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Analysis of Factors Affecting Fisherman Income in West Sumatera Province

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ABSTRACT
This study aimed to explain the effect of the potential fish, the number of boats, fishing gear and working capital on the income of fishermen in the province of West Sumatra. The data used were panel data (cross section and time series) consisting of 7 regencies and cities in West Sumatra during 2012 to 2019 period. The method used was panel data regression. The results of the study found that the potential fish had a positive and insignificant effect on fishermen's income, while the number of boats, fishing gear, and working capital had a positive and significant effect on fishermen's income in West Sumatra.
***Keywords**: Fishermen's income, potential fish, number of boats, fishing gear, working capital, panel data.*

1. INTRODUCTION

In astronomical terms, West Sumatra Province is located between 00 54' 'North Latitude and 3030' South Latitude and 98036 'and 101053' East Longitude. Based on its geographical position, West Sumatra Province is located on the west coast of the central part of Sumatra Island and has an area of approximately 42.2 thousand Km² or the equivalent of 2.21 percent of the total area of the Republic of Indonesia. West Sumatra is directly adjacent to North Sumatra Province, Riau Province, Jambi Province, Bengkulu Province and the Indonesian Ocean. (KKP 2018).

The position of West Sumatra, which is located on the west coast of Sumatra, which is directly connected to the Indian Ocean, has a coastal area of approximately 138,750 km2 and this does not include the waters of the Indonesian Exclusive Economic Zone (ZEEI). The length of the entire coastline including the Mentawai Islands is 2,045 km with 125 islands and 70 percent of them are scattered in the Mentawai Islands. Of the 19 regencies and cities in West Sumatra, only seven of which have sea areas, namely West Pasaman Regency, Agam Regency, Padang Pariaman Regency, Pariaman City, Padang City, Pesisir Selatan Regency and Mentawai Islands Regency.

West Sumatra has a sea area of up to 12 miles, or 51,060 (km²). With these sea conditions, the potential for marine fisheries is still quite promising compared to offshore and oceanic fisheries. Based on the characteristics of the fish habitat / environment, West Sumatra has the potential for large pelagic fish resources which are quite promising, including tuna, skipjack, tuna and mackerel. West Sumatra is included in the Fisheries Management Area (FMA) - 572: Indian Ocean, western part of West Sumatra and the Strait Sunda, which has an estimated potential of fish resources as in table 1.

Table 1. Fish Resource Potential in West Sumatra in 2019

Fish Resource Group	Indian Ocean FMA 572 Tons / Year	The number that can be caught
Large Pelagic Fish	364,830	291,864
Small Pelagic Fish	412,915	330,356
Demersal Fish	366,066	292,853
Penaeid shrimp	8,249	6,599
Coral Fish Consumption	48,098	38,478
Lobster	1,297	1,307
Squid	14,579	11,663
Crab	12,537	10,029
Total Potential (Tons/Year)	1,228,601	982,879

Source: KKP 2019

With the potential for marine fisheries in West Sumatra of 1,228,601 tons/year, currently only 211,530.7 tons or 17% of which have been utilized. Fishery businesses that still have the

opportunity to be developed are for medium and large scale investments, namely fishing for tuna in the waters of the Exclusive Economic Zone (EEZ) so that it does not compete with traditional fishermen on the coast.

Fisherman is a term for people who daily work to catch fish or other biota that live on the bottom, column or surface of the waters. The waters which are the area of fishermen activity can be fresh, brackish or marine waters. In developing countries such as in Southeast Asia or in Africa, there are still many fishermen who use simple equipment to catch fish. Fishermen in developed countries usually use modern equipment and large vessels equipped with sophisticated technology (Kusnadi, 2000). The income growth of regency or urban fishermen in West Sumatra can be seen in Table 2.

Table 2. Income Growth of Fishermen in West Sumatra from 2017 to 2019

No.	Regency / City	Year	Income of Fishermen (Thousand IDR / Year)	(%)
1	Mentawai Islands Regency	2017	52,042,500	-
		2018	52,912,500	1.64
		2019	52,042,500	-1.67
2	Pesisir Selatan Regency	2017	75,511,000	-
		2018	89,346,250	15.48
		2019	86,502,500	- 3.29
3	Padang Pariaman Regency	2017	41,109,750	-
		2018	42,972,000	4.33
		2019	41,107,500	- 4.54
4	Agam Regency	2017	19,158,000	-
		2018	18,299,250	-4.69
		2019	19,155,000	4.47
5	West Pasaman Regency	2017	77,178,205	-
		2018	79,243,025	2.61
		2019	77,177,500	-2.68
6	Padang City	2017	74,598,250	-
		2018	70,819,000	-5.34
		2019	73,205,000	3.26
7	Pariaman City	2017	36,883,205	-
		2018	35,067,500	-5.18
		2019	36,882,500	4.92

Source: DKP West Sumatra Province, 2019

Based on table 2, it can be seen that the income of fishermen from the regencies and cities fluctuated from 2017 to 2019. The highest growth of fishermen's income was in Pesisir Selatan Regency in 2018 at 15.48 percent, while the lowest growth occurred in the city of Padang in 2018 amounting to -5.34 percent

The decline and increase in fishermen's income can be influenced by several factors, namely the growth potential fish, the number of boats, fishing gear, and working capital from 2017 to 2019. The growth of the potential fish from 2017 to 2019 tended to be constant. The highest growth is in the Mentawai Islands Regency. in 2019 it was 8.95 percent, and the lowest potential fish growth was in the Mentawai Islands Regency as well in 2018 amounting to -72.97 percent. The decline in the potential fish in the Mentawai Islands Regency in 2017 did not actually result in a decrease in income.

The growth number of boats in seven regencies and cities in West Sumatra from 2017 to 2019 fluctuated. The lowest number of boats was in the Mentawai Islands Regency in 2018 of -72.97 percent, and the highest number of boats was in the Mentawai Islands Regency in 2019 at the amount of 8.95 percent. The conditions that occurred in 2019 in the Mentawai Islands Regency were contrasting. While the growth number of boats increased, the income of fishermen decreased.

The growth of fishing gear in West Sumatra from 2017 to 2019 fluctuated. The growth of the highest number of fishing gears was in Agam Regency in 2018 at 50.68 percent. However, in the same year, the growth of fishermen's income decreased which means that it is not in line with the theory. The growth of the lowest number of fishing gear is in the Padang Pariaman Regency in 2019 amounting to -70.10.

Furthermore, the growth of working capital in the province fluctuated from year to year. The highest growth occurred in 2018 in the Mentawai Islands Regency, 6.13 percent, and the lowest growth of working capital for fishing for fishermen was in 2019 in Agam regency of -0.03 percent. Nevertheless, in that year, the income of fishermen in Agam Regency witnessed an increase.

1.1. Literature Review

1.1.1. Income Theory

Income is the reward received by all households in society of a country after carrying out economic activities. This income is used by the community to meet consumption needs and the rest is savings to meet the future (Tito 2011). In other words, income in more detail is the result

of reduction between the amount of revenue and the costs incurred. The total income is the sum of all income obtained from the results of the business carried out.

According to Soeharjo and Patong (1994: 234) there is a positive relationship between marketed production and income, meaning that the greater the marketed production is, the greater the income earned. The amount of income has a function to fulfill the needs of daily life. In an activity or a production process which is often related to money, it is referred to as income.

Sitorus (1994) states that income is the number of uses that can be generated through a business. In essence, the amount of money received by a producer (fisherman/fish farmer) for the production he sells depends on: 1. The amount of money that must be spent by the consumer 2. The number of products marketed 3. Costs for transporting the product to the market. Fishermen's income comes from two sources, namely income from fishing businesses and income from outside the fishing business. The main source of income for fishermen is from fishing businesses, while income from outside the fishing business is usually lower (Sajogya 1996).

1.1.2. Definition of Fisherman

Government Regulation of the Republic of Indonesia Number 15 of 1990 (15/90) concerning Fisheries Business, that fishermen are defined as people whose livelihoods are fishing. In general water fisheries statistics, fishermen are defined as people who actively carry out fishing operations in public waters. People who perform jobs such as making nets, transporting fishing gear into boats or motorboats, transporting fish from boats or motor boats, are not categorized as fishermen (Ministry of Marine Affairs and Fisheries 2002). Catching fish is an activity that aims to obtain fish in waters that are not cultivated by any tools or means, including activities that use ships to load, transport, store, cool, cultivate or preserve it. Fishery businesses that work in the fishing sector are included in capture fishery activities (Wikipedia 2012).

1.1.3. Determinants of Fishermen's Income Income

Income is the outcome obtained by fishermen in the form of fish-sold products caught at sea or the results of profit sharing activities from fishing. Fishermen's income is determined by the amount of fish caught. The Department of Fisheries and Marine Affairs of West Sumatra Province (2012) states that the productivity of fishermen in getting fish is influenced by the following factors:

a. Technologies related to the equipment used by fishermen in fishing are boats without engines or boats with engines, nets and fishing rods. Fishermen's equipment or costs are the value of the equipment used, such as the price of a boat, the price of fishing equipment, and foodstuffs brought to sea and left at home. This is an input for fishermen when going to the sea (catching fish).
b. Socio-Economy is age, education, experience, equipment, participation in fishermen organizations, and season. Age affects fishermen's income because someone who is 15 years and over can be called a fisherman. The education taken by fishermen is also a factor that influences fishermen's income. Experience determines the skills of fishermen in fishing, the more skilled the fishermen are to eat their catch, the better. The factor of ownership of the equipment used by fishermen or whether the fisherman has his own equipment or not, also play a role. if the fisherman does not have his own equipment and only receives a salary, then it is said to be a fisherman. The existence of the organization in the participation of fishermen in the organization is expected to have a positive impact on fishermen's income.
c. Fish Trading System is a perishable commodity, so the storage process must be good. The quality of fish affects the selling price of fish in the market. So from the viewpoint of the efficiency value of the use of the fisheries trading system, the better and more efficient the fisheries trading system is, the better the price will be.
d. Natural factors. Fauzi (2010) stated, apart from over-exploitation and rampant IUU (Illegal, Unreported, Unregulated) fishing, the fisheries sector is experiencing serious problems related to climate change and its impact on the sustainability of capture and aquaculture businesses. Gradual changes in temperature increases occurring globally which result in changes in biophysical aspects such as changes in extreme weather, sea level rise, changes in food webs, and changes in reproductive physiology, will have an impact on the socio-economic aspects of fisheries. There are at least two extreme phenomena for the oceans due to

global climate change, namely an increase in sea water temperature and sea level. The increase in sea water temperature affects the coral reef ecosystem which is the fishing ground and nursery ground for fish that live in the area and the fish that live in the coral area will experience a decline in population. In addition, sea level rise has a wide impact on the activities of fishpond fishermen in coastal areas.

According to Muttaqien (2010), fishermen productivity is estimated to drop 60% due to climate anomalies characterized by high rainfall and big waves, which make fishing activitie dangerous. The effect of extreme weather which is characterized by high rainfall causes the acidity of sea water to decrease. So that the fishing area is further away and is not accessible to small fishermen who only use traditional boats. In addition, high waves and strong winds prevent fishermen from going to sea. Waves that are usually only one meter high will dramatically increase to two meters or more. The air and the sea are closely interacting and that it influences the sea conditions. Wind, for example, greatly determines the occurrence of waves and currents on the sea surface, and rainfall can determine the salinity (diversity) of sea water.

2. METHODOLOGY

This research is categorized as descriptive and associative research. Descriptive research is research that aims to describe or explain an event, and also to find out how much influence the causal variable has on the effect variable, where the data used is in the form of numbers. Associative research aims to see the relationship between the independent variable and the dependent variable.

The type of data in this study is quantitative data consisting of four variables, namely Fishermen's Income as the dependent variable (Y) and the Independent Variable. Potential fish(X1), number of boats (X2), fishing gear (X3), working capital (X4). The data used in this research is secondary data sourced from the Department of Marine Fisheries of West Sumatra Province.

The data used in econometric analysis are panel data. Panel data is a combination of cross-section and time series data. This research started from 2012 to 2019, the amount of time series data was 8 years and the number of cross sections was 7 regencies-cities, so it was obtained 8 x 7 = 56 observations.

2.1. Panel Data Regression Analysis

Panel data analysis is a regression that combines time series data with cross section data, known as panel data regression. Panel data regression has a double subscript for each variable, where i denotes individual and cross section aspects, while t shows both time and time series aspects. Panel data regression can be modeled as follows (Baltagi, 2005):

$Y_{it} = \alpha + X_{it}\,\beta + \varepsilon_{it}$.....(1)

Where:

i = Regency - City

t = 2012 to 2019

Information:

Y_{it}: the value of the dependent variable from individual i-th, at time t-th

α: intercept (constant)

a_i: the specific effect of each individual i-th that is not unobserved (*unobserved*)

Xit: the value of the explanatory variable of the individual or the i-th observation at t-th time

β : estimated parameter

ε_{it}: error

2.2. Research Model Specifications

The specification of this research model can be written in the following equation:

$Y_{it} = \alpha_0 + \alpha_1 X1_{it} + \alpha_2 X2_{it} + \alpha_3 X3_{it} + \alpha_3 X4_{it} + \varepsilon_{it}$ ..... (2)

Where:

Y_{it} = Income of fishermen in The Regencies and Cities i in period t

$X1_{it}$ = Potential fish in The Regencies and Cities i in period t

$X2_{it}$ = Number of boats in The Regencies and Cities i in period t

$X3_{it}$ = Fishing gear in The Regencies and Cities i in period t

$X4_{it}$ = Working capital in The Regencies and Cities i in period t

α = Regression coefficient

ε_{it} = error term

3. Panel data regression model estimates

There are three types of model estimates used in panel data regression, namely the common effect model, the fixed effect model, and the random effect model. the fundamental difference between the three is the presence of individual

specific effects (α_i). the presence of individual specific effects and their correlation with the observed explanatory variable (X_{it}), largely determines the model to be used.

2.3. Common Effect Model

The common effect model assumes that the intercept and slop coefficient are constant between individuals over various periods of time, and the error terms explain the difference in intercept and slop coefficient over time and for these individuals. This model combines time series data and cross section data, the estimation used is Ordinary Last Square (OLS) regression.

In general, the common effect model in the form of a regression equation can be explained as follows (Baltagi, 2008):

$Y_{it} = \alpha + X_{it}\,\beta + \varepsilon_{it}$ ..... (3)

Where

i = The Regencies and Cities in West Sumatra

t = 2012 to 2019

Information:

Y_{it} : the value of the dependent variable of the individual i, at time t

α : intercept (constant)

X_{it} : the value of the explanatory variable of the individual I or the observation at time t

β : estimated parameter

ε_{it} : error

2.4. Fixed Effect Model

This model assumes that the intercept of each individual is different, while the slope between individuals remains the same. To distinguish one subject from another, where each α_i is an unknown parameter and will be estimated using dummy variables (Verbeek, 2004)

$Y_{it} = \alpha + i\alpha_i + X_{it}\,\beta + \varepsilon_{it}$ ..... (4)

Where :

i = The Regencies and Cities in West Sumatra

t = 2012 to 2019

Information:

Y_{it} : the value of the dependent variable of the individual i, at time t

α : intercept (constant)

α_i : the unobserved specific effects of each individual i

i : Variable *dummy* for the individual i

X_{it} : the value of the explanatory variable of the individual i at time t

β : estimated parameter

εit : error

This fixed effect technique is also known as the Least Square Dummy Variable (LSDV). besides being used for individual effects, LSDV also accommodates systematic time effects. This can be done by adding a time dummy variable to the model.

2.5. Random Effect Model

This model estimates panel data where residual variables are thought to have a relationship between time and between individuals. In REM, the specific effect of each individual α_i is treated as part of the error component which is random and uncorrelated with the observed explanatory variable (X_{it}). Random effect model is often referred to as the error component model (ECM). then, the random effect model equation can be written as follows (Gujarati, 2004):

$Y_{it} = \alpha + X_{it}\,\beta + w_{it}$ ..... (5)

Where :

i = The Regencies and Cities in West Sumatra

t = 2012 to 2019

Information :

Y_{it} : the value of the dependent variable of the individual i, at time t

α : intercept (constant)

X_{it} : the value of the explanatory variable of the individual i at time t

β : estimated parameter

wit : a combination of individual error components and time

3. RESULTS AND DISCUSSION

3.1. Inductive Analysis

3.1.1. Determination of the Estimation Method Chow test

Determination of the use of the common effect model (CEM) or fixed effect model (FEM) is determined by conducting the chow test, the results are as follows:

Table 3. Chow test

Redundant Fixed Effects Tests
Equation: Untitled
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	389.138270	(6,45)	0.0000
Cross-section Chi-square	222.214814	6	0.0000

Source: Eviews 10 (2021, processed)

Based on table 3, the chow test results show that the Chi-square probability is 0.0000 smaller than the probability $\alpha = 0.05$, so H_0 is rejected and H_a is accepted, so the Fixed Effect is the right model to use.

Hausman Test

Determination of the use of the fixed effect model (FEM) or Random effect model (REM) is determined by carrying out the Hausman test, the results are as follows:

Table 4. Chow test

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	20.245866	4	0.0004

Source: Eviews 10 (2021, processed)

Based on Table 4, the results of the Hausman test show that the 0.0004 Chi-square probability is smaller than the probability $\alpha = 0.05$, so H_0 is rejected and H_a is accepted, so the Fixed Effect is the right model to use.

3.2. Classic assumption test

3.2.1. Heteroscedaticity Test

To detect heteroscedasticity disorders in the estimation model, a heteroscedasticity diagnostic residual test is carried out provided that if the probability value of the independent variable used is below a significant value at $\alpha = 0.05$, it means heteroscedasticity occurs.

Table 5.Heteroscedaticity Test Results

Dependent Variable: LOG(RESABS)
Method: Panel Least Squares
Date: 01/14/21 Time: 17:48
Sample: 2012 2019
Periods included: 8
Cross-sections included: 7
Total panel (balanced) observations: 56

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.346642	13.65346	-0.025389	0.9799
LOG(X1)	0.046497	0.792022	0.058706	0.9534
LOG(X2)	-0.399743	0.487853	-0.819393	0.4169
LOG(X3)	-0.397826	0.213660	-1.861955	0.0691
LOG(X4)	0.170728	0.729538	0.234022	0.8160

Source: Eviews 10 (2021, processed)

Based on table 5, the heteroscedaticity test can be seen that there are no independent variables whose probability value is below the significant value $\alpha = 0.05$, it can be concluded that there is no heteroscedasticity.

3.3. Estimation Results of Fixed Effect Model

Based on the results of the Chow test and the Hausman test, it can be determined that the best estimation model is the fixed effect model as follows:

Table 6. Test Results of Fixed Effect Model

Dependent Variable: LOG(Y)
Method: Panel Least Squares
Date: 01/14/21 Time: 17:30
Sample: 2012 2019
Periods included: 8
Cross-sections included: 7
Total panel (balanced) observations: 56

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	19.63612	0.817861	24.00913	0.0000
LOG(X1)	0.109064	0.047443	2.298843	0.0262
LOG(X2)	0.063589	0.029223	2.175981	0.0348
LOG(X3)	0.027019	0.012799	2.111138	0.0403
LOG(X4)	0.141804	0.043700	3.244910	0.0022

Source: Eviews 10 (2021, processed)

Based on Table 4.10, it can be written that the estimation model of this study is as follows:

$$Y_{it} = 19.63612 + \log 0.109064X_{1_{it}} + \log 0.063589X_{2_{it}} + \log 0.027019X_{3_{it}} + \log 0.141804X_{4_{it}} + \varepsilon_{it} \text{.....(5)}$$

From equation (5) it can be seen that:

The constant value is obtained by 3.81E + 10 which means that when there is no influence of

the independent variable, namely the potential fish (X_1), the number of boats (X_2), fishing gear (X_3), and working capital (X_4), the dependent variable, namely fishermen income (Y) in West Sumatra amounting to 3.81E + 10.

The potential fish (X_1) has a positive and insignificant effect on fishermen income (Y) in West Sumatra with a regression coefficient of 104459.9. This means that when there is an increase in the potential fish (X_1) by 1 unit, it will increase the income of fishermen (Y) in West Sumatra as much as 104459.9 unit.

The number of boats (X_2) has a positive and significant effect on fishermen's income (Y) in West Sumatra with a regression coefficient of 849844.2. This means that when there is an increase in the potential fish (X_2) by 1 unit, it will increase the income of fishermen (Y) in West Sumatra as much as 849844.2 unit.

Fishing gear (X_3) has a positive and significant effect on fishermen's income (Y) in West Sumatra with a regression coefficient of 664701.0. This means that when there is an increase in the potential fish (X_3) by 1 unit, it will increase the income of fishermen (Y) in West Sumatra as much as 664701.0 unit.

Working capital (X_4) has a positive and significant effect on fishermen's income (Y) in West Sumatra with a regression coefficient of 2.114257. This means that when there is an increase in the potential fish (X_4) by 1 unit, it will increase the income of fishermen (Y) in West Sumatra as much as 2.114257 unit.

4. CONCLUSIONS

Based on the results of research and discussion of the factors that affect the income of fishermen in West Sumatra province, it can be concluded that:

The potential fish has no significant positive effect on income of fishermen in the province of West Sumatra. The number of boats has a positive and significant effect on income of fishermen in West Sumatra province. Fishing gear has a positive and significant effect on income of fishermen in the province of West Sumatra, and Working capital has a positive and significant effect on income of fishermen in West Sumatra province

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