KOCHI UNIVERSITY OF TECHNOLOGY

Social Design Engineering Series *SDES-2018-5*

Individual time preferences of married couples in a fisheries society

Yayan Hernuryadin
Ministry of Marine Affairs and Fisheries, Republic of Indonesia

Koji Kotani
Research Institute for Future Design, Kochi University of Technologyy
School of Economics and Management, Kochi University of Technology

Tatsuyoshi Saijo
Research Institute for Humanity and Nature
School of Economics and Management, Kochi University of Technology
Research Institute for Future Design, Kochi University of Technology
Urban Institute, Kyusyu University

28th August, 2018

School of Economics and Management
Research Institute for Future Design
Kochi University of Technology

Individual time preferences of married couples in a fisheries society

Yayan Hernuryadin[*,†] Koji Kotani[*,‡,§,¶,‖] Tatsuyoshi Saijo[**,‡,*,§]

August 28, 2018

Abstract

Overexploitation of marine resources in Indonesia is threatening their sustainability and is considered to be induced by shortsightedness of fishermen and/or of their wives at household level. Given this states of affairs, we address individual time preferences of married couples (fishermen and their wives) in fisheries. To this end, we conduct an individual discounting elicitation experiment with 200 married couples (200 fishermen and 200 fishermen's wives) in an Indonesian fisheries society, Karawang regency. We find that fishermen's discount factors are slightly higher than their wives' ones on an average with positive correlation between the two, and their incomes have idiosyncratic influences on individual time preferences of a couple. Fishermen's incomes weakly influence only wives' time preferences, while wives' incomes significantly and positively affect not only fishermen's but also wives' time preferences to be farsighted. The betafit regression demonstrates that a wife's (fisherman's) discount factor increases by 5.1 % (5.6 %) when a wife's income increases by 1 million Rp. This result suggests that economic empowerment of fishermen's wives is key for sustainability of marine resources and societies in Indonesia.

Key words: Time preferences; Income; Fishermen; Fishermen's wives; Fisheries society

[*]School of Economics and Management, Kochi University of Technology
[†]Ministry of Marine Affairs and Fisheries, Republic of Indonesia
[‡]Research Institute for Future Design, Kochi University of Technology
[§]Urban Institute, Kyusyu University
[¶]College of Business, Rikkyo University
[‖]Corresponding author, E-mail: kojikotani757@gmail.com
[**]Research Institute for Humanity and Nature

Contents

Nomenclature

BPS Badan Pusat Statistik

DKI Daerah Khusus Ibukota

FAO Food and Agriculture Organization of the United Nations

MMAF Ministry of Marine Affairs and Fisheries Republic of Indonesia

Rp Indonesia rupiahs

SD Standard deviation

1 Introduction

Overexploitation of marine resources in Indonesia and the rest of the world is threatening their sustainability. FAO Fisheries and Aquaculture Departement (2018) reports that 33.1 % of fish stock is caught at biologically unsustainable levels, and some important fish resources have declined due

to their overexploitation. Akpalu (2008) and Fehr and Leibbrandt (2011) show that fishermen's time preferences are important for fish stock sustainability because shortsighted fishermen take more fish by using non-selective gears, more advanced technologies and/or illegal methods without considering sustainability. While fishing practices of fishermen are demonstrated to be linked with their own time preferences, it can also be considered that fishermen's time preferences are influenced by their wives & other factors, or vice versa, through their interactions and daily life at household level. In other words, one of the main reasons for overexploitation of marine resources is directly linked to shortsightedness of fishermen and their wives together with their relationship. Therefore, this paper addresses individual time preferences of married couples (fishermen and their wives) in fisheries, contributing to policy designs for conservation and sustainability of marine resources.

Past studies show that household economic decisions and situations regarding risks, savings and education are highly correlated with household members' time preferences (Tanaka et al., 2010, Carlsson et al., 2012, Eckel et al., 2013, Yang and Carlsson, 2016). Tanaka et al. (2010) examine household time preferences in Vietnam, showing that people who have more income tend to be farsighted. Eckel et al. (2013) find that time preferences among poor households in Canada are associated with educational investments, reporting that farsighted people tend to invest more for household members' education. Carlsson et al. (2012) and Yang and Carlsson (2016) investigate time preferences of married couples associated with household joint decisions in China. They report that individual time preferences of husbands and wives do matter, but wives are less influential than husbands in determining joint decisions.

Several works focus on examining fishermen's time preferences. Akpalu (2008) and Fehr and Leibbrandt (2011) analyze the correlation between fishermen's time preferences and fishing practices, and they find that shortsighted fishermen are likely to infringe fishing regulations by using non-selective gears and/or other illegal methods. On the contrary, Javaid et al. (2016) find that shortsighted fishermen tend not to invest on fishing capabilities such as vessels, gears and technologies in Zanzibar so that such shortsighted fishermen are not successful in harvesting fish ef-

ficiently. Johnson and Saunders (2014) estimate and compare time preferences of fishermen and divers, finding that fishermen are more shortsighted than divers since divers are accustomed to be farsighted for preservation of a healthy ocean in sustaining their job. Nguyen (2011) compares time preferences of fishermen and other occupations such as farmers, traders, businessmen and government officers in Vietnam and shows that fishermen that participated in conservation programs for fish stock are more farsighted than people with other occupations. Teh et al. (2014) examine fishermen's time preferences in relation to types of fishery management system in Fiji and Malaysia, and demonstrate that fishermen in customary marine tenure management are more shortsighted than those in open access management. In summary, these previous findings suggest that working environments and experiences characterize fishermen's time preferences and fishing practices.

None of the previous studies have addressed time preferences of fishermen and their wives in fisheries, despite an importance of its impact and the relation for sustainability of marine resources. Given this state of affairs, we empirically and experimentally characterize individual time preferences of married couples (fishermen and their wives) and seek to identify what factors shall induce them to be farsighted for ensuring sustainability of marine resources. To this end, we conduct an individual discounting elicitation experiment with 200 married couples (200 fishermen and 200 fishermen's wives) in an Indonesian fisheries society, Karawang regency (see figure 1). We find that fishermen's discount factors are slightly higher than their wives' ones on an average with positive correlation between the two, and their incomes have idiosyncratic influences on individual time preferences of a couple. While fishermen's incomes weakly influence only wives' time preferences, wives' incomes significantly and positively affect not only fishermen's and but also wives' time preferences to be farsighted. The betafit regression demonstrates that a wife's (fisherman's) discount factor increases by 5.1 % (5.6 %) when a wife's income increases by 1 million Rp. This result suggests that economic empowerment of fishermen's wives is important for sustainability of marine resources and societies in Indonesia.

2 Overview of fisheries in Indonesia

Indonesia is the world's largest archipelagic and the second longest of a coastline country with 17 504 islands and 99 093 km of coastline. The total area of Indonesia water is 6 315 222 km^2 and the potency of fish resource is 12.5 million ton per year (Ministry of Marine Affairs and Fisheries, 2015a). This big potency places Indonesia on the second largest seafood producer in the world. However, it is reported that such a big potency does not necessarily lead Indonesian fishermen to be more prosperous. The number of Indonesia fishermen in 2015 is 2 275 139 with an average income 1 032 080 Rp per month which is below the regional minimum income (1 997 819 Rp). About 25 % of total poor people in Indonesia are from fisheries societies (BPS-Statistics Indonesia, 2017). Our study field is Karawang regency in the north part of Jawa Barat Province, Indonesia (see figure 1). This regency is located between 107°2′ and 107°40′ east longitude, and 5°56′ and 6°34′ south latitude. The population in 2016 was 2.3 million people with the density of 1309 people per km^2 (BPS-Statistics of Karawang Regency, 2017), and 168 901 people are working in agriculture and fishery sectors (Karawang Regency Government, 2015). Fishermen in Karawang are categorized to be in small scale fisheries since they operate fishing vessels less than 10 gross tonnage and catch fish on a daily basis (Goverment of Indonesia, 2016).

Most fishermen are habituated to use up their daily salary because they believe that they will earn money by fishing the next day, and do not have a strong motivation to save their income for future (Muflikhati et al., 2010, Yasin, 2013, National Development Planning Agency Republic of Indonesia, 014b). It is also reported that fishermen tend to buy luxury goods in a harvest high season, while they sell the luxury goods for survival when they face or continue to have a bad season (Nugroho, 2004). In the worst case scenario, such fishermen get a loan shark when they have nothing in their home. Such harvest seasonality and fishermen's shortsightedness in fisheries induces themselves to be poorer and to harvest more marine resources without considering sustainability, representing a typical life cycle or pattern in Indonesian fisheries.

[Figure 1 about here.]

It is established that a role of fishermen's wives is crucial since they take care of their children and support their husbands in fisheries (Zhao et al., 2012, Harper et al., 2013, Febri et al., 2017). In most cases, they are also in charge of managing household financial matters, and they are more knowledgeable and sensitive to household financial situations than their husbands. Depending on financial situations, fishermen's wives are motivated to contribute to households by generating additional incomes (Febri et al., 2017). Table 1 summarizes the information regarding occupation types of fishermen's wives in our study field, Karawang. Out of 200 wives, 142 are housewives (not working), whereas the rest of 58 wives are working as traders, fish processors, entrepreneurs, net makers, trap fishers and other occupations. In general, fishermen's wives in Karawang usually face difficult economic situations to control and allocate money for daily needs, children's education and household appliances under tight budget limitations.

[Table 1 about here.]

3 Experimental design and procedure

3.1 A discounting elicitation experiment

We employ an experimental procedure to elicit individual time preferences, called a discounting elicitation experiment. This procedure is different from a multiple-price list procedure as done by Coller and Williams (1999), Harrison et al. (2002) and Tanaka et al. (2010). The multiple-price list procedure normally asks participants to have a bank account or to have an additional meeting at a different date and time to receive experimental rewards. In an Indonesian fisheries society, it is difficult to apply the multiple-price list procedure due to the working schedule and daily lifestyle fishermen follow (For instance, only 30 % of fishermen households have bank accounts). Subjects claim that they could neither understand nor follow the multiple-price list procedure in the trial experiment, since the experimental procedures did not match their life schedule, and fishermen's

and wives' educations are limited.[1] Therefore, we design and institute a discounting elicitation experiment to estimate individual time preferences.

An individual interview was conducted in the discounting elicitation experiment. We explained that subjects would receive 20000 Rp (≈ 1.50 USD) on an average in the beginning of the experiment and instructed subjects that it is the best strategy to seriously and honestly answer a series of questions and tasks based on their daily money senses and life. Subjects are asked to prefer or to make a choice between options A and B:

Option A: You receive 20000 Rp today.

Option B: You receive $20000 + z$ Rp in one month.

Here, the initial value of z, denoted by z_0, starts with 4000. When a subject prefers option A to option B with $z = z_0 = 4000$, we proceed to the next question where the value of z in option B is increased by 4000, i.e., $z_1 = z_0 + 1 \cdot 4000 = 4000 + 4000 = 8000$, and the subject is again asked to answer the question with the updated value of $z_1 = 8000$. This process of asking the subject a series of questions by updating the value of $z = z_k = z_0 + k \cdot 4000$ continues for arbitrary k times, as far as she keeps choosing option A up to the kth questions. We shall stop the process when the subject chooses option B for the first time at the $k+1$th question where the value of x in option B is updated with $z_{k+1} = z_0 + (k+1) \cdot 4000$. In this case, we can consider that her preference over options A and B is reversed between kth and $k+1$th questions, and there should exist a threshold future value of $\overline{z}$ between z_k and z_{k+1} that makes the subject to be indifferent between receiving $20\,000$ Rp today and $20000 + \overline{z}$ Rp one month later. Therefore, as a final process, we interview the subject and ask her some final questions by gradually adjusting the value of z between z_k and z_{k+1} up until each interviewer identifies the threshold value of $\overline{z}$.

The subject will receive her experimental reward from the discounting elicitation experiment in the following way. We set up a lottery where it has a probability $\rho = \frac{20000}{20000+\overline{z}}$ of successfully

[1] In reality, most subjects do not believe that they will actually get paid later periods as the experimental instructions of the multiple-price list procedures indicate, because they often experience that the payments that must be made on a specific date and time in the future period as a binding agreement are not fulfilled as planned in their daily life. This is another reason that we could not implement the multiple-price list procedure.

getting the value of $20000 + \overline{z}$ Rp by picking a yellow card in the bag and a probability $1 - \rho$ of receiving no reward by picking a red card with the expected payoff of 20 000 Rp. For this, we prepare 20 yellow cards and $\frac{\overline{z}}{1000}$ red cards in the lottery depending on the individual threshold value of $\overline{z}$. Because most subjects are not familiar with the concept of probabilities, we show and calculate the number of yellow and red cards in front of each subject before putting those cards into a bag, and explain the lottery's rule to her. Then, we proceed by asking each subject whether she prefers receiving 20 000 Rp for sure or to possibly get $20000 + \overline{z}$ Rp by choosing a lottery. A subject who does not pick the lottery receives 20 000 Rp, while a subject who picks the lottery will receive the reward based on the outcome of the lottery. At the same time, we also observe whether the subject is a risk taker or not.

3.2 Experimental procedure

To conduct a field experiment in an Indonesian fisheries society, we first visited the fishing village offices to get consent. Among the 13 fishing villages in Karawang, 3 fishing villages offices gave us an approval and provided a list of fishermen households. We randomly picked a required number of households based on the population of each village. We invited a married couple from each household to take part in our experiment by delivering letters. In total, 200 married couples (200 fishermen and 200 fishermen's wives) participated in our field experiment.[2] The field experiments were held at the fishing village halls in each place. We first conducted a discounting elicitation experiment and second a field survey to get sociodemographic information in a session. After completing the experiment, we asked each subject to leave the experimental hall soon for avoiding interactions among subjects.

A printed instruction of the discounting elicitation experiment was provided to subjects in the Indonesian language (Bahasa). The instruction was explained by a verbal presentation of the first author in this research, and we also confirmed each subject's understanding by giving a series of

[2]Due to our budget limitation, we employed only 200 couples. Some couples showed up in the experimental site, but could not participate in the experiment due to our budget issue. In such a case, we gave them a show-up fee and asked them to go home.

quizzes about our experimental rules and procedures after the presentation. To encourage subjects to attend and seriously participate in the experiment, we announced that subjects would earn 35 000 Rp ($\approx$ 3 USD) as an experimental reward including show-up fees of 15 000 Rp on an average, the reward would vary depending on their decisions and the best way to earn the experimental reward would be to seriously and honestly answer or decide on a series of tasks and questions posed in our experiment on the basis of their daily money senses and practices. Each session consists of $7 \sim 10$ married couples as participants and took $2 \sim 3$ hours.

4 Empirical methods

Betafit regression established by Ferrari and Cribari-Neto (2004) is applied to characterize the determinants of fishermen's and their wives' discount factors, since our dependent variables of individual discount factors are bounded between 0 and 1 and the regression can take account of various non-normal distributions. The specifications are as follows:

$$m_{ik} = \beta_{0k} + \boldsymbol{\beta}_{1k}\mathbf{x}_i + \epsilon_{ik}, \tag{1}$$

where subscript i represents an ID of each subject and subscript k ($= \{f, w\}$) is an index to represent fishermen's discount factors by $k = f$ or wives' discount factors by $k = w$. The m_{ik}s represent fishermen's and their wives' discount factors elicited from the experiment denoted by m_{if} and m_{iw}, respectively. A dependent variable of individual discount factors, $m_{ik}, k = \{f, w\}$, is assumed to follow a beta distribution:

$$f(m_{ik}; \mu_k, \phi_k) = \frac{\Gamma(\phi_k)}{\Gamma(\mu_k\phi_k)\Gamma((1-\mu_k)\phi_k)} m_{ik}^{\mu_k\phi_k - 1}(1 - m_{ik})^{(1-\mu_k)\phi_k - 1}, \quad m_{ik} \in (0, 1),$$

where $\mathbb{E}(m_{ik}) = \mu_k$, $\mathrm{Var}(m_{ik}) = \frac{\mu_k(1-\mu_k)}{1+\phi_k}$, ϕ_k represents a precision parameter and $\phi_k - 1$ represents a dispersion parameter. A various combinations of μ_k and ϕ_k can accommodate nonnormal J shaped, inverted J shaped and U shaped distributions for fishermen's and their wives' discount

factors.

The $\mathbf{x}_i$ is a set of independent variables of fishermen's and their wives' sociodemographic information such as age, education, income and a number of household members (Table 2 summaries the definitions of all the variables applied in the statistical analysis), while we do not include a wife's (fisherman's) discount factor as an independent variable in the regression to characterize a fisherman's (wife's) discount factor due to an issue of simultaneity in endogenous problems as noted in Wooldridge (2010). The betafit regressions are considered to be appropriate with our data set, because the distributions of our individual discount factors are observed to be inverted J shaped (see figure 2). The maximum likelihood method is applied to identify the unknown parameters β_{0k} and $\boldsymbol{\beta}_{1k}$ in betafit regressions for $k = \{f, w\}$, generating the marginal effect of an independent variable on the individual discount factors of fishermen or of their wives, m_{ik}.

[Table 2 about here.]

The independent variables in table 2 are hypothesized to influence fishermen's and/or their wives' discount factors, following Harrison et al. (2002), Reimers et al. (2009), Tanaka et al. (2010) and Nguyen (2011). In this experiment, a fisherman's (a wife's) discount factor is represented as a percentage rate of discounting the future monetary value that will surely be received one month later in such a way that the discounted future value equals the value of receiving 20 000 Rp today, as explained in section 3.1. We are interested in how fishermen's and/or their wives' discount factors are characterized by sociodemographic variables of fishermen, their wives and households within a single analytical framework. Therefore, we keep the same set of independent variables for both regressions of fishermen's and their wives' discount factors. Doing so enables us to quantify how a change in one factor within a household or a married couple affects fishermen's and their wives' time preferences.

5 Results

Table 3 provides summary statistics of the sampled couples in a fisheries society, Karawang, Indonesia. Fishermen's and their wives' average monthly incomes are 2.495 million Rp and 0.367 million Rp, respectively. This indicates that fishermen earn much more money than their wives, being consistent with the fact that fishermen's income is usually a main source of their household incomes. We see in table 3 that fishermen's and their wives' median monthly incomes are 1.900 million Rp and 0.000 million Rp, respectively, implying that more than half of wives do not earn money. The average (median) discount factors of fishermen and their wives are 0.302 (0.100) and 0.252 (0.100), respectively. These results demonstrate that married couples in the fisheries society are generally shortsighted, and fishermen's discount factors are slightly higher than their wives' ones on an average. The average (median) ages of fishermen and their wives are 41 (40) and 38 (37) years, respectively. Table 3 also presents that fishermen have only primary education on an average, because most fishermen usually think that a high level of education is not necessary in an Indonesian fisheries society (In our sample, fishermen's and their wives' education levels happen to be identical).[3] The average and median number of household members are 4.5 and 4 people, respectively, confirming that household members typically consist of a fisherman, his wife and children.

[Table 3 about here.]

[Figure 2 about here.]

Figure 2 shows frequency distributions of fishermen's and their wives' discount factors elicited in our discounting elicitation experiment. The vertical axis denotes the frequency percentage and the horizontal axis denotes the discount factors. Figure 2 reveals that the distributions of fishermen's and their wives' discount factors do not follow normality and are not significantly different from each other. Both distributions of fishermen's and their wives' discount factors have the same

[3] We do not include wives' education in the summary statistics, because it is identical to fisherman's education.

degree of skewness with two modes at the boundaries of 0 and 1. The highest spike in both distributions is found around 0, while the spike in the fishermen's distribution is slightly lower than that in their wives' one. It implies that fishermen's discount factors are comparatively higher than their wives' ones, consistent with the means and medians presented in table 3. Overall, the distributions of fishermen's and their wives's discount factors almost share the same features, such as the shape, location of the highest spikes and skewness, while fishermen's discount factors are slightly higher than their wives' ones.

On the basis of the summary statistics in table 3 and figure 2, we statistically examine whether the distributions of fishermen's and their wives' discount factors are the same by runing a non-parametric Mann-Whitney test (Conover, 1999). The null hypothesis is that the distributions are independent of (or identical between) fishermen and their wives. The test does not reject the null hypothesis, implying that the distributions of fishermen's and their wives' discount factors do not differ from one another. Figure 3 shows a scatter plot between fishermen's and their wives' discount factors, demonstrating that there is no clear linear relationship between fishermen's and their wives' discount factors. This is due to the fact that most observations of discount factors concentrate around the origin or corners of 1.00 in either axis. However, we confirm that there is a positive correlation around 0.2 between fishermen's and their wives' discount factors by implementing several different correlation analyses that accommodate the concentrations of observations at the corners and/or boundaries.

[Figure 3 about here.]

To characterize individual time preferences of fishermen and their wives in relation to sociodemographic factors, we run the betafit regressions. Models 1 and 2 of table 4 present the marginal effects of the independent variables on fishermen's and their wives' discount factors, respectively. Model 1 demonstrates that wives' incomes and a number of household members are significant in characterizing fishermen's discount factors. Model 2 in table 4 shows that fishermen's and wives' incomes are significant predictors of wives' time preferences. The estimated coefficients on wives' incomes could be interpreted as follows: an increase in wives' incomes by 1 million Rp positively

affects fishermen and their wives' discount factors by 5.6 % and 5.1 % as demonstrated in models 1 and 2, respectively. On the other hand, fishermen's incomes weakly influence only wives' time preferences. That is, an increase in fishermen's incomes by 1 million Rp is associated with a 0.9 % rise in wives' discount factors as illustrated in model 1, which is considered to be practically insignificant. As a robustness check, several other regression specifications have been tested, and we confirm that our main results in models 1 and 2 in table 4 remain consistent and robust with respect to the role of incomes in characterizing individual time preferences of fishermen and their wives. These results corroborate that incomes are important factors to determine individual time preferences, which is consistent with previous studies, such as Harrison et al. (2002), Reimers et al. (2009) and Tanaka et al. (2010). That is, having higher incomes generally leads couples to be more farsighted. However, our original finding is that their incomes possess idiosyncratic influences on fishermen's and their wives' time preferences.

[Table 4 about here.]

The most important finding in our statistical analyses is that wives' incomes have stronger influences on couples' time preferences to be farsighted than fishermen's (or husbands') ones. In Indonesia, a majority of fishermen are known or reported to use up their daily income or splurge on drinking, gambling and prostitution, sometimes bringing little money to their home (Muflikhati et al., 2010, Yasin, 2013, National Development Planning Agency Republic of Indonesia, 014b).[4] In other words, fishermen's incomes shall not contribute to household incomes or wealth in a practical manner in the sense that what their wives can receive at home is only the partial of what fishermen earn on a daily basis. As mentioned earlier, fishermen's wives are in charge of managing household financial matters. However, it is common that they do not have enough money to control and to allocate for households' daily needs as well as for the betterment of their future due to the aforementioned reasons. In this type of situations, fishermen and their wives usually share the same opinion and recognition about their household financial problems in a large picture. However,

[4]We tried to elicit how much of daily income fishermen bring to home in the pilot questionnaire. However, most fishermen rejected answering the questions. Thus, we quit asking this type of questions because it is too private and sensitive.

wives, as a manager of household financial matters, appear to be more knowledgeable and sensitive to how much money their households need on the basis of our survey, reflecting that fishermen's discount factors are slightly higher than their wives' discount factors.

When wives earn additional incomes, the wives' incomes practically contribute to households under their 100 % control. As an evidence from our survey, we identify that wives who generate additional incomes have more gold of 3.41 gram as part of their saving than do wives who do not generate incomes. When wives work and generate additional incomes, fishermen (husbands) also know that their wives' incomes practically contribute to their households, the part of which is saved as gold.[5] Therefore, fishermen shall be secured and induced to be farsighted by their wives' incomes, while they know how their daily incomes by fishing have been spent without being saved. While wives' incomes are usually considered supplementary in fisheries, it might be surprising that an increase in wives' incomes shall more practically and strongly contribute to fishermen couples' time preferences. This is qualitatively consistent with other findings of previous works, such as Thomas (1990), Browning et al. (1994), Lundberg et al. (1997), Phipps and Burton (1998), Duflo (2003), Namoro and Roushdy (2009), Carlsson et al. (2012) and Yang and Carlsson (2016), reporting that people that handle and manage incomes and/or revenues in an organization or a household can influence other members' behaviors and preferences.

Fishermen in many countries have the same tendency as Indonesian fishermen to spend a considerable portion of their income or splurge on drinking, gambling and prostitution as reported in Entz et al. (2000), Samsuddin et al. (2011) and Duy (2015). Therefore, the result established in this research may apply to other countries' fisheries as a possible guidance for policies toward sustainability of marine resources. Nowadays, many researches in various different fields of social science suggest that women's empowerment is important as a process in which women elaborate and recreate what they can be, do and accomplish in a given circumstance (see, e.g., Duflo, 2012, Ashraf et al., 2010). In this context, our research can be considered an important evidence of how "economic empowerment for wives in fisheries" has a practical significance on couples' time pref-

[5] In an Indonesian fishery society, as mentioned earlier, 70 % of fishermen households do not have bank accounts. Therefore, gold is usually saved in the various forms of ornaments such as rings, bracelets and so on.

erences. For example, Indonesia government provides and promotes vocational training programs and policies for women's economic empowerment in fisheries villages, such as food processing, financial skills and so on (Soero et al., 2014, Ministry of Marine Affairs and Fisheries, 2015b, National Development Planning Agency Republic of Indonesia, 014a). Based on our results in this research, such training programs and policies should be continued and further promoted to enhance wives' skills and abilities for income generating activities. More importantly, this shall be one of the most practical steps toward sustainability of local fisheries as well as their societies.

6 Conclusion

We have conducted an individual discounting elicitation experiment with 200 fishermen and 200 fishermen's wives in an Indonesian fisheries society. We find that fishermen's discount factors are slightly higher than their wives' ones on an average, and their incomes have idiosyncratic influences on individual time preferences of couples. While fishermen's incomes weakly influence only wives' time preferences, wives' incomes have strong influences on fishermen's and wives' time preferences. The betafit regression reveals that a wife's (fisherman's) discount factor increases by 5.1 % (5.6 %) when a wife's income rises by 1 million Rp. This result can be considered an important evidence of how "economic empowerment for wives in the fisheries" has a practical significance on couples' time preferences in fisheries of emerging and developing countries. For example, Indonesia government provides and promotes vocational training programs and policies for women's empowerment in fisheries villages for food processing, financial skills and so on. Based on our results in this research, such training programs and policies targeting fishermen's wives should be further promoted to enhance wives' skills and abilities for generating more of their income. These policies will induce both fishermen and their wives to be farsighted, practically contributing to sustainability of local fisheries as well as their societies.

Finally, we note some limitations of our research and directions for future research. This research was conducted in small-scale fisheries of Indonesia. To generalize the findings, we should

conduct further experiments in other countries and/or in a different type of fisheries, such as large-scale or industrialized fisheries in developing countries that suffer from overexploitation of marine resources and related problems. At the same time, we expect that the qualitatively same results established in this research shall be obtained as far as the basic natures and behaviors of fishermen do not differ from those in Indonesia. Although we admit that there may be some other limitations of this research and future avenues of further research with respect to time preferences of fishermen and their household members, it is our strong belief that our result shall remain important. This is because small-scale fisheries still occupy approximately 50 % of global fish production in developing countries and will remain so over the next 20 to 30 years (Franz and Stamoulis, 2015).

7 Bibliography

Akpalu, W. (2008). Fishing regulations, individual discount rate, and fishermen bahaviour in a developing country fishery. *Environment and development economics*, 13:591–606.

Ashraf, N., Karlan, D., and Yin, W. (2010). Female empowerment: Impact of a commitment savings product in the Philippines. *World development*, 38:333–344.

BPS-Statistics Indonesia (2017). Statistics of marine and coastal resources 2017. Technical report, BPS-Statistics Indonesia.

BPS-Statistics of Karawang Regency (2017). Karawang regency in figures 2017. Technical report, BPS-Statistics of Karawang Regency.

Browning, M., Bourguignon, F., Chiappori, P. A., and Lechene, V. (1994). Income and outcomes: A structural model of intrahousehold allocation. *Journal of political economy*, 102:1067–1096.

Carlsson, F., He, H., Martinsson, P., Qin, P., and Sutter, M. (2012). Household decision making in rural China: Using experiments to estimate the influences of spouses. *Journal of economic behavior and organization*, 84:525–536.

Coller, M. and Williams, M. B. (1999). Elicting individual discount rates. *Experimental economics*, 2:107–127.

Conover, W. (1999). *Practical nonparametric statistics*. New York: John Wiley & Sons.

Duflo, E. (2003). Grandmothers and granddaughters: Old-age pensions and intrahousehold allocation in South Africa. *World bank economic review*, 17:1–25.

Duflo, E. (2012). Empowering women with micro finance: Evidence from Bangladesh. *Journal of economic literature*, 50:1051–1079.

Duy, P. T. (2015). *Socio-cultural issues and development in a fishing community of southern Vietnam: a case study of Song Doc community in Tran Van Thoi district, Camau*. Ph.d. thesis, Tokyo University of Marine Science and Technology.

Eckel, C., Johnson, C., and Montmarquette, C. (2013). Human capital investment by the poor: Informing policy with laboratory experiments. *Journal of economic behavior and organization*, 95:224–239.

Entz, A. T., Ruffolo, V. P., Chinveschakitvanich, V., Soskolne, V., and van Griensven, G. (2000). HIV-1 prevalence, HIV-1 subtypes and risk factors among fishermen in the gulf of Thailand and the Andaman sea. *AIDS*, 14:1027–1034.

FAO Fisheries and Aquaculture Departement (2018). The state of world fisheries and aquaculture 2018. Technical report, Food Agriculture Organization of the United Nation.

Febri, S. P., Wiyono, E. S., Wisudo, S. H., Haluan, J., and Iskandar, B. H. (2017). The role of women in small-scale fisheries of Langsa city, Aceh, Indonesia. *Aquaculture, aquarium, conservation and legislation*, 10:402–409.

Fehr, E. and Leibbrandt, A. (2011). A field study on cooperativeness and impatience in the tragedy of the commons. *Journal of public economics*, 95:1144–1155.

Ferrari, S. L. P. and Cribari-Neto, F. (2004). Beta regression for modelling rates and proportions. *Journal of applied statistics*, 31:799–815.

Franz, N. and Stamoulis, K. (2015). Small-scale fisheries. FAO.

Goverment of Indonesia (2016). Law no. 7/2016 concerning protection and empowerment of fishermen, fish farmers and salt farmers, Jakarta 2016.

Harper, S., Zeller, D., Hauzer, M., Pauly, D., and Sumaila, U. R. (2013). Women and fisheries: Contribution to food security and local economies. *Marine policy*, 39:56–63.

Harrison, G. W., Lau, M. I., and Williams, M. B. (2002). Estimating individual discount rates in Denmark: A field experiment. *American economic review*, 92:1606–1617.

Javaid, A., Kulesz, M. M., Schluter, A., Ghosh, A., and Jiddawi, N. S. (2016). Time preference and natural resource extraction behavior: An experimental study from artisanal fisheries in Zanzibar. *PLoS ONE*, 11:e0168898.

Johnson, A. E. and Saunders, D. K. (2014). Time preperences and the management of coral reef fisheries. *Ecological economics*, 100:130–139.

Karawang Regency Government (2015). Information on report performance of Karawang District Government 2015 (in Indonesia). Technical report, Karawang Regency Government.

Lundberg, S. J., Pollak, R. A., and Wales, T. J. (1997). Do husbands and wives pool their resources? Evidence from the United Kingdom child benefit. *Journal of human resources*, 32:463–480.

Ministry of Marine Affairs and Fisheries (2015a). Marine and fisheries in figures 2015. Technical report, Ministry of Marine Affairs and Fisheries.

Ministry of Marine Affairs and Fisheries (2015b). Ministerial regulation no. 25/2015 concerning the strategic plan of ministry of marine affairs republic of Indonesia, Jakarta 2015.

Muflikhati, I., Hartoyo, Sumarwan, U., Fahrudin, A., and Puspitawati, H. (2010). Socio-economic factors and family welfare: The case of coastal area in west Java (in Indonesia). *Jurnal Ilmu Keluarga dan Konsumen*, 3:1–10.

Namoro, S. and Roushdy, R. (2009). Intrahousehold resource allocation in Egypt: Women empowerment and investment in children. *Middle east development journal*, 1:105–121.

National Development Planning Agency Republic of Indonesia (2014a). Book II, national development agenda (in Indonesia). Technical report, National Development Planning Agency, Republic of Indonesia.

National Development Planning Agency Republic of Indonesia (2014b). Fishermen exchange number (in Indonesia). Technical report, National Development Planning Agency, Republic of Indonesia.

Nguyen, Q. (2011). Does nurture matter: Theory and experimental investigation on the effect of working environment on risk and time preferences. *Journal of risk and uncertainty*, 43:245–270.

Nugroho, T. (2004). The development disparity between north and south coastal are of west Java (A case study in Karawang Subang-Garut Ciamis) (in Indonesia). Master's thesis, Bogor Agricultural University.

Phipps, S. A. and Burton, P. S. (1998). What's mine is yours? The influence of male and female incomes on patterns of household expenditure. *Economica*, 65:599–613.

Reimers, S., Maylor, E. A., Stewart, N., and Chater, N. (2009). Associations between a one-shot delay discounting measure and age, income, education and real-world impulsive behavior. *Personality and individual differences*, 47:973–978.

Samsuddin, N., Ali, A., Aris, M. A. M., Draman, S., and Akter, S. F. U. (2011). Social and HIV/AIDS risk behaviours in a fishing community. *International journal of humanities and social science*, 1:251–257.

Soero, P. M. H. P., Sulistyo, D., and Hayat, A. (2014). The empowerment of fisherman's wife through village unit cooperatives (KUD) (in Indonesia). *Jurnal administrasi publik*, 2:41–46.

Tanaka, T., Camerer, C. F., and Nguyen, Q. (2010). Risk and time preferences: Linking experimental and household survey data from Vietnam. *American economic review*, 100:557–571.

Teh, L., Teh, L., and Sumaila, U. (2014). Time preference of small-scale fishers in open access and traditionally managed reef fisheries. *Marine policy*, 44:222–231.

Thomas, D. (1990). Intra-household resource allocation: An inferential approach. *Journal of human resources*, 25:635–664.

Wooldridge, J. M. (2010). *Econometric analysis of cross section and panel data*. MIT press.

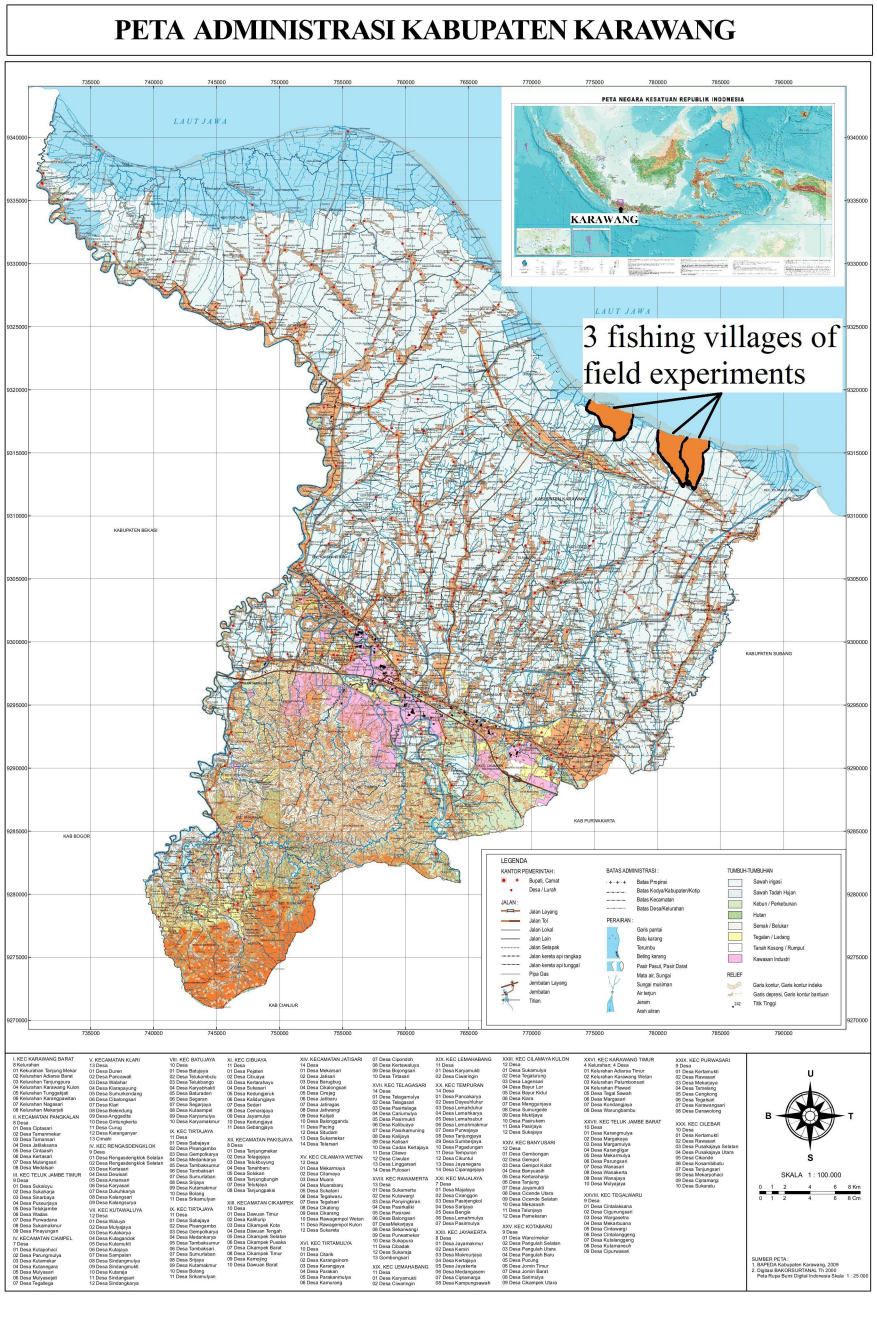
Yang, X. and Carlsson, F. (2016). Influence and choice shifts in households: An experimental investigation. *Journal of economic psychology*, 53:54–66.

Yasin, A. (2013). Akhir derita nelayan Jawa Barat (in Indonesia). `anwaryasin.wordpress.com/2013/04/29/akhiri-derita-nelayan-jawa-barat`. Accessed the online, April 15, 2018.

Zhao, M., Tyzack, M., Anderson, R., and Onoakpovike, E. (2012). Women as visible and invisible workers in fisheries: A case study of northern England. *Marine policy*, 37:69–76.

List of Figures

Figure 1: The study area: Karawang



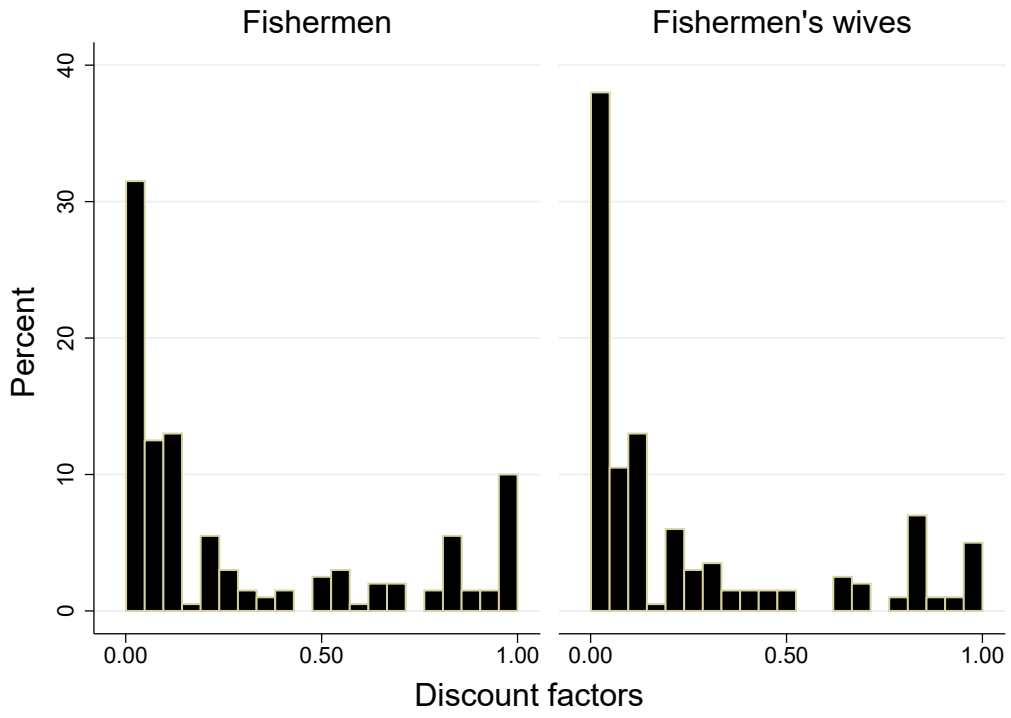
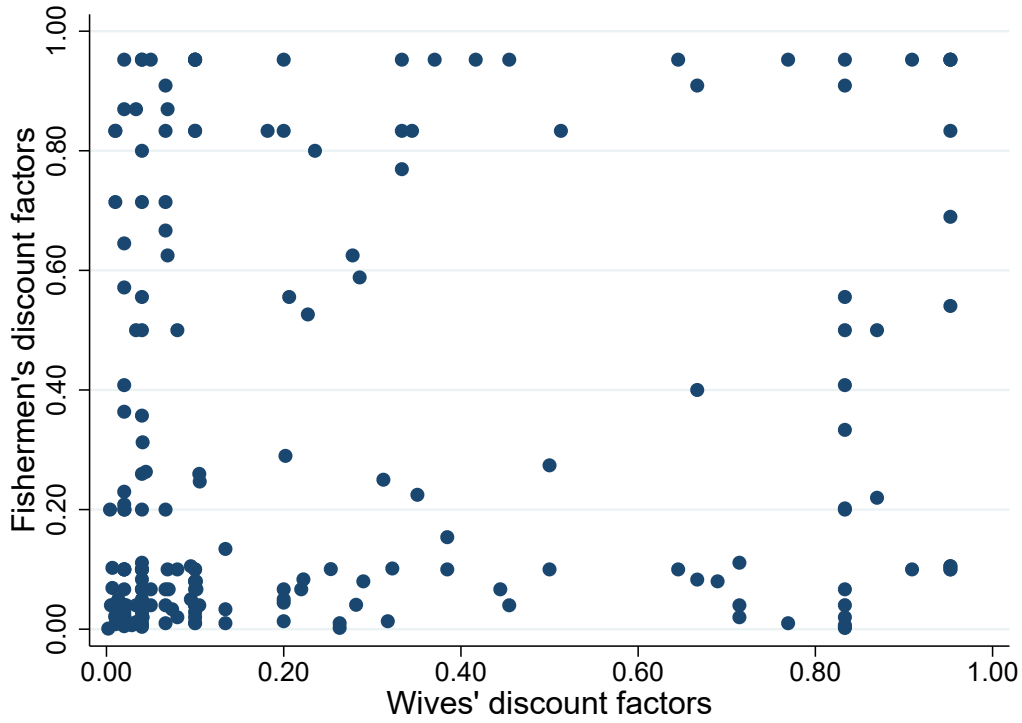


Figure 2: Frequency distributions of fishermen's and their wives' discount factors

Figure 3: Scatter plot of fishermen's and their wives' discount factors



List of Tables

Table 1: Occupation types of fishermen's wives

Occupation types	Number of wives	Percentage
Entrepreneurs	4	2.00
Fish processors	12	6.00
Mending nets	3	1.50
Traders	36	18.00
Trap fishers	1	0.50
Other occupations	2	1.00
Housewives (not working)	142	71.00
Total	200	100.00

Table 2: Definitions of variables used in statitical analysis

Variable	Description
Discount factor	Percentage rate of discounting the future monetary value that will surely be received one month later in such a way that the discounted future value equals the value of receiving 20 000 Rp today.
Fisherman's discount factor	Percentage rate of discounting the future monetary value of a fisherman that will surely be received one month later in such a way that the discounted future value equals the value of receiving 20 000 Rp today.
Wife's discount factor	Percentage rate of discounting the future monetary value of a fisherman's wife that will surely be received one month later in such a way that the discounted future value equals the value of receiving 20 000 Rp today.
Wife's income	Fishermen's wives' income in 1 million Rp.
Fisherman's age	Years.
Wife's age	Years.
Fisherman's (wife's) education	Categorical variable (Illiterate (0), Elementary Level (1), Junior High School Level (2), Senior High School Level (3) College Degree (4) and University Degree (5).
Household members	Number of household members.

Table 3: Summary statistics of the variables with 400 observations

	Average (Median)[1]	SD[2]	Min	Max
Dependent variables				
Fisherman's discount factor	0.302 (0.100)	0.344	0.001	0.952
Wife's discount factor	0.252 (0.100)	0.310	0.002	0.952
Independent variables				
Fisherman's income	2.495 (1.900)	2.247	0.500	20.000
Wife's income	0.367 (0.000)	0.714	0.000	4.000
Fisherman's age	40.955 (40.000)	12.100	18.000	72.000
Wife's age	38.395 (36.500)	11.363	17.000	70.000
Fisherman's education[3]	1.025 (1.000)	0.535	0.000	3.000
Number of household members	4.535 (4.000)	1.954	1.000	12.000

[1] Median in parentheses.

[2] SD stands for standard deviation.

[3] Regarding education, we identify that fishermen's education is identical to their wives' one. Therefore, we only report fishermen's education in this table.

Table 4: Marginal effects of the betafit regression for fishermen's and their wives' discount factors

Independent variable	Model 1 (Fishermen)	Model 2 (Fishermen's wives)
Fisherman's income	0.006	0.009*
	(0.007)	(0.005)
Wife's income	0.056**	0.051**
	(0.028)	(0.024)
Fisherman's age	0.003	−0.003
	(0.002)	(0.002)
Wife's age	−0.001	0.010
	(0.002)	(0.002)
Fisherman's education	0.058	−0.008
	(0.040)	(0.030)
Number of household members	−0.015*	−0.007
	(0.008)	(0.006)

***significant at the 1 percent level, **significant at the 5 percent level and *significant at the 10 percent level