3-31-2021

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Bayu Rhamadani Wicaksono
Universitas Padjadjaran-Ritsumeikan University and BPS-Statistics Indonesia,
bayu18007@mail.unpad.ac.id

Yuniarti Yuniarti
Directorate of Statistical Analysis and Development, BPS-Statistics Indonesia, efi@lpem-feui.org

Dede Yoga Paramartha
Directorate of Statistical Analysis and Development, BPS-Statistics Indonesia, efi@lpem-feui.org

Factors to Improve Fishery Household Welfare: Empirical Analysis of Indonesia

Bayu Rhamadani Wicaksono[a,*], and Mohamad Fahmi[b]

[a]*Universitas Padjadjaran-Ritsumeikan University and BPS-Statistics Indonesia*
[b]*Universitas Padjadjaran*

Abstract

This study attempts to verify the linkage between the characteristics of fishers and the welfare of fishery household in Indonesia, which is explained by the surplus obtained by fishers. Based on the empirical results using multiple linear regression analysis, variables with significant impacts on improving the welfare of fishery household in Indonesia in both marine and inland open water fisheries are fishing gear, number of fishers, number of crew, salary, province, age, gender, education level, processed storage, transportation, and market target. Furthermore, the characteristics of fishers are divided into similarities and differences. Observed from the similarities, the main fishers play a prominent role to fulfill the daily needs of their families. Observed from the differences, fishers in marine fisheries prefer to use a boat with an inboard motor, prepare more funds, and require more crew members because they usually catch fish on long trips. On the other hand, fishers in inland open water fisheries prefer to use a boat without an inboard motor, prepare less funds, and require less crew members because they usually catch fish on short trips. The government needs to formulate effective, efficient, and targeted policies for the welfare of fishers. The findings suggest several policy recommendations related to the improvement of fishery household welfare in Indonesia, such as soft loan in the form of People's Business Credit (KUR), storage facilities for a better supply chain, and revitalization of fish auction sites.

Keywords: capture fisheries; characteristics of fishers; welfare; fisheries policy

JEL classifications: D600; I310; I380; Q220

1. Introduction

The fisheries sector is closely associated with small-scale fisheries. Approximately 90% of the 35 million people registered as fisheries actors worldwide are classified as small-scale fisheries and an additional 20 million people are estimated to be active in the post-harvest of small-scale fisheries (Food and Agriculture Organization [FAO] 2021). According to the FAO, the concept of small-scale fisheries is "*Small-scale fisheries can be broadly characterized as a dynamic and evolving sector employing labor intensive harvesting, processing, and distribution technologies to exploit marine and inland water fisheries resources. This sector, therefore, is not homogenous within and across countries and regions and attention to this fact is warranted when formulating strategies and policies for enhancing its contribution to food security and poverty alleviation,*" (Béné 2006).

The small-scale fisheries provide an important contribution to not only food security and poverty alleviation, but also nutrition and sustainable livelihoods, particularly in developing countries, such as Peru (Alfaro-shigueto et al. 2010), West African (Belhabib, Sumaila & Pauly 2015), and Indonesia (Duggan & Kochen 2016; Ayunda, Sapota & Pawelec 2018). On the other hand, there are five main issues in small-scale fisheries, namely: (1) problems of access to livelihoods and poverty alleviation for fishery household; (2) supply chain from

*Corresponding Address: BPS-Statistics Indonesia, Jl. dr. Sutomo No. 6-8, Jakarta 10710. Email: bayu18007@mail.unpad.ac.id.

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catch to market (technology, tool, and infrastructure); (3) low capacities for policy research and development; (4) limited access to health, education, and other social services; and (5) access to learning, training, and counseling (FAO 2020).

Indonesia is the largest archipelago country in the world with huge potential of fishery resources and a big home to 25% of fish species in the world (World Wildlife Fund Indonesia 2018). Under the current administration, the fisheries sector has gained attention. Several indicators of fisheries sector performance, such as Gross Domestic Product (GDP) of fisheries sector and fisheries production, show an increasing trend.

Based on data from BPS-Statistics Indonesia (2018a), the fisheries sector has improved. In 2016, the GDP of fisheries sector reached IDR 214.5 trillion with a growth of 5.15% and a contribution of 2.56% to the National GDP. In 2017, the GDP reached IDR 227.3 trillion with a growth of 5.95% and a contribution of 2.57% to the National GDP. According to the data from the Ministry of Marine Affairs and Fisheries (2019a), the production of capture fisheries in 2016 and 2017 reached 6.58 million ton and 7.07 million ton respectively. In 2018, the production increased to 7.25 million ton. The types of capture fisheries in Indonesia are marine and inland open water fisheries. The production of aquaculture fisheries has increased rapidly in recent years, yet it is not the subject of this study. Several of these facts provide better hope of further growth for the fisheries sector in Indonesia.

On the other hand, the fishery household welfare remains in a poor condition. The Farmers' Terms of Trade (NTP) of Fisheries Sector describes the purchasing power of fishery households in Indonesia. Based on BPS-Statistics Indonesia (2019), the NTP of Fisheries Sector increased by 1.94 points from 104.05 in 2017 to 105.99 in 2018. This fact shows that the purchasing power of fishers is better, yet their surplus value (income minus expenditure) remains significantly low. According to the results of Census of Agriculture 2013, the poor capture fishery households reached 23.79% for the marine

fisheries and 24.98% for the inland open water fisheries (BPS-Statistics Indonesia & IPB University 2015).

Based on the results of Census of Agriculture 2013 (ST2013) (BPS-Statistics Indonesia 2013) and the 2018 Inter-Census Agricultural Survey (SUTAS2018) (BPS-Statistics Indonesia 2018a), the number of capture fishery households in Indonesia actually has decreased in the last five years. The capture fishery households declined by 9.8% from 864.5 thousand in 2013 to 780 thousand in 2018. The declining number of the fishery households is an "alarm" indicating the increasing unpopularity of the fisheries sector. It is not easy for fishers to switch to other sectors as their new main job because they have several limitations such as low education and also need some room for improvement, such as new skills and knowledge (Syuryani 2017).

Several scholars have investigated the welfare of fishery households. Balasubramaniam, Remesan & Gopal (2005) study fish productivity and associated factors among fishers operating Fiber Reinforced Plastics (FRP) crafts in India that provide further progress in material and mold processing technology for boats. The age of the fishers, the size of the FRP craft, investment on nets, annual maintenance costs, annual income, and average selling value of fish (socio-economic variables) have positive impacts on fish productivity related to fishery household welfare. However, the number of samples is too small, only 40 respondents from the Veraval Centre area and 31 respondents from the Quilon area.

Jensen (2007) examines the relationship among information technology, market performance, and welfare in the South Indian fisheries sector. He analyzes the use of mobile phone as a proxy for the information technology that affects the welfare of fishers. He discovers that better information technology leads to higher market performance and welfare. The variable used for information technology is only mobile phone, while other variables to be analyzed are boat and fishing gear.
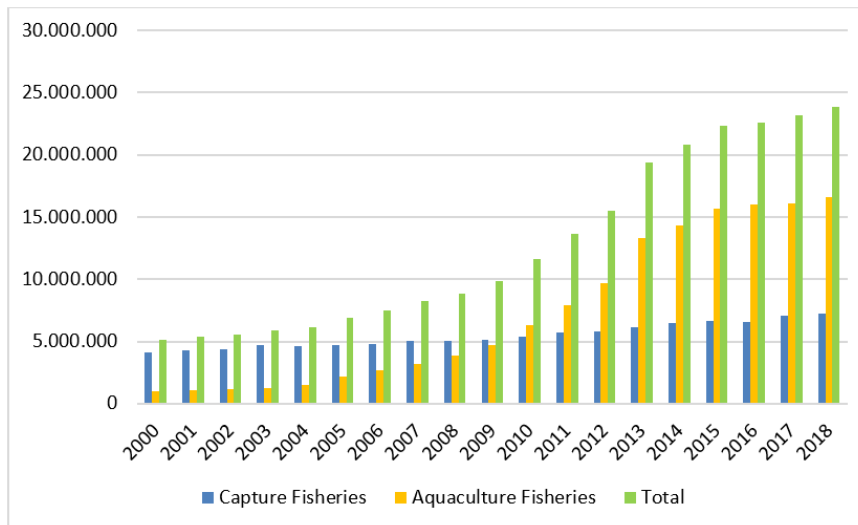
Figure 1. Fisheries Production in Indonesia, 2000–2018 (in Ton)
Source: The Ministry of Marine Affairs and Fisheries (2019)

Belhabib, Sumaila & Pauly (2015) study the contribution of West African small-scale fisheries to the economy, food security, and poverty alleviation. The profitability is used as a proxy for poverty alleviation linked to the fishery household welfare. There is an increase in the dependency of West African coastal communities on food and profit with the goals of reducing poverty and improving fishery household welfare. This study only uses the qualitative analysis based on the official data and re-estimates data acquired from various studies.

Lein & Setiawina (2018) study the factors affecting the income and welfare of fishery household in East Flores District, Indonesia. The factors of production costs (food, drink, diesel oil, gasoline oil, wage of labor, and fishing equipment), technology (fishing gear), and fish catch have a significant impact through income on fishery household welfare. This study only focuses on one local region, thus it cannot generate a result for national scope to represent the condition of Indonesia.

Based on the previous studies, several variables can be used as proxy for fishery household welfare, such as fish productivity, fisheries production value, the income of fishers, and profit. Many selected independent variables have impacts on fish-

ery household welfare, such as age of fishers, the size of the ship, technology, and production costs. Those studies provide contribution to this study using the micro data, the characteristics of fishers for independent variables, profit (surplus) for the dependent variable, and multiple linear regression for the empirical analysis. On the other hand, they have several limitations, such as the number of the sample, the variation of independent variables, and the scope of the study that will be completed in this study.

Supposing the potential of the fisheries sector in Indonesia is managed properly, it can provide an enormous contribution to the improvement of the fisheries sector. Several facts presented show that the indicators of fisheries sector performance in Indonesia are heading towards a positive direction. This is certainly quite promising, especially concerning the sustainability of the development of the fisheries sector itself. However, in facts, the fishery household welfare shows a contrast condition compared to the indicators of fisheries sector performance. Overall, the growth in those performance indicators still have no huge impacts on improving fishery household welfare in Indonesia. This study attempts to verify the linkage between the fisheries

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sector performance and fishery household welfare in Indonesia.

The questions of this study are summarized as follows: (1) What are the characteristics of fishers that have significant impacts on improving the fishery household welfare in Indonesia in marine and inland open water fisheries? (2) What are the similarities and differences between fishers in marine and inland open water fisheries?; and (3) How should the policy implications from the empirical results be applied to improve the fishery household welfare in Indonesia? To answer these questions, this study analyzed the micro data from the capture fishery households (marine and inland open water fisheries) in Indonesia in 2014 using the framework of multiple linear regression model. The expected results as hypotheses are the characteristics of fishers have positive impacts on improving the fishery household welfare in Indonesia and there are several similarities and differences between fishers in marine and inland open water fisheries. In addition, this study will provide insight into alternative policies targeted to protect the economy of fishery household and improve the fishery household welfare in Indonesia.

The major question in this study is to examine the characteristics of fishers in marine and inland open water fisheries that have significant impacts on improving the fishery household welfare in Indonesia. This research used the micro data from the latest survey, namely the 2014 Survey of Capture Fishery Household. Based on the knowledge of the author, previous studies using these data are quite limited (BPS-Statistics Indonesia & IPB University 2015). The empirical results can also be applied to answer the third question of the study, aiming at the recommendations of policy implications to improve the fishery household welfare in Indonesia.

2. Literature Review

According to the Food and Agriculture Organization (FAO 2013), the agricultural population is defined as people whose livelihoods depend on agriculture, fishery, forestry, and hunting activities. More than a third of the global population works in the agricultural sector, with the largest part being found in Asia. The agricultural sector is closely related to small-scale households. This is true for fisheries sector in Indonesia (e.g. Suryahadi et al. 2006; Schippers, Weber & Faust 2007; Yamauchi 2014; Rahman et al. 2016; Rahim, Hastuti & Bustanul 2018) and also in the world, e.g. Nigeria (Adewumi & Omoresho 2002), Ethiopia (Asayehegn, Yirga & Rajan 2011), and China (Ito, Bao & Su 2012). Therefore, the agricultural sector remains the backbone of economy, especially for small-scale households in developing countries, including Indonesia.

The evolution of the agricultural sector over centuries has had a major influence on the development of the fisheries sector. The development of global fisheries, especially in capture fisheries, has progressed rapidly. In line with the development, the utilization of natural resources and the authority of the state that administers them have become an intensive discussion in the world since 1958 through a forum known as the United Nations Convention on the Law of the Sea (UNCLOS). UNCLOS has succeeded in formulating several new paradigms about marine affairs in the fisheries sector, such as the archipelagic principle proposed by Indonesia, in which inter-island seas are part of territorial waters and the concept of the Exclusive Economic Zone (EEZ) of 200 miles (UNCLOS 1994).

According to Zachman (1973 as cited in Arinardi 1992), the history of fisheries in Indonesia is divided into two phases, namely before and after 1968. In the period before 1968, national economic conditions were unstable that the role of the fisheries sector could not contribute optimally to the national economic development. In the period after 1968, there was a new policy to prepare a program of Five-year Development Phase One whose main characteristic was the marketing aspect. The strategy for developing the fisheries sector was tailored to the good management of fisheries resources to meet the national economic development targets,

such as increasing GDP, adding foreign exchange, and supplying animal protein.

The difference between traditional and modern theories is the mindset of the fishers, but both have similar goals of how to improve household welfare. One of theories about traditional agriculture is Schultz' Theory. In this theory, a type of agriculture is entirely based on the factors of production that have been managed by farmers for generations. The knowledge used in traditional agriculture is constant knowledge for one or more generations. Because of this constraint, farmers face many difficulties to improve their welfare (Lundahl 2011). In the theory of modern agriculture, there are a combination of three elements: (1) the technological level ("product-oriented" farms); (2) the high integration with national or global markets ("market-oriented" farms); and (3) the attitude to follow public policies to obtain greater government support ("policy-makers-oriented" farms). Using these schemes, farmers can be encouraged to improve their welfare properly (Sortino & Chang 2008). In developing countries, including Indonesia, most fishers still use a traditional approach rather because of the limitation of the small-scale traditional fisheries, including limitation by system (Halim et al. 2019). The ultimate goal is how to bring them to a modern approach, but transition needs more time.

In Schultz' Theory, traditional agriculture frequently, but not always, presents a bad output because the income earned by fishers is significantly low. There is no significant change in the factors of production over the years, such as the use of traditional technology (Lundahl 2011). This fact causes stagnation in the efforts to improve fishery household welfare. This similar condition still occurs in the context of Indonesia, especially capture fisheries, the focus of this study. Poor capture fishery households are closely related to low welfare. It is necessary to have a better way to improve household welfare that will depend on better collaboration between the government and fishers.

Based on the Law of the Republic of Indonesia No. 11 of 2009 (President of the Republic of Indonesia 2009), community welfare is a fulfillment condition of material, spiritual, and social needs of the community to be able to obtain better livelihood and a prosperous life, the welfare of fishers included. One of the factors to support the welfare of fishers is laws that can empower fishers and provide them with benefits, such as expanding employment opportunities, offering ease of obtaining permits, and providing government assistance. On the other hand, improving the welfare of fishers is linked to legal protection for fishers, especially the small-scale fishers, to realize sustainable fisheries development (Hasan, Bueno & Corner 2020).

3. Method

This study used the micro data of capture fishery households in Indonesia collected from the latest survey, namely the 2014 Survey of Capture Fishery Household, conducted by BPS-Statistics Indonesia (2014a). The respondents are the main fishers in each household. They can be the head of the household or a household member working as a fisher. The number of samples is 56,406 households from 34 provinces.

The model containing at least two independent variables that has correlation with the dependent variable is called the multiple regression model. The multiple regression analysis is more compatible with ceteris paribus conclusions because it allows us to explicitly manage many other factors that affect the dependent variable simultaneously. The concept of ceteris paribus, meaning "other (relevant) factors being equal", leads a prominent part in the causal analysis (Wooldridge 2015). This study analyzed the observed factors using multiple linear regression analysis with the equation as follows.

$$\log Y_i = \beta_0 + \sum_{k=1}^{15} \beta_k X_{ki} + \mu_i \qquad (1)$$

The explanation of the variables are as follows. The dependent variable (Y) is the surplus value (IDR thousands). The independent variables include the

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type of main ship (dummy), the type of main fishing gear (dummy), the type of funding source (dummy), the number of household members as fishers, the number of crew or workers, the salary of the crew or workers (IDR thousands), the age of main fishers, the province in where the main fishers live (dummy), the gender of the main fishers (dummy), the highest education level of the main fishers (dummy), the participation in cooperatives (dummy), the participation in Collective Business Group (KUB) (dummy), the type of main production sold (dummy), the type of main transportation (dummy), and the type of main marketplace (dummy). Whereas, i represents Capture fishery household order i-th, β_0 is the intercept, $\beta_1, \beta_2, \ldots, \beta_{15}$ are the coefficient for each independent variable, and u_i is the error term.

This study chose surplus value as a proxy for fishery household welfare rather than the value of fisheries production (Balasubramaniam, Remesan & Gopal 2005) or the income of fishers (Lein & Setiawina 2018). The surplus value is defined as the production in capture fishery household in IDR thousands. The notation of "log" in y denotes the natural logarithm. This means that to obtain a better characterization of how surplus changes with the characteristics of fishers, each independent variable increases surplus by a constant percentage.

The formula for the dependent variable, namely surplus value, is the net income where the value of fish catching is reduced by the total costs of the main ship. Based on BPS-Statistics Indonesia (2014b), the value of fish catching is the total of fish catches carried out at fishing operations in one trip on average. The total costs are the cost component of fishing operations in one trip on average, such as fuel, salt, ice, supplies (food and drink), and operational costs (rent, taxes, maintenance, retribution, and depreciation).

The independent variables will be analyzed using multiple linear regression analysis. To simplify the hypothesis, the summary for the null and alternative hypotheses in this study is as follows.

H_0: *Each independent variable has no signif-*

icant impact on surplus

H_1: *Each independent variable has a significant impact on surplus*

The independent variables are categorized into production side and distribution side. The production side is divided into three aspects, namely: (1) fixed and current capital (ship, fishing gear, assets); (2) labor (number of fishers, number of crew, salary); and (3) characteristics of fishers (province, age, gender, education, member of cooperative, member of KUB). Meanwhile, the distribution side is storage, transportation, and market target.

The variables of fixed and current capital are dummy variables. Based on BPS-Statistics Indonesia (2014b), ship is the main ship operated by the main fishers in each household. The types of ship are inboard motorboat, outboard motorboat, man-powered boat, and non-boat. The dummy 1 is assigned to inboard motorboat while the dummy 0 is otherwise. Fishing gear is the main tool used to catch fish in the main ship. The types of fishing gear are trawls, gill nets, lift nets, purse seines, traps, hooks and lines, others (such as cash nets and harpoons), and no fishing gear. The dummy 1 is assigned to trawl or net while the dummy 0 is otherwise. Loan is the main source of funds for fishing operations. The types of funds are own funds, bank loans, non-bank loans, and others (grant and other loans for fishers). The dummy 1 is assigned to bank or non-bank loans while the dummy 0 is otherwise.

The variables of labor are continuous variables. Based on BPS-Statistics Indonesia (2014b), number of fishers is the number of household members aged 10 years old and over who join fishing operations using the main ship. Number of crew is the number of crew contributing in fishing operations using the main boat. Salary is the total wages of crew or workers participating in fishing operations using the main ship, including paid and unpaid workers (family).

The variables of characteristics of fishers are dummy variables, except age (a continuous variable). According to BPS-Statistics Indonesia

Table 1. Types of Data and Descriptions of Dummy for Variables

Variable Name	Type	Description of Dummy
(1)	(2)	(3)
surplus	Continuous	-
ship	Dummy	1 = inboard motorboat, 0 = otherwise
fishing gear	Dummy	1 = trawl or net, 0 = otherwise
loan	Dummy	1 = bank or non-bank loan, 0 = otherwise
number of fishers	Continuous	-
number of crew	Continuous	-
salary	Continuous	-
age	Continuous	-
province	Dummy	1 = provinces with large production value, 0 = otherwise
male	Dummy	1 = male, 0 = female
high school	Dummy	1 = high school or higher education, 0 = otherwise
member of cooperative	Dummy	1 = yes, 0 = no
member of KUB	Dummy	1 = yes, 0 = no
processed	Dummy	1 = processed, 0 = otherwise
transportation	Dummy	1 = motor vehicles or air transportation, 0 = otherwise
market target	Dummy	1 = auction place, 0 = otherwise

Sources: The Survey of Capture Fishery Household (2014), modified by authors

(2014b), age is the age of main fishers in each household. Province is the region where fishers live. The dummy 1 is assigned to provinces with large production value while the dummy 0 is otherwise. Gender is the gender of the main fishers in each household. The types of gender are male and female. The dummy 1 is assigned to male while the dummy 0 is female. Education is the highest education of the main fishers. The types of education are no school, elementary school, junior high school, senior high school, diploma, bachelor's, master's, and doctoral degree. The dummy 1 is assigned to high school or higher while the dummy 0 is otherwise. Member of cooperative is a fisher who joins cooperatives at the national level while member of KUB is a fisher who joins cooperatives in the local region. The dummy 1 is assigned to a member (yes) while the dummy 0 is not a member (no).

The variables of storage, transportation, and market target are dummy variables. According to BPS-Statistics Indonesia (2014b), storage is the condition of fish catches sold, whether alive, fresh, or in processed form. The dummy 1 is assigned to processed while the dummy 0 is otherwise. Processed form involves the simple or traditional activity for fish, such as salting and storing in cold or frozen storage. Transportation is the main means of transportation

to carry the fish catches to the marketplace. The types of transportation are air transportation (airplane), motor vehicles (car, truck, or motorcycle), non-motor vehicles (bicycle), animal power, human power, and no transportation. The dummy 1 is assigned to motor vehicles or air transportation while the dummy 0 is otherwise. Market target is the main marketplace to sell the fish catches. The types of market target are auction sites, sellers, consumers, cooperatives, hotels, restaurants, fish processing industries, and exporters. The dummy 1 is assigned to auction sites while the dummy 0 is otherwise.

4. Result

4.1. Estimation Result

The types of capture fisheries in Indonesia are marine and inland open water fisheries. Marine fisheries are a fishing activity carried out in the sea by fishers with the aim of selling the fish they catch and obtaining a profit. Inland open water fisheries are a fishing activity carried out in public or inland open water (rivers, lakes, reservoirs, and swamps) by fishers with the objective of selling the fish they catch and gaining a surplus (BPS-Statistics Indonesia 2014b).

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Table 2. The Result of Multiple Linear Regression Analysis

log(surplus)	marine fisheries			inland open water fisheries		
	mean	coefficient	p-value	mean	coefficient	p-value
(1)	(2)	(3)	(4)	(5)	(6)	(7)
ship	17.77%	0.1348***	0.000	1.87%	0.0873	0.183
fishing gear	48.84%	0.1481***	0.000	47.73%	0.1879***	0.000
loan	5.01%	0.0908***	0.000	1.17%	0.0070	0.932
number of fishers	1.11	0.5057***	0.000	1.11	1.0630***	0.000
number of crew	1.99	0.0034***	0.000	0.84	0.1115***	0.000
salary	411.47	0.00002***	0.000	74.12	0.0004***	0.000
province	38.38%	0.1323***	0.000	34.53%	0.4317***	0.000
age	43.52	0.0314***	0.000	43.74	0.0610***	0.000
male	98.79%	6.9556***	0.000	95.37%	4.0432***	0.000
high school	9.08%	0.1600***	0.000	8.51%	0.4089***	0.000
member of coop	7.18%	0.0066	0.722	4.16%	-0.0304	0.508
member of KUB	14.94%	0.0124	0.349	4.75%	0.0733*	0.087
processed	37.92%	0.1233***	0.000	4.35%	0.1437***	0.001
transportation	13.88%	0.0425***	0.001	17.92%	0.1697***	0.000
market target	22.34%	0.0438***	0.000	86.43%	0.0539*	0.086
R2		0.9906			0.9794	
Prob > F		0.000			0.000	
Observation		37,848			18,558	

Source: Estimated by authors (2020)
Note: *p-value < 0.10; **p-value < 0.05; ***p-value < 0.01

Table 2 shows the results of multiple linear regression analysis. Observed from F-statistics or simultaneous tests, the p-values of both marine and inland open water fisheries are close to 0.0000. It is less than alpha 1%, indicating that all independent variables have significant impacts simultaneously. The values of R-squared for marine and inland open water fisheries are 0.9906 and 0.9794 respectively. It means that the fifteen variables simultaneously have significantly explained 99.06% (marine fisheries) and 97.94% (inland open water fisheries) of the variation for fishery household welfare.

Table 2 also presents the results of t-statistics or partial tests. The p-value for each independent variable is compared to α 0.10; 0.05; or 0.01 to check whether it has a partial significant effect or not. The general results indicate that most independent variables significantly affect fishery household welfare, except member of cooperative and member of KUB (for marine fisheries), and ship, loan, and cooperative member (for inland open water fisheries).

In this study, the surplus value is a proxy for fishery household welfare. The fifteen variables are analyzed to determine whether the impact of each independent variable is significant or not. In terms of evaluating public policy, the goal is to interpret that one variable (such as ship) has a causal effect on fishery household welfare (surplus value) and assume that other independent variables are ceteris paribus. The variables that have significant impacts on improving fishery household welfare in both marine fisheries and inland open water fisheries in Indonesia are fishing gear, number of fishers, number of crew, salary, province, age, gender, education level, processed storage, transportation, and market target.

4.2. Production Side Analysis

The production side consists of the variables of fixed and current capital, labor, and characteristics of fishers. The variables of fixed and current capital are ship, fishing gear, and loan. The activities of fishers are certainly related to the availability of a ship to support their effort in catching fish. Based on BPS-Statistics Indonesia (2013), there are only 8% of fishers in marine fisheries and 28% of fishers in inland open water fisheries who catch fish without ship. In marine fisheries, ship with a p-value close to 0.0000 is less than $\alpha = 0.01$ and the coefficient value is 0.1348. It means that ship has a positive

and significant impact on surplus. The surplus increases by 13.48% supposing fishers use a boat with an inboard motor. This is in line with Tewfik et al. (2008) who state that ship is the first phase in a successful maintain of livelihood of fishers to improve their welfare. Putra, Jamhari & Hardyastuti (2020) state that the better the type of the ship, the greater the income and the level of welfare of fishers. On the other hand, in inland open water fisheries, ship has no significant impact on surplus (p-value of 0.183). This is in accordance with Hasanuddin, Noor & Santosa (2013) who argue that ship has no significant impact in order to eradicate poverty and improve the welfare of fishers.

The activities of fishers are also certainly linked to the use of fishing gear to maximize fish catches. In both marine and inland open water fisheries, the p-values for fishing gear close to 0.0000 are less than $\alpha = 0.01$ and the coefficient values are 0.1481 and 0.1879, respectively. It means that fishing gear has a positive and significant impact on surplus. Supposing fishers use fishing gear with trawls or nets, the surplus increases by 14.81% for marine fisheries or 18.79% for inland open water fisheries. This is in accordance with Lein & Setiawina (2018) who discover that fishing gear has a positive and significant impact on fishery household welfare.

In marine fisheries, the p-value for loan close to 0.0000 is less than $\alpha = 0.01$ and the coefficient value is 0.0908. It means that loan has a positive and significant effect on surplus. The surplus increases by 9.08% supposing fishers utilize a bank or non-bank loan to conduct capture fisheries activity. This is in line with Asfaw et al. (2012) who state that bank or non-bank loan has a positive and significant effect on the consumption expenditure as a measure of household welfare. On the other hand, in inland open water fisheries, loan with the p-value of 0.932 has no significant impact on surplus. This is in accordance with Asmah (2011) and Asayehegn, Yirga & Rajan (2011) who find that credit has no significant impact on household welfare.

The variables of labor are number of fishers, number of crew, and salary. In both marine and inland

open water fisheries, the p-values for number of fishers close to 0.0000 are less than $\alpha = 0.01$. It means that the number of fishers has a positive and significant effect on surplus. This is in accordance with Asfaw et al. (2012) and Asayehegn, Yirga & Rajan (2011) who reveal that the number of labor force in the family of fishers has a positive and significant effect on household welfare.

The p-values for number of crew in both marine and inland open water fisheries close to 0.0000 are less than $\alpha = 0.01$. It means that number of crew has a positive and significant impact on surplus. This is in line with Asayehegn, Yirga & Rajan (2011) who state that higher labor availability means greater household welfare.

In both marine and inland open water fisheries, the p-values for salary close to 0.0000 are less than $\alpha = 0.01$. It means that salary has a positive and significant effect on surplus. This is in line with Lein & Setiawina (2018) who find that the wage of the workers (production cost) has a positive and significant effect on fishery household welfare.

The variables of the characteristics of fishers are province, age, gender, high school, member of co-operative, and member of KUB. In both marine and inland open water fisheries, the p-values for province close to 0.0000 are less than $\alpha = 0.01$ and the coefficient values are 0.1323 and 0.4317 respectively. It means that province has a positive and significant impact on surplus. Supposing fishers live in a province with large fisheries production value, the surplus increases by 13.23% for marine fisheries or 43.17% for inland open water fisheries. This is in line with Jensen (2007) who argues that province has a positive and significant effect on fishery household welfare.

The p-values for age in both marine and inland open water fisheries close to 0.000 are less than $\alpha = 0.00$ and the coefficient values are 0.0314 and 0.0610 respectively. It means that age has a positive and significant effect on surplus. The surplus increases by 3.14% for every additional age of fishers in marine fisheries or 6.10% for that in inland

open water fisheries. This is in accordance with Balasubramaniam, Remesan & Gopal (2005) who discover that the age of fishers has a significant effect on fish productivity that is a proxy they use for welfare. Asmah (2011) also finds that the older the head of the household, the higher the welfare.

In both marine and inland open water fisheries, the p-values for male fishers close to 0.000 are less than $\alpha = 0.01$. It means that gender, particularly male, has a positive and significant impact on surplus. This is in line with Asmah (2011) and Asayehegn, Yirga & Rajan (2011) who reveal that the level of household welfare is likely to be high supposing the business actor is male.

The p-values for high school in both marine and inland open water fisheries close to 0.000 are less than $\alpha = 0.01$ and the coefficient values are 0.1600 and 0.4089 respectively. It means that high school has a positive and significant impact on surplus. The surplus increases by 16% (marine fisheries) or 40.89% (inland open water fisheries) supposing fishers completed high school or higher education level. This is in line with Asfaw et al. (2012) who state that education level has a positive and significant effect on the consumption expenditure as a measure of household welfare. Asmah (2011) also states that the higher the education level, the greater the household welfare.

Observed from the variables of member of cooperative and KUB, only member of KUB in inland open water fisheries has a significant effect on surplus with a p-value of 0.087, less than $\alpha = 0.10$. It means that member of KUB has a positive and significant impact on surplus. Being a member of cooperative and KUB in marine fisheries has a positive but not significant impact on surplus while being a member of cooperative in inland open water fisheries has a negative but not significant effect on surplus. This is not in line with Asfaw et al. (2012) who argue that member of a farmer cooperative in terms of consumption expenditure as a proxy of household welfare has a positive and significant effect because of modern agricultural technologies. On the other hand, a similar result is obtained by Asmah

(2011) that the impact of agricultural cooperatives on household welfare in Ghana is insignificant because of traditional technologies and management. The different results from two previous studies indicate that technology adoption in cooperative has a potential role to improve household welfare.

4.3. Distribution Side Analysis

The variables of processed, transportation, and market target are categorized as the distribution side. The p-values for processed close to 0.0000 (marine fisheries) and 0.001 (inland open water fisheries) are less than $\alpha = 0.01$ and the coefficient values are 0.1233 and 0.1437 respectively. It means that processed has a positive and significant effect on surplus. Supposing fishers sell processed fish, the surplus increases by 12.33% for marine fisheries or 14.37% for inland open water fisheries. This is in line with Islam, Miah & Haque (2001) who present that processed fish generates more profit for increasing the welfare of fishers. Soedarwo & Saati (2018) also present that processed fish can increase consumer interest to purchase those products and it implies the welfare improvement of fishers.

The p-values for transportation that are 0.001 (marine fisheries) and close to 0.0000 (inland open water fisheries) are less than $\alpha = 0.01$ and the coefficient values are 0.0425 and 0.1697 respectively. It means that transportation has a positive and significant impact on surplus. The surplus increases by 4.25% for marine fisheries or 16.97% for inland open water fisheries, supposing fishers go to a marketplace using a motor vehicle or air transportation. This is in accordance with Asfaw et al. (2012) who denote that transportation has a positive and significant impact on the consumption expenditure as a proxy for household welfare. Asmah (2011) also denotes that households having easy access to transportation can enjoy greater welfare.

The p-values for market target close to 0.0000 (marine fisheries) and 0.086 (inland open water fisheries) are less than $\alpha = 0.10$ and the coefficient val-

ues are 0.0438 and 0.0539 respectively. It means that market target has a positive and significant effect on surplus. Supposing fishers sell fish at fish auctions, the surplus increases by 4.38% for marine fisheries or 5.39% for inland open water fisheries. This is in line with Asmah (2011) and Anggara & Rudin (2020) who states that the local community market (such as fish auction places) has a positive and significant effect on household welfare.

4.4. The Similarities and Differences of Fishers

Based on the empirical results, there are several variables that can describe fishers based on their characteristics in marine and inland open water fisheries. The descriptions are divided into similarities and differences of the characteristics of fishers. Observed from the similarities, most of the main fishers are the head of the household, leading a prominent role to fulfill the daily needs of the family with the main goals of improving their welfare. Most fishers are male as the main earner of income in the family, especially male with married status. They are 44 years old on average, indicating that there are only a few of the younger generation who want to be fishers to continue the work of their predecessors. Only a few fishers graduated from high school or higher. The higher the education level, the more rational the decision will be (Fan 2017). Due to this fact, most Indonesian fishers still use a traditional approach to catch fish.

In addition, both fishers use trawls or nets because the better the fishing gear, the more the fish they catch. Both fishers have better surplus when living in a province with large production value because the province has coastlines, lakes, rivers, and reservoirs. Both fishers use motor vehicles or air transportation to go to the marketplace. Several fishers use airplanes, especially fishers in the eastern region because the marketplace is located on a different island or mountain area.

Observed from the differences, fishers in marine fisheries prefer to use a boat with an inboard motor,

prepare more funds, and need more members of crew because they usually catch fish on long trips (days, weeks, months). Due to the long trips, many fishers tend to make processed fish before they sell it to the auction sites and they feel that becoming a member of cooperative or KUB has no benefits for their welfare. On the other hand, fishers in inland open water fisheries prefer to use a boat without an inboard motor, prepare less funds, and need less members of crew because they usually catch fish on short trips (one day). Due to the short trips, only a few fishers tend to make processed fish before they sell it to the auction place. Most fishers sell fish at the auction place because they can reach the location easily and follow the auction process properly. They feel that becoming a member of KUB has a significant impact on their welfare. They are more familiar with KUB located in their hometown or village, thus the local fishers can obtain more benefits, such as loans, training, and technical assistance.

In addition, number of crew in marine fisheries are 2 people (usually paid workers) while number of crew in inland open water fisheries are 1 person (usually an unpaid or a family worker). Due to this fact, fishers in marine fisheries need to prepare more funds for the salaries of the crew or workers. It takes almost six times more than the salaries of the workers that fishers in inland open water fisheries need to prepare.

4.5. Discussion on Policy Implication

The government of Indonesia under the current administration has stated that "Sea is the Future of Nation's Civilization". The marine and fisheries development must be carried out by all stakeholders and policy-makers to achieve a better condition by utilizing fisheries resources in an optimum, efficient, effective, and accountable manner. To optimize this development, it is necessary to develop a policy approach expected to be able to encourage better fisheries development. The essence of this approach is sustainability, namely harmony between the economy, social, and environmental aspects to ensure the suitable needs for present and future

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generations of fishers (Sutardjo 2014). Marine and fisheries development has the ultimate goal to improve fishery household welfare in a sustainable manner.

The welfare of fisheries actors, including fishers, is one of the important pillars with the aim of improving national competitiveness in the era of free trade and the application of the ASEAN Economic Community (MEA). However, the welfare of fishers and other business actors to be able to meet their daily needs with the income they obtain remains significantly limited (the Ministry of Marine Affairs and Fisheries 2017). Therefore, the government needs to formulate effective, efficient, and targeted fisheries policies in order to achieve better welfare for fishery households. The applied fisheries policy must target fishers directly. In addition, this policy must be carried out effectively and efficiently in accordance with the needs of fishers. Therefore, the benefits of this policy can be directly felt by fishers in improving their welfare. Other countries also implement fisheries policies for the similar goal, such as countries in the Pacific Islands (Pretes & Petersen 2004) and countries in Europe (Salomon & Holm-Müller 2013). Based on the empirical results, there are three recommendations of policy implications related to the improvement of fishery household welfare in Indonesia as summarized in Table 3.

The poor capture fishery households need a stimulus with a direct impact and advantage on improving their welfare. The provision of assistance to fishers is expected to optimize their fishing activities. Observed from the market side, the improvement of capture fisheries facilities (such as better storage systems) and optimization of the fish auction place is expected to help fishers in selling their catch easily. In addition, the role of cooperatives needs to be re-encouraged to allow fishers who want to be a member to feel more benefits from the existence of the cooperative.

The variables of loan, ship, and fishing gear play a prominent part in this recommendation of policy implications. The activities of fishers are certainly related to the three variables in an effort to maximize their fish catches. Referring to marine fisheries, all variables have positive and significant impacts on fishery household welfare. On the other hand, for inland open water fisheries, only fishing gear has a positive and significant effect on fishery household welfare. To catch fish, fishers in marine areas need more time allocation (long trips) than fishers in inland open water areas (Kramer, Simanjuntak & Liese 2002). Due to this reason, they tend to prepare better loan scheme, better ship, and better fishing gear.

Ashari (2009) argues that the limited capital remains a big problem encountered by the agricultural sector actors, including fishers. To resolve it, the government has launched several credit or fund assistance programs to support the current capital, such as asset strengthening, interest subsidies, and semi-commercial schemes. These credit schemes have been applied in both rural and urban areas in Indonesia (Wardhono, Modjo & Utami 2019).

The government needs to consistently provide soft loan in the form of KUR for fishers. Hopefully, the provision of soft loan in the form of KUR can improve fishery household welfare in Indonesia. The government of Indonesia can adopt the One Village One Product (OVOP) program initiated in Oita Prefecture, Japan (Widiyanti 2018). The KUR program is a priority program of the government in the form of policies for loans to work funds and loans to individuals, business entities, or business communities that are productive and feasible. The objectives are to expand financial access to productive businesses, increase the capacity of business competitiveness, encourage economy growth, and improve welfare. This credit scheme has succeeded in helping business activities of the small-scale households from other sectors in Indonesia, such as the food crop sector (Oktaviani, Sugema & Ratnawaty 2003) and tofu industry sector (Syaifudin, Handika & Setyobudi 2018).

Furthermore, the government also needs to offer other programs related to strengthening the fixed capital, such as the provision of ship and fishing gear. The activities of fishers are certainly linked

Table 3. Policy Recommendations

No.	Variable	Program
(1)	(2)	(3)
1	Loan; Ship; Fishing gear	a) Soft loan in the form of People's Business Credit (KUR) b) Provision of fishing gear c) Ship assistance
2	Processed; Market target	a) Better storage system b) Revitalization of fish auction place
3	Member of cooperative; Member of KUB	a) Re-active fisheries cooperatives b) Upgrading KUB level

Source: Estimated by authors (2020)

to the availability of a ship to assist their effort in catching fish. Based on BPS-Statistics Indonesia (2013), there are 92% of fishers in marine fisheries and 72% of fishers in inland open water fisheries who catch fish with a ship. The government should provide assistance in line with the needs and habits of fishers in marine fisheries (long trips) and fishers in inland open water fisheries (short trips).

The variables of processed and market target as the distribution side have an important point for this recommendation of policy implications. All variables have a positive and significant effect on fishery household welfare in both marine fisheries and inland open water fisheries. Small-scale fisheries are influenced by a highly diverse market orientation (Halim et al. 2019), thus market conditions have always been significantly competitive (Jensen 2007). An appropriate market policy can positively affect the livelihoods and welfare of fishers (Adhuri et al. 2016). Furthermore, other supporting factors are also needed in order to achieve successful implementation of a market policy, such as better infrastructure facilities and storage systems.

The Fish Auction Place (TPI) is one of main parts in capture fisheries that needs to be properly managed and organized, mainly for fish marketing activities (Lubis & Pane 2012). Firdaus et al. (2019) mention that there are three groups of market organizers in Fish Auction Place, namely profiteers (government, brokers, and agents), sellers, and buyers. Ariwibowo (2020) states that one of the main roles of Fish Auction Place is to arrange an auction of fish catches. The profiteers are responsible for organizing this fairly in order that it provides bene-

fits for not only sellers but also buyers. Observed from the perspective of sellers, fishers can sell their catches through pure auction with better prices. Observed from the perspective of buyers, communities can obtain fish with good quality and reasonable prices. For example, according to Jacobs (2005), there is Tsukiji Fish Market in Japan that is the largest Fish Auction Place in the world where various types of fish are collected from various fishers throughout Japan and other countries every day. Then, the wholesalers or auction houses estimate the value and prepare the ready items for auction, ranging from cheap products (such as seaweed) to the expensive one (such as caviar). The buyers who already have a license to participate in the auction also verify the fish to determine which fish they want to bid on and at what price.

The policy of maintaining the storage system in the market should also be a concern of the government. Most fishers prefer to use frozen or cold storage, not only in Indonesia (Balqis et al. 2019) but also in other countries, such as Bangladesh (Islam, Miah & Haque 2001) and Norway (Helstad et al. 2005). Nur et al. (2014) state that the development of the Ozone Technology Fish Storage System (OTFIS) can be utilized for fish storage. Their prototype creation is integrated with fish container and ozone generator. A good storage system can certainly maintain the quality of processed fish products more than fresh products expected by fishers to achieve their goal of a better price.

Several fishers in not only marine fisheries but also inland open water fisheries decide to join cooperatives (national scope) or KUB (smaller coopera-

tives in local scope) to obtain more benefits, but the empirical results indicate a different outcome. Only members of KUB in inland open water fisheries obtain a positive and significant impact on surplus. The government should act properly in order to increase the impacts of the cooperative and KUB on the fishery household welfare in Indonesia. In comparison, one type of agricultural cooperative, the Village Unit Cooperative (KUD), has made good contributions to the success of food self-sufficiency program in the food crops sector in Indonesia (Suradisastra 2006). In China, the agricultural cooperative also plays an important role for farmers in order to improve their welfare (Ito, Bao & Su 2012).

The cooperatives are significantly important to be more empowered as the economic strength of the fisheries sector. One of the government programs to achieve Indonesia as "The World Maritime Center" will be tremendous supposing it is supported by fisheries cooperatives. On the other hand, there are still many challenges, such as (1) how to improve the competence of human resources; (2) how to organize the cooperative management; and (3) how to provide more benefits to ensure that fishers cooperatives are economically powerful, especially in the rural areas (the Ministry of Cooperative and Small Medium Enterprises 2017).

According to data from the Ministry of Cooperative and Small Medium Enterprises as cited in the Ministry of Marine Affairs and Fisheries (2019b), there are 2,884 fisheries cooperatives or 2.09% of the total cooperatives in Indonesia: consisting of 2,802 units of Micro Business Scale, 69 units of Small Business Scale, and 13 units of Medium Business Scale. However, only 1,687 or 58.5% of fisheries cooperatives are still active. Due to this fact, the Ministry of Maritime Affairs and Fisheries and the Japan International Cooperation Agency (JICA) establish good cooperation, especially in training for human resources managing fisheries cooperatives in Indonesia. The cooperation is part of the Sustainable Management and Utilization of Fisheries Resource project (*Republika.co.id* 2019). Hiariey

& Romeon (2017) argue that the government also needs to pay more attention to upgrading the level of KUB into cooperative (higher level). To realize this goal, the aspects to consider are the condition of the community, institution, and policy.

5. Conclusion

The fisheries sector is closely associated with small-scale fisheries, especially in developing countries. The small-scale fisheries provide an important contribution to poverty alleviation and sustainable livelihoods of fishers. Indonesia as the largest archipelago country in the world has huge potential of fishery resources. Supposing this potential is managed properly, it can offer a great contribution to the growth of the fisheries sector. This research attempts to verify the linkage between the performance of fisheries sector and fishery household welfare in Indonesia. According to the empirical results, variables with significant impacts on improving fishery household welfare in Indonesia in both marine and inland open water fisheries are fishing gear, number of fishers, number of crew, salary, province, age, gender, education level, processed storage, transportation, and market target.

The characteristics of fishers are separated into the similarities and differences. Observed from the similarities, the main fishers lead a main part to fulfill the daily needs of the family with the ultimate goal of improving their welfare. Most fishers are male and aged 44 years old on average. Only 9% of fishers graduated from high school or higher level. They have a better surplus when they live in provinces with large production value and they use a motor vehicle or air transportation to go to the marketplace.

Observed from the differences, fishers in marine fisheries prefer to use a boat with an inboard motor, prepare more funds, and need more members of crew because they usually catch fish on long trips. Due to the long trips, many fishers prefer to make processed fish before they sell it to the auction place. They feel that becoming a member of

cooperative or KUB has no significant benefits for them. On the other hand, fishers in inland open water fisheries prefer to use a boat without an inboard motor, prepare less funds, and need less members of crew because they usually catch fish on short trips. Due to the short trips, only a few fishers prefer to make processed fish before they sell it to the auction place. They feel that becoming a member of KUB has significant benefits for them.

The welfare of fishers and other business actors to fulfill daily needs with their income is still highly limited. Therefore, the government should formulate effective, efficient, and targeted fisheries policies in order to realize a better welfare for fishery households. Based on the empirical results, there are several recommendations of policy implications related to the improvement of fishery household welfare in Indonesia, such as soft loan in the form of KUR, storage facilities for better supply chain, and revitalization of fish auction sites.

This research used the micro data of capture fisheries from the last survey conducted in 2014, thus it is only one period of data or cross-sectional data. The analysis in this study only focuses on micro variables (household data) rather than combining them with macro variables, such as GDP, export, and investment. Further studies can add time series data to analyze the trend of fishery household welfare over years as well as append aquaculture fisheries and macro variables to enrich the empirical analysis and results.

Acknowledgement

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