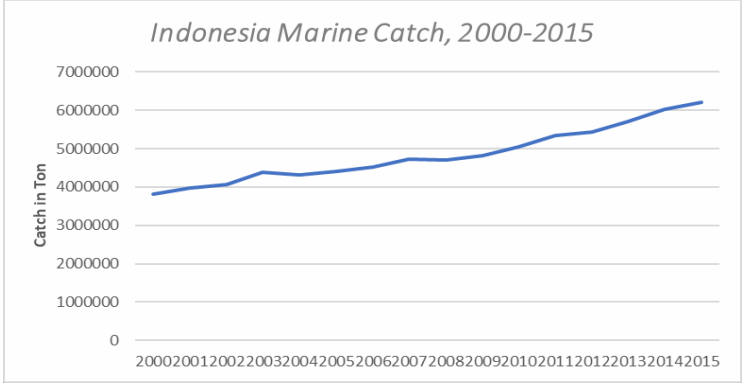

Figure 1. Indonesia Marine catch 2000-2015

As shown in Figure 1, the development of Indonesian fisheries production has experienced an increasing trend. The fisheries production rate in the period 2000-2015 having an average production increase of 1.03 percent. This supports the view

(Hilborn, 2007 and Murawski et al., 2007) stating that fishing practices are sustainable, so concerns over the collapse of fish stocks at sea are marked by a decrease in the number of harvests at sea as feared by (Pontecorvo and Schrank, 2012; Zeller and Pauly, 2005) are not proven in Indonesian marine waters. More specifically, it can be seen from all provinces in Indonesia, some provinces such as Maluku, North Sumatra, South Sulawesi accounted for 26.6 percent of the national harvest in 2000 as percentage decreased to national catch percentage in 2015 amounting to 23.06 percent of the total national catch. Some areas having an increased in fish harvests by 2 percent from 2000 to supply total national income in 2015 such as North Maluku and DKI Jakarta.

The second section looks at the relationship of catch volume influenced by economic growth, population growth and effort effectiveness. Empirically to provide evidence of the role of economic growth, population growth and effort effectiveness on the volume of fish catch in estimation using RE (Random Effects) and FE (Fixed Effects). The data panel is used to overcome the problems that exist in the estimation model as there are constant variables across time that are in the error so that will affect the value of coefficients in the model. Fixed effects and random effects model are two methods to overcome the condition.

The estimation results from the main model are shown in the output in table 1 below. The output shows the variation of results based on model and variation when the regression is done. In addition for displaying regression results, the model test is seen from Hausman Test. Hausman Test is to provide limits so it can be concluded which model is the best model. After getting the best model based on model specification test then the next step is to analyze the coefficient value in the model so that can be interpreted result obtained by regression analysis of panel data.

The first step taken in analyzing the results of regression output on the panel data model is by testing the model specification.

Based on the results of Hausman test is used to test between Random Effects and Fixed Effects, in the test obtained p- value value of 0.6603 on the model so it can be concluded that the random effects model is the selected model.

The Random Effect method obtained the result as follows: Table 1. Regression Estimation Results

Variable	Coefficient	Std. Error	P>|Z|
lnY	.175734	.0868948	0.043
lnP	.2329193	.0745119	0.002
lnE	.4911982	.1055401	0.000

Source: processed data, 2017

The output analysis result of random effect for model is analyzed in relation between variable. Table 1 shows that economic growth is statistically significant and significant at the 0.05 level, which means that economic growth contributes to the harvests of fish in the sea. The value of economic growth coefficient is 0.175734 which is means that if there is an increase of 1 percent economic growth it will increase the harvesting of fish at 0.175 percent. The study of economic growth as a result of the catch as Sugiawan (2017) In the economic development stage of the composition of the economic effect resulted in the creation of new environmental regulations and clean industry that preserve the environment and cancel the damage of the previous stage of development of fish stock.

Another influence is also indicated by population growth, the effect of population growth is indicated by a positive and significant value at the level of 0.01 with a coefficient of 0.2329193 which means that if there is an increase of 1 percent population density, it will increase the fish catch in the sea of Indonesia of 0.232 percent. The influence of population on positive catch volume is in line with Sugiawan's (2017) study at global level which states that the population has positive effect on catchment. The higher population, the catch will increase. So, we can conclude that the stock of sea fish is still in sufficient supply.

Another effect for sea catch is shown by the effectiveness of the effort. Effect of effort effectiveness undertaken is indicated by the positive and significant value at the 0.01 level with the coefficient value 0.4911982 which means that if there is an increase of effort effectivity done by 1 percent, it will increase the catch in the sea of Indonesia by 0,491 percent. This is in accordance with the research conducted by (Jin et al., 2002) and (Hannesson, 2007) stating that better ships and equipment that used will increase the number of fish catches.

From the regression estimation it can be concluded that during the period 2000-2015 the number of fish catches at the sea in Indonesia increased. This indicates that the decreasing stock inventory that effect on the catch will decrease as feared by previous research (Pontecorvo and Schrank, 2012; Zeller and Pauly, 2005; Myers and Worm, 2003; Pauly et al., 1998; Merino, 2012) have not been proven in Indonesian seas.

Conclusion and policy Implementation

The purpose of this study is to examine the state of Indonesia's marine fisheries and to study its relation to economic factors, population growth and effort effectiveness. For this purpose, we use capture as a proxy for the abundance of marine resources. Our model uses panel datasets in 33 provinces in Indonesia in 2000-2015. We found no evidence of a reduction in Indonesian fishery catches that are affected by economic and population growth as much as experts fear.

Each important country like Indonesia is an important political entity that cares about the interests of the state, in relation to fisheries interest in policies focusing more on policy-specific for the improvement of national economy such as employment field in fishery industry, export value, utility satisfaction and so on. So the attention to the secondary issues tends to be lower, in this case the base of marine resources for the long term.

This is important considering that economic growth, population growth, and effort effectiveness in the form of ship quantities, environmentally friendly technologies will continue to increase it and keep the resource base maintained for the utilization of the sea as a basic human need and keep humans' wealth remain sustainable.

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