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Time preferences of food producers between fishermen and farmers: Do "cultivate and grow" matter?

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Time preferences of food producers between fishermen and farmers: Do "cultivate and grow" matter?

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Abstract

Resource scarcity and food security are two important issues due to overexploitation of natural resources with increasing population, market demand and mass production, whereas fishermen and farmers have been two main occupations that produce food, utilizing natural resources. The production mode between fishermen and farmers is distinct in that fishermen (farmers) harvest (cultivate, grow and harvest), leading to different daily life style and culture. It is hypothesized that such differences in daily practices and production mode between fishermen and farmers characterize their time preferences or discounting behaviors. We have conducted a discounting elicitation experiment for fishermen and farmers in Indonesia. The statistical analysis shows that the average (median) discount factors of farmers are 0.48 (0.50), respectively, whereas those of fishermen are 0.30 (0.10). The betafit and median regressions demonstrate that the discount factors of farmers are 9.8 % and 26.8 % higher than those of fishermen, respectively, implying that fishermen are much more shortsighted than farmers. This result appears to reflect that farmers wait or "cultivate and grow" six months for their harvest because of which they save some portion of their income, while fishermen catch or "harvest" fish every day and typically use up their daily income. Although same policies have been uniformly implemented on these two occupations, the government may need some devices and education on fishermen to nurture a culture of "cultivate and grow" fish stock for promoting long-term conservation behaviors as well as sustaining fishery and their lives.

Key Words: Time preferences; field experiments; food security; resource sustainability; fishermen; farmers

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1 Introduction

Resource scarcity and food security are becoming two important issues due to overexploitation of natural resources with increasing population, high market demand and mass production. For example, Indonesia is known to be the second largest marine capture producer, contributing to food security in the world (FAO Fisheries and Aquaculture Departement, 2016). However, some important fish stock in Indonesia is reported to have been severely depleted due to the overexploitation. One of the main reasons for the overexploitation is that fishermen tend to choose environmentally unfriendly fishing gears or advanced technologies to catch more fish for immediate profits without considering fish stock sustainability. For resource sustainability and food security, it is important to understand possible myopic behaviors or time preferences of food producers, and therefore, this paper seeks to address these issues by conducting field experiments.

Past literature empirically analyzes individual time preferences in relation to sociodemographic factors by questionnaire surveys or experiments. Reimers et al. (2009) establish the correlation between individual time preferences and age, income, education, demonstrating that younger people

with less income and education prefer smaller immediate rewards to larger-later ones. Similarly, Tanaka et al. (2010) demonstrate that household sociodemographic characteristics influence individual time preferences in Vietnam and, particularly, people in poor villages tend to be less patient. Harrison et al. (2002) also show that sociodemographic characteristics affects people's discounting behaviors in Denmark, reporting that age, income and education are highly correlated with individual discount rates. Overall, these works suggest that sociodemographic factors are important determinants for shaping individual time preferences and discounting behaviors, irrespective of the countries and locations.

Another group of works focuses on estimating time preferences of food producers by conducting field surveys or experiments. Nguyen (2011) estimates and compares time preferences between fishermen and other occupations in Vietnam, and concludes that fishermen are more patient than other occupations especially because they participate in resource stock conservation programs. Johnson and Saunders (2014) compare time preferences between fishermen and divers. They find that divers are more farsighted than fishermen because divers are required to be patient for securing healthy ecosystem service and environment for their jobs. Akpalu (2008) and Fehr and Leibbrandt (2011) examine time preferences of fishermen in relation to fishing activities, and find that shortsighted fishermen tend to use small mesh size and to violate fishing regulations for catching more fish. Casse and Nielsen (2005) and Duquette et al. (2011) focus on time preferences of farmers, illustrating that farmers who adopt best management practices in earlier stages or never do slash-and-burn agriculture are more farsighted. These studies establish that time preferences of food producers well correlate with daily production practices.

Fishermen and farmers have been two main occupations that produce food through utilizing natural resources, and it is crucial to understand their time preferences for food security and resource sustainability. The production mode between fishermen and farmers is distinct in that fishermen (farmers) harvest (cultivate, grow and harvest), and such differences in production mode between fishermen and farmers may characterize their time preferences or discounting behaviors, leading to different daily life style and culture. In Indonesia, farmers need to wait or "cultivate

and grow" six months for their "harvest," while fishermen catch or "harvest" fish every day and typically use up their daily income. This implies that farmers may require more patience than fishermen for survival. Thus, it could be hypothesized that farmers are more farsighted than fishermen in a case of Indonesia. To test this hypothesis, a discounting elicitation experiment is conducted for fishermen and farmers in the fields of Indonesia where the ethnicity, languages and sociodemographic factors are relatively homogeneous except the production mode.

2 Methods and materials

2.1 Study areas

The questionnaire surveys and field experiments were conducted in 3 rural fishing villages and 9 rural farming villages within Karawang district (figure 1). The district is located in the north part of Jawa Barat Province between 107°2′ and 107°40′ east longitude, and 5°56′ and 6°34′ south latitude. The total land area is 1753.27 km^2. Karawang has fertile soil for agriculture. The population in 2015 is 2 273 579 with the density of 1094 km^2 (BPS Statistics of Karawang Regency, 2016), and 168 901 or 18.15 % of the inhabitants work in agriculture or fishery sectors (Karawang Regency Government, 2015). Most fishermen in Karawang engage in day to day fishing in which they take 3 or 4 hours to reach fishing grounds, whereas most farmers cultivate paddy and the production needs 6 months from soil preparation to harvest. These villages are selected as fields for our study because the ethnicity, languages and sociodemographic factors are relatively homogeneous except the production mode between fishermen and farmers.

[Figure 1 about here.]

2.2 Discounting elicitation experiment

Previous studies on individual time preferences employ a multiple-price list procedure (Coller and Williams, 1999, Harrison et al., 2002, Tanaka et al., 2010). This research employs a different

experimental procedure to elicit individual time preferences in the fields. The multiple-price list procedure usually requires subjects to have a checking (bank) account or to come back to an experimental site at a different date and time for receiving experimental rewards.[1] However, the subjects in our experiments are farmers and fishermen in Indonesia, and it is impossible for us to make such binding arrangements due to their living conditions, daily life styles and cultures. We also confirm that the multiple-price procedure in previous research cannot be well understood by subjects in the pilot experiments, because education of most fishermen and farmers in Karawang district is highly limited. Therefore, we institute a new procedure of experiments to elicit individual time preferences from fishermen and farmers, called a discounting elicitation experiment.

A discounting elicitation experiment consists of an individual interview, asking farmers and fishermen whether they want to receive money today or wait for more money in the future. Since most subjects are not educated with limited literacy and cannot come back to experimental sites in different time and dates, we design simple experiments in the way that our subjects can easily follow and the monetary payments can be readily made on the spot. We start asking each subject a simple question of whether he prefers options A or B consisting of

Option A: You receive 20000 Rp today.

Option B: You will receive $20000 + x$ Rp one month later.

Here, the value of x starts with $x_0 = 4000$. When the subject prefers option A to B, the question is updated by increasing the value of x by 4000 for option B, i.e., $x = x_1 = x_0 + 1 \cdot 4000 = 4000 + 4000 = 8000$. Then, the updated question is again asked to the subject whether he prefers option A to B. This process continues arbitrarily n times for x to be $x_n = 4000 + n \cdot 4000$ as far as the subject prefers option A to B. When the subject prefers option B to A at an arbitrary nth trial, we stop the procedure. Rather, we ask the subject a series of questions to identify the threshold value $\overline{x}$ between x_{n-1} and x_n that makes him indifferent from receiving 20 000 Rp today. To this end, we keep asking the questions by gradually adjusting the value of x between x_{n-1} and x_n until each interviewer successfully elicits the threshold value $\overline{x}$.

[1] More than 70 % of our subjects do not have a bank account.

As of the payment for the discounting elicitation experiments, we paid the subject the reward on the spot. For this, we prepare the lottery with the probability $\rho = \frac{20000}{20000+\overline{x}}$ of successfully obtaining the value of $20000 + \overline{x}$ Rp and the probability $1 - \rho$ of getting nothing. This lottery is made of yellow and red cards where the number of yellow cards is always 20 and the number of red cards is adjusted to be $20 + \frac{\overline{x}}{1000}$. Since most subjects in our experiments are not familiar with the concept of probabilities, we count the number of yellow and red cards in front of each subject, putting them into a bag. After preparing the lottery of a bag, we ask each subject whether he wants to pick the lottery for possibly getting $20000 + \overline{x}$ Rp or receive 20 000 Rp for sure. Those who decide to pick the lottery get paid based on the outcome of the lottery on that spot, and those who decide not to pick the lottery surely receive 20 000 Rp. In this way, we also implicitly elicit subjects' attitudes over uncertainty, risk averse, risk neutral or risk lover.

2.3 Experimental procedure

We first contacted the village offices to get the consent for conducting our experiments. Among the 13 fishermen villages and 296 farming villages in Karawang, 3 fishing and 9 farming village authorities gave us the permission to conduct experiments in their villages, respectively. We got the list of households and residents from the village offices and based on the population of each village, we randomly selected the required number of households. Hereafter, we invited one earning member from each of the selected households to participate in our experiment by sending them invitation letters. A total of 397 subjects participated in our experiment, among them 200 are fishermen and 197 are farmers. We conducted our experiments at village halls in each field. To avoid possible biases from interactions among the participants, we confirmed that soon after participation, each respondent leaved the experimental hall.

In each experimental session, we provided written experimental instructions of our discounting elicitation experiment to the respondents in Indonesia language, Bahasa. Additionally, an experimenter made oral presentation about the instructions, and confirmed participants' understandings about the experiment. Hereafter, we elicited respondents their individual discount factors and col-

lected their socioeconomic information through discounting elicitation experiments of individual interviews. We implemented our experiments with monitory incentives to attract subjects to experimental sites and motivate them to attend the experiment seriously given the opportunity and transportation costs. The payoff calculation is announced to be based on the decisions and outcomes of the discounting elicitation experiment, which is included in the experimental instructions and verbal presentations. After eliciting respondents' discount factor in the discounting elicitation experiments and socioeconomic information, subjects were paid based on the outcome of the experiments. The average experimental earning for the games including show-up fee was 65 Rp ($\approx$ 5 USD), which is roughly equivalent to 1 day wage of a unskilled labor in Indonesia. Each session in our experiment has $15 \sim 20$ participants, taking $2 \sim 3$ hours.

2.4 Empirical method

We apply betafit and median regressions to characterize the determinants of individual discount factors. The two models employ the same set of independent variables and are specified as follows:

$$d_i = \beta_0 + \boldsymbol{\beta}_1 \mathbf{x}_i + \beta_2 z_i + \epsilon_i \tag{1}$$

where subscript i represents each subject's ID, d_i is an individual discount factor estimated in the discounting elicitation experiments, $\mathbf{x}_i$ is a vector of independent variables of sociodemographic information such as age, education, household income, children under 12, a number of household members and family structure, z_i is a dummy variable of occupations that takes 1 when subject i is a farmer, otherwise 0. The definitions of variables used in the regression analysis are summarized in table 1.

The betafit regression developed by Ferrari and Cribari-Neto (2004) is employed for our analysis, since individual discount factors are bounded between 0 and 1. It assumes that individual

discount factors d_is follow the beta distribution:

$$f(d_i;\mu,\phi)=\frac{\Gamma(\phi)}{\Gamma\mu\phi\Gamma((1-\mu)\phi)}d_i^{\mu\phi-1}(1-d_i)^{(1-\mu)\phi-1},\quad d_i\in(0,1)$$

where $\mathbb{E}(d_i)=\mu$, $\mathrm{Var}(d_i)=\frac{\mu(1-\mu)}{1+\phi}$, ϕ is a precision parameter and $\phi-1$ is a dispersion parameter. Different combinations of μ and ϕ can describe various types of beta densities including J shapes, inverted J shapes and U shaped (Ferrari and Cribari-Neto, 2004). Since the distributions of individual discount factors estimated in our experiments are U shaped, we decide to use this betafit regression. The maximum likelihood methods are applied to identify unknown parameters $\beta_0,\boldsymbol{\beta}_1,\beta_2$ with which the marginal effect of an independent variable on individual discount factors, d_i, shall be derived and estimated.

For robustness check, we employ the quantile regression approach developed by Koenker and Basset (1978) and Koenker and Hallock (2001), following the specification of equation (1). The quantile regression estimate one parameter vector for each quantile under a weak assumption that each quantile of error terms is zero, i.e., $\mathrm{Quant}_\theta(\epsilon_i)=0$ for $\theta\in(0,1)$ where θ represents a quantile level. The quantile regression is based on the least absolute distance, and therefore, it can efficiently estimate a set of the unknown parameters $\beta_0,\boldsymbol{\beta}_1,\beta_2$ even under non-normal and skewed distributions with outliers. Since the distributions of individual discount factors in our experiments are identified to be non-normal and bi-modal around 0 and 1 (see figure 2), the quantile regression can be considered appropriate. We decide to run the median regression of $\theta=0.5$ for the comparison with the result in the betafit regression.

[Table 1 about here.]

All of the variables in table 1 are expected to be determinants of individual discount factors. In particular, our main focus is on occupation dummy to capture how individual discount factors are different between fishermen and farmers. Our hypothesis is proven to be true when the dummy variable consistently exhibits statistical and economic significance to affect individual discount factors. We have tried many different specifications of the models in addition to the models we

present in this paper by including the interaction terms of two independent variables and different sets of independent variables. However, our results do not differ significantly, and the results we will present in what follows remain consistent.

3 Results

Table 2 presents the summary statistics of major independent variables and individual discount factors for fishermen, farmers and the total sample. The overall average age is 45 years old (see the "overall" column in table 2), however, once we look at the ages of fishermen and farmers, we find a clear difference between them such that farmers are 8 years older than fishermen on an average. Definitely, fishing is more labor intensive than farming, and thus fishermen tend to retire earlier than farmers. Regarding education, farmers are more educated than fishermen since farmers usually get the junior high school degree, whereas fishermen usually have only the primary education. One the other hand, when we look at the median of education, we do not find any difference between fishermen and farmers. The difference in mean and median education can be explained by the standard deviation (hereafter SD) of education. The SD of farmers' education is 1.13 which is twice as much as the SD of fishermen's education. This finding implies that some farmers are highly educated, for instance, the university degree (see the "max" row under education in table 2). The gap in education is relatively low in fishing societies and the fishermen who are the most educated are senior high school graduates.

[Table 2 about here.]

Farmers earn more than the fishermen in that farmers' average monthly income is approximately 1 million rupiahs higher than fishermen. The income gap among the farmers is higher than that of the fishermen since the SD of farmers' monthly income is almost twice as much as the SD of fishermen's income. This finding indicates that some farmers' earning is significantly higher than that of the majority, whereas fishermen experience less disparity in their income and standard of living. In case of the number of children under 12 years of age per household, the number

of household members and family structure, farming society and fishing society are not different from one another. In summary, farmers are relatively old and highly educated compared with the fishermen, and in addition, farmers' income is higher and comes with a relatively larger income gap than fishermen's one.

[Figure 2 about here.]

The median (mean) discount factors of farmers and fishermen are 0.500 (0.482) and 0.100 (0.302), respectively. This states a significant difference of estimated individual time preferences between farmers and fishermen, implying that fishermen discount their future more heavily than farmers. Figure 2 shows the frequency distributions of individual discount factors between fishermen and farmers. The vertical axis denotes the percentage of frequencies and the horizontal axis denotes the discount factors. The highest spike in the frequency distribution for farmers occurs at discount factors close to 1, while it does at 0 for fishermen. The finding in figure 2 is in line with the summary statistics. On the basis of the summary statistics and figure 2, we run a Mann-Whitney test to examine whether the distribution of discount factors are the same between fishermen and farmers or not. The null hypothesis is that the distributions of discount factors are independent of individual occupations between farming and fishing. Our test rejects the null hypothesis at 1 % significance level. This result suggests that the distributions of farmers' and fishermen's discount factors differ from one another.

[Table 3 about here.]

The summary statistics, frequency distributions and the Mann-Whitney test suggest that individual discount factors are different between farmers and fishermen. To further characterize the relationship, we run betafit and median regressions. Columns 2 and 3 of table 3 present the marginal effects of the independent variables on individual discount factors in betafit and median regressions, respectively. The results show that age, education, household income and occupation dummy are the significant predictors of discount factors in betafit regression, while occupation

dummy is the only significant determinant in the median regression. Although we have tried many different specifications of betafit and median regressions, we have obtained a consistent result that the occupation dummy of fishermen or farmers is the statistically and economically significant predictor for individual discount factors.

The betafit regression shows that an additional year increase in age is associated with a 0.3 % rise in discount factors. Although this effect might be considered rather small, the discount factor is estimated to increase by 4 % for one standard deviation rise ($\approx$ 12 years) in age. The result reveals that young people tend to discount future more heavily than old people, which is consistent with the previous studies (Green et al., 1994, Harrison et al., 2002, Reimers et al., 2009). It is claimed that as people become old, the level of self-control is known to increase and also, people become more generative and think more about the future generations up until the age of 60 years (Green et al., 1994, McAdams et al., 1993).

The effect of education demonstrates that getting more education induces people to care more about future since betafit regression estimates a 3 % rise in discount factor in relation to an increase in education category. Harrison et al. (2002) and Reimers et al. (2009) show that more educated people tend to be future-oriented or farsighted, and our result is in line with this finding. Similar to the effect of age, education should enhance self-control mechanisms and cognitive abilities (Bauer and Chytilova, 2010). Moreover, education is known to train people to logically think, simulate and organize the future, helping make a balance between present and future events.

Finally, we look at the effect of occupations on discount factors, more precisely, how farmers or fishermen have different time preferences, controlling for other socioeconomic factors fixed. The occupation dummy is identified to be the important predictor of individual discount factors in both betafit and median regressions with 1 % statistical and economic significance. Betafit regression estimation tells that farmers' discount factors are 9.5 % higher than fishermen, while median regression estimates a 26.8 % higher discount factors for farmers than those of the fishermen. Consistent with our summary statistics, both the regression estimations confirm that fishermen tend to

discount their future more heavily than farmers.[2]

Several past studies demonstrate that the occupations and the associated life practices are important determinants to characterize individual behaviors and preferences such as social preferences and competitiveness (Hoekstra, 1985, Casse and Nielsen, 2005, Henrich et al., 2005, Akpalu, 2008, Duquette et al., 2011, Fehr and Leibbrandt, 2011, Nguyen, 2011, Leibbrandt et al., 2013, Johnson and Saunders, 2014). Given the literature, our study could be considered an additional evidence with respect to the effect of occupations on "time preferences" for the specific case of the food producers, fishermen and farmers, in Indonesia. Now, a key question is why occupations of farmers and fishermen significantly affect their time preferences to be different? Here, we argue that the difference comes from their daily life practices and production mode, that are distinct between farmers and fishermen. In other words, farmers "cultivate, grow and harvest" the crops, while fishermen only "harvest" fish in their food production. The differences characterize their discounting behaviors.

Fishermen in Karawang typically fish every day and can receive daily income by selling the fishes in their local auction markets. They easily expect that they can go for fishing tomorrow or the day after tomorrow, earning money for their living whenever their money is short. Because of such income generating practices of daily fishing, they are neither accustomed to, nor motivated for saving. In our experiments, we have confirmed that fishermen almost use up their total daily earning on the same day. Therefore, their saving is identified to be very low from our data and individual questionnaires (the median of saving in fishermen sample is zero). In addition, in our survey, we asked the fishermen whether they believe that fish stocks are exhaustible or not. Surprisingly, 80.5 % of the fishermen respond that the "God" always provides fish in the sea, and therefore, fish stock is inexhaustible.[3] In summary, the daily fishing of "earn and burn practices" and the belief

[2]This finding looks inconsistent with Nguyen (2011) since they show that, in Vietnam, fishermen are more patient than people with other occupations. However, one key difference between our study and Nguyen (2011) is that the fishermen in Vietnam participated in resource conservation programs, such as permanent area closures to recover fishery, while Indonesian fishermen in our study do not experience any conservation or training program for resource sustainability. We argue that the conservation program induces Vietnamese fishermen to become more patient than others.

[3]Fishermen in Karawang have a festival called "Nadran Laut." This festival is an acculturation tradition of Islamic and Hindu that has been inherited over hundreds years generations by generations. The objective of this festival is to

of "inexhaustible" fish stock remain the part of their culture in fishing villages, inducing fishermen to be shortsighted.

Farmers in Karawang need to cultivate and grow paddy or wait six months for harvesting, because of which they are motivated to save, invest and accumulate for their survival. In our study areas, farmers cultivate arable land for their livelihood which is basically their own property, and they maintain or even accumulate their capital and wealth through saving gold as a preparation for uncertain future. Natural disasters and calamities are main concerns of uncertainty for farmers, because they destroy whole agricultural productions in the regions. However, fishermen can still go fishing within a few days even after natural disasters. This is one example that come from differences in the production mode between fishermen and farmers that affect the motivations of how to prepare for future. The data also shows that farmers' saving is much higher than fishermen's one, which is consistent with the result of individual time preferences. We conjecture that farmers' daily practices and the mode of production for cultivating, growing and harvesting crops require farmers to wait, save and invest for future, nurturing them to be farsighted as part of cultures.

The motivations of maintaining and transferring capital and wealth to the next generations could be different between farmers and fishermen due to their production mode. In farming villages, maintaining and transferring capital and wealth, such as land and irrigation, from one generation to the subsequent generations is very important as a common practice for their survival, because these two factors are crucial in cultivating and growing crops. On the other hand, in fishing villages, fishermen do not have specific capital and wealth to maintain and transfer to the subsequent generations except their hands-on experiences and skills for harvesting as part of human capital, because fishing is mainly labor intensive.[4] Therefore, the differences in motivations to maintain and transfer their capital and wealth to the future generations may be attributed to the production mode, explaining why farmers are more farsighted than fishermen.

Past studies demonstrates that daily practices, history and environment as part of culture affect

express gratitude to God for providing fish in the last year, praying to catch more fish in the current and future with safety in the sea. In this festival, fishermen slaughter a buffalo and they go to sea together with bringing the buffalo's head, and then throw it to the sea as gratitude to God.

[4]Fishing vessels and gears belong to the owners, not to individual fishermen in Indonesia.

human behaviors and preferences (Boyd and Richerson, 1985, Schultz et al., 1997, Henrich et al., 2005, Tomasello et al., 2005, Dawkins, 2006, Gilbert and Wilson, 2007, Richerson and Boyd, 2008, Wilson et al., 2009, O'Brien et al., 2010, Moya et al., 2015, Gerlach et al., 2014, Szpunara et al., 2014, Shahrier et al., 2016, Timilsina et al., 2017, Shahrier et al., 2017). We demonstrate that daily life practices and production modes related to the occupation of farmers and fishermen characterize their individual time preferences. At the same time, this research brings some new questions and hopes for people's behaviors over the future. Some effective policies or new education systems such as training/conservation programs or institutions to change people's cultures to be patient shall be essential. For this, "cultivate and grow" shall matter based on our findings. In fishery, it is necessary for fishermen to be farsighted toward sustainable fishery. To this end, nurturing a new culture of fishermen in Indonesia for "cultivating and growing fish" through some public education or programs shall be an important first step.

4 Conclusion

The past studies show how daily practices, history and environment as part of culture influence human behaviors and preferences. Fishermen and farmers as main food producers play important roles for food security and resource sustainability. The production mode between fishermen and farmers is distinct in that fishermen (farmers) harvest (cultivate, grow and harvest), leading to different daily life style and culture. It is hypothesized that such differences in daily practices and production mode between fishermen and farmers characterize their time preferences or discounting behaviors. To examine this hypothesis, we have conducted a discounting elicitation experiment for fishermen and farmers in the fields of Indonesia.

The result of this study reveals that fishermen are much more shortsighted than farmers. The results of betafit and median regressions illustrate that the discount factors of farmers are 9.8 % (26.8 %) higher than that of the fishermen, controlling for other sociodemographic factors. We argue that this difference comes from daily life practices and production mode associated with

their occupations of farmers and fishermen. The results well reflect the fact that farmers cultivate and grow paddy or wait six months for their harvest and they tend to save some portion of the income for the future, while fishermen catch fish every day and use up their daily income. Although same policies have been uniformly implemented on these two occupations, the government may need some new devices and education on fishermen to nurture a culture of "cultivate and grow" fish stock and to be more farsighted for promoting long-term conservation behaviors in sustaining fishery and their lives.

We note some limitations of our research and the direction of future research. This research was conducted in small-scale fisheries under open access and top-down management system in Indonesia. Fishermen in the experiments have never participated or gotten involved in any type of resource conservation programs or management so that they only catch fish every day with their belief that the stocks are inexhaustible. However, in reality, fishermen in other countries experience participating in such programs or engage in different types of fishing such as more large-scale fisheries or industrialized one, potentially having different ways of thinking, behaviors and preferences. Therefore, our results should be understood with some caution. Future research should be able to focus more on other types of fishery societies or the effects of resource conservation and training programs of "cultivate and grow" on individual time preferences of fishermen as well as people with other occupations, considering various production modes.

5 Bibliography

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

Bauer, M. and Chytilova, J. (2010). The impact of education on subjective discount rate in gandan villages. *Economic development and cultural change*, 58:643–669.

Boyd, R. and Richerson, P. J. (1985). *Culture and the evolutionary process*. University of Chicago press.

BPS Statistics of Karawang Regency (2016). Karawang regency in figures 2016. Technical report, BPS Statistics of Karawang Regency.

Casse, T. and Nielsen, U. (2005). Farmer strategies and forest conservation: A case study from south-western Madagascar. *International journal of social economics*, 32:704–716.

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

Dawkins, R. (2006). *The selfish gene*. Oxford university press.

Duquette, E., Higgins, N., and Horowitz, J. (2011). Farmer discount rate: Experimental evidence. *American journal of agricultural economics*, 94:451–456.

FAO Fisheries and Aquaculture Departement (2016). The state of world fisheries and aquaculture 2016. Technical report, Food Agriculture Organization of the United Nation (FAO).

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.

Gerlach, K. D., Spreng, R. N., Madore, K. P., and Schacter, D. L. (2014). Future planning: Default network activity couples with frontoparietal control network and reward-processing regions during process and outcome simulations. *Social cognitive and affective neuroscience*, 9:1942–1951.

Gilbert, D. T. and Wilson, T. D. (2007). Prospection: Experiencing the future. *Science*, 317:1351–1354.

Green, L., Fry, A. F., and Myerson, J. (1994). Discounting of delayed rewards: A life-span comparison. *Psychological science*, 5:33–36.

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.

Henrich, J., R., Bowles, S., Camerer, C. F., Fehr, E., Gintis, H., McElreath, R., Alvard, M., Barr, A., Ensminger, J., Heinrich, N. S., Hill, K., Gil-White, F., Gurven, M., Marlowe, F. W., Patton, J. Q., and Tracer, D. (2005). "Economic man" in cross-cultural perspective: Behavioral experiments in 15 small-scale soceities. *Behavioral and brain sciences*, 28:795–855.

Hoekstra, D. (1985). Choosing the discount rate for analysing agroforestry systems/technologies from a private economic viewpoint. *Forest ecology and management*, 10:177–183.

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.

Koenker, R. and Basset, G. (1978). Regression quantiles. *Econometrica*, 46:33–50.

Koenker, R. and Hallock, K. F. (2001). Quantile regression. *Journal of economic perspectives*, 15(4):143–156.

Leibbrandt, A., Gneezy, U., and List, J. A. (2013). Rise and fall of competitiveness in individualistic and collectivistic societies. *Proceedings of the National Academy of Sciences of the United States of America*, 110:9305–9308.

McAdams, D. P., St. Aubin, E., and Logan, R. L. (1993). Generativitiy among young, midle, and older adults. *Psychology and aging*, 8:221–230.

Moya, C., Boyd, R., and Henrich, J. (2015). Reasoning about cultural and genetic transmission: Developmental and cross-cultural evidence from Peru, Fiji, and the United States on how people make inferences about trait transmission. *Topics in cognitive science*, 7:595–610.

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.

O'Brien, M. J., Lyman, R. L., Mesoudi, A., and VanPool, T. L. (2010). Cultural traits as units of analysis. *Philosophical transactions of the royal society B*, 365:3797–3806.

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.

Richerson, P. J. and Boyd, R. (2008). *Not by genes alone: How culture transformed human evolution*. University of Chicago press.

Schultz, W., Dayan, P., and Montague, P. R. (1997). A neural substrate of prediction and reward. *Science*, 275:1593–1599.

Shahrier, S., Kotani, K., and Kakinaka, M. (2016). Social value orientation and capitalism in societies. *PLoS ONE*, 11:e0165067.

Shahrier, S., Kotani, K., and Saijo, T. (2017). Intergenerational sustainabilty dillemma and the degree of capitalism in societies: A field experiment. *Sustainability science*, 12:957–967.

Szpunara, K. K., Spreng, R. N., and Schactera, D. L. (2014). A taxonomy of prospection: Introducing an organizational framework for futureoriented cognition. *Proceedings of the National Academy of Sciences of the United States of America*, 111:18414–18421.

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.

Timilsina, R., Kotani, K., and Kamijo, Y. (2017). Sustainability of common pool resources. *PLoS ONE*, 12:e0170981.

Tomasello, M., Carpenter, M., Call, J., Behne, T., and Moll, H. (2005). Understanding and sharing intentions: The origins of cultural cognition. *Behavioral and brain sciences*, 28:691–735.

Wilson, D. S., O'Brien, D. T., and Sesma, A. (2009). Human prosociality from an evolutionary perspective: Variation and correlations at a city-wide scale. *Evolution and human behavior*, 30:190–200.

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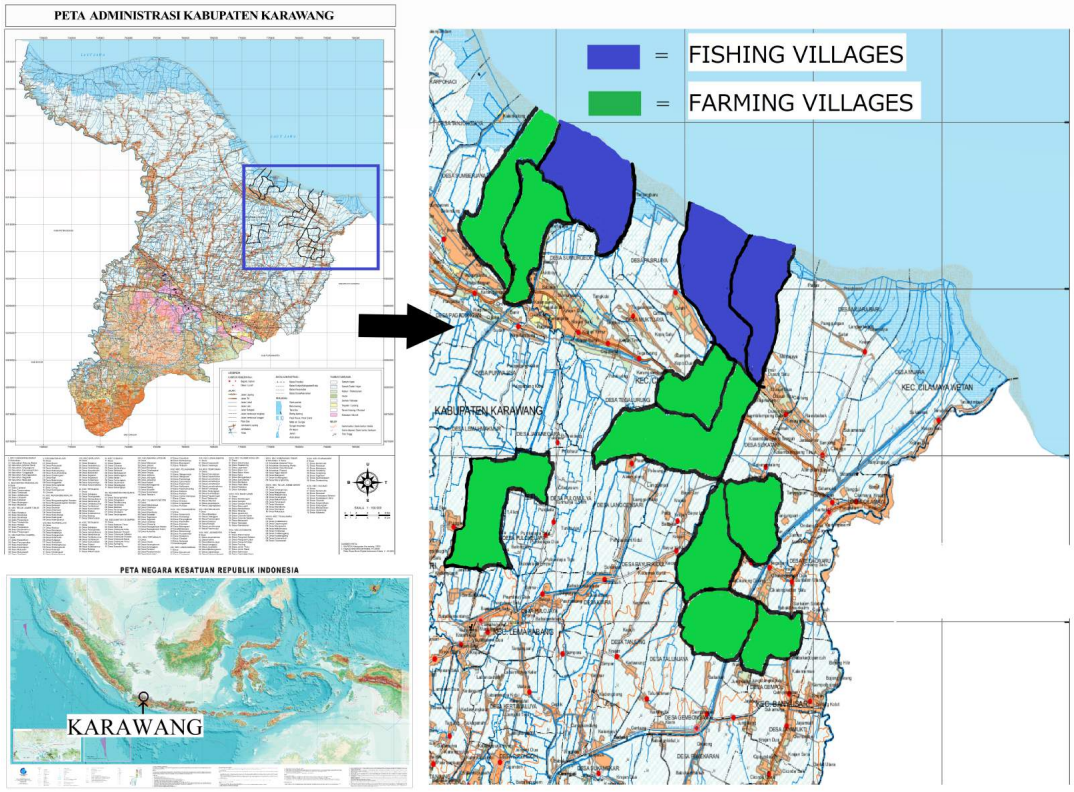

Figure 1: The study area: Karawang

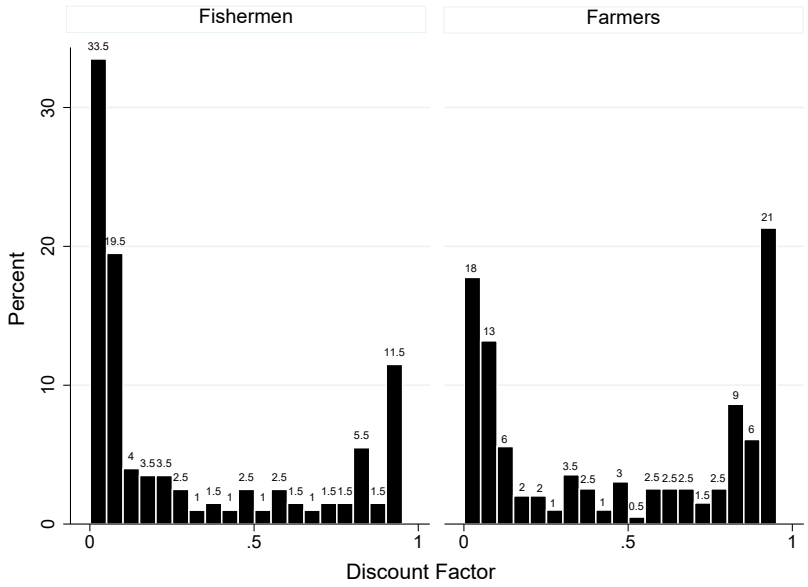

Figure 2: Frequency distributions of discount factors between fishermen and farmers

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Table 1: Description of socioeconomic characteristics

Variables	Description
Discount Factor	Discounting value, the amount of money today divided by the amount of money 1 month later (20,000 rupiahs)
Occupation Dummy	Farmers (1) and Fishermen (0)
Age	Years
Education	Categorical variable (Illiterate (0), Elementary Level (1), Junior High School Level (2), Senior High School Level (3) College Degree (4), University Degree (5).
Household Income	Household income per month in 1 million rupiahs
Children under 12	Number of children under 12 years of age in the household
Member of Household	Number of household member
Family structure	Single family structure are coded as 1, otherwise (joint family) as 0

Table 2: Summary statistics of field experiment and socioeconomic characteristic between fishermen and farmer, 397 observations (fishermen 200 observations, farmers 197 observations)

	Work setting		Overall
	Fishermen	Farmers	
Age			
Average (Median) [1]	40.955 (40.000)	48.741 (47.000)	44.818 (45.000)
SD [2]	12.099	10.871	12.135
Min	18.000	23.000	18.000
Max	72.000	80.000	80.000
Education			
Average (Median)	1.025 (1.000)	1.584 (1.000)	1.302 (1.000)
SD	0.535	1.133	0.926
Min	0.000	0.000	0.000
Max	3.000	5.000	5.000
Household income			
Average (Median)	2.852 (2.000)	3.953 (3.000)	3.398 (2.600)
SD	2.434	4.164	3.444
Min	0.500	0.700	0.500
Max	20.000	30.000	30.000
Children under 12			
Average (Median)	1.055 (1.00)	0.659 (1.00)	0.873 (1.00)
SD	1.152	0.827	1.062
Min	0.000	0.000	0.000
Max	7.000	5.000	7.000
Number of household members			
Average (Median)	4.535 (4.00)	4.264 (4.00)	4.418 (4.00)
SD	1.954	1.933	2.060
Min	1.000	1.000	1.000
Max	12.000	18.000	18.000
Family structure			
Average (Median)	0.609 (1.00)	0.698 (1.00)	0.654 (1.00)
SD	0.489	0.459	0.475
Min	0.000	0.000	0.000
Max	1.000	1.000	1.000
Discount factor			
Average (Median)	0.302 (0.100)	0.482 (0.500)	0.391 (0.206)
SD	0.344	0.374	0.370
Min	0.001	0.003	0.001
Max	0.952	0.952	0.952

[1] Median in parentheses.
[2] SD stands for standard deviation.

Table 3: Marginal effects of betafit regression and median regression for Discount Factor between fishermen and farmers

Variable	Betafit regression	Median regression
Age	0.003**	0.004
	(0.001)	(0.004)
Education	0.032*	0.022
	(0.019)	(0.047)
Household income	−0.007*	−0.006
	(0.004)	(0.011)
Children under 12	−0.010	−0.008
	(0.015)	(0.038)
Number of household members	−0.009	−0.011
	(0.008)	(0.019)
Family structure (base group=joint family)	−0.017	−0.029
	(0.031)	(0.078)
Occupation dummy (base group=fishermen)	0.098***	0.268***
	(0.034)	(0.085)

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