

# A Note on Social Preference and Cooperative Behavior of Fishers:

## Preliminary Analysis using Experimental Data from Fishing Villages in Puerto Princesa, the Philippines<sup>†</sup>

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Using data of the experimental and questionnaire survey carried out in the fishing villages of Puerto Princesa in May 2014, we examine the relationship between personal attributes and the preference for cooperation and the relationship between personal attributes and cooperative behavior. We find that the more education a fisher received, and/or the higher is his income, the more likely it is that he would be cooperative/altruistic rather than aggressive. It is also verified that fishing experience has a significantly negative effect on social preference. We also find that the behavior of altruistic/cooperative fishers is rational while that of other types of fishers is not rational. Moreover, it is verified that the more experience a fisher has, and/or the less migratory people of his community are, the more likely it is that he will behave cooperatively.

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## 1. Introduction

Having observed the decrease in fish resource stocks worldwide, it is important to find out the solution for sustainable use of those resources.<sup>1)</sup> Governments have often enforced top-down types of catch-restrictive measures, such as quotas and closed season, which may work well for this purpose. However, these types of measures can give fishers the wrong incentives if they are not conscious of the importance of sustainability. For example, restrictions on vessel scale lead to vessels with higher horsepower that allow fishers to go fishing more times than they can do with lower-horsepower vessels. Quotas may lead to the disposal of low-value species because fishers are usually not able to select species before they haul up their nets. Moreover, marine environmental situations are different across areas. The characteristics of fishers and customs are also different among communities. Thus, it is becoming more important for local and central authorities to elaborate a package of measures for each area/community to avoid overfishing.

Territorial used rights fisheries (TURF) management is one possibly effective measure. The purpose of TURF is to allocate rights to use fish resources in specific geographic areas to specific fishers or groups of fishers, and make those fishers create their own resource management schemes.<sup>2)</sup> Fishers are familiar with the situation of fishing grounds they use and they usually have lived in the community for a long time even across the generations. Thus, if they are able to devise a scheme to use their resources sustainably by themselves, this type of management is desirable. In other words, whether TURF schemes work effectively depends on cooperative

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1) According to the FAO (2012), 30% of fish species around the world were overexploited as of 2009, and this ratio has increased continuously.

2) This type of management system was formally defined by Christy (1983). For the Japanese TURF scheme, see Cancino et al. (2007), Makino and Matsuda (2005), and Yamamoto (1995).

behavior of fishers within a community.

The purposes of this paper are (i) to examine the relationship between personal attributes and the preference for cooperation (*social preference*), and (ii) to examine the relationship between personal attributes and cooperative behavior. This analysis is the first step towards clarifying what types of fishers are able to behave cooperatively and, accordingly which communities fit with the aim of TURF management schemes.

To this end, we use the method of field experiments that can clarify behavior and preferences of subjects. In environmental and resource economics, the method has often been used because behavior of local people is critical for the protection of the local environment.<sup>3)</sup> In particular, we use the results of experiments carried out in the fishing villages of Puerto Princesa, the Philippines, in May 2014. We conducted a game to extract social (cooperative) preference and the public-goods game (PGG) with other 4 types of games. Subjects of the experimental survey are fishers. We also carried out a questionnaire survey to obtain data on personal and community attributes of those subjects.

The main results are as follows. We find that the more education a fisher received, and/or the higher is his income, the more likely it is that he would be cooperative/altruistic rather than aggressive. It is also verified that fishing experience has a significantly negative effect on social preference. The results about cooperative behavior are also interesting. The behavior of altruistic/cooperative fishers is rational while that of other types of fishers is not rational. It is also verified that the more experience a fisher has, and/or the less migratory people of his community are, the more likely it is that he will behave cooperatively.

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3) For the articles using field experimental methods, for example, see Castillo et al. (2011), Gleich et al. (2007), Kanchanaroek et al. (2013), Nguyen and Leung (2009), and Velez et al. (2010).

Section 2 describes the design of experimental and questionnaire surveys. Section 3 investigates the relationship among personal attributes, social preferences, and cooperative behavior. Section 4 provides concluding remarks.

## 2. Design of Experimental and Questionnaire Surveys

We conducted a series of surveys in May 2014 in the suburban area of Puerto Princesa City. We conducted 2 sessions on 13th and 1 session on 14th and 15th. Puerto Princesa is located in the middle of Palawan Island, which faces the South China (West Philippine) Sea. The fishing industry, in particular coastal fishing is one of the important industries for local people in the island. 14 subjects participated in the first session and 16 subjects participated in each of the other sessions, giving us 62 samples for the following analysis. All of them were male fishers. Experimental games were conducted by Arvin Vista, one of the authors, and Elmer Sunaz, an assistant.<sup>4)</sup>

Although we conducted six types of games, we explain two of them in detail, and we focus on those two in this paper.<sup>5)</sup> The first one is a game to extract social (cooperative) preferences of subjects. In this game, 8 pairs were made randomly. Each subject did not know who exactly their partner was. Following Offerman (1996) and Park (2000), we use the method of value orientation, which has been used not only in economics but also in other fields such as social psychology. This game consisted of 24 questions (See Figure 1). In each question, subjects chose between two alternatives: Choice A and Choice B. Each option specifies an amount of points to the

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4) He is an graduate student of Department of Agricultural Economics, College of Economics and Management, University of Philippines Los Banos.

5) The other games were the game to extract risk preference, the game to extract time preference, the dictator game, and the ultimatum game.

Figure 1. Questions in Game 3

1 <sup>o</sup>	Choice A <sup>o</sup>	Choice B <sup>o</sup>
	You get 0 point <sup>o</sup>	You get 3.9 point <sup>o</sup>
	Your partner get 15 point <sup>o</sup>	Your partner get 14.5 point <sup>o</sup>
2 <sup>o</sup>	Choice A <sup>o</sup>	Choice B <sup>o</sup>
	You get 3.9 point <sup>o</sup>	You get 7.5 point <sup>o</sup>
	Your partner get 14.5 point <sup>o</sup>	Your partner get 13 point <sup>o</sup>
3 <sup>o</sup>	Choice A <sup>o</sup>	Choice B <sup>o</sup>
	You get 7.5 point <sup>o</sup>	You get 10.6 point <sup>o</sup>
	Your partner get 13 point <sup>o</sup>	Your partner get 10.6 point <sup>o</sup>
4 <sup>o</sup>	Choice A <sup>o</sup>	Choice B <sup>o</sup>
	You get 10.6 point <sup>o</sup>	You get 13 point <sup>o</sup>
	Your partner get 10.6 point <sup>o</sup>	Your partner get 7.5 point <sup>o</sup>
5 <sup>o</sup>	Choice A <sup>o</sup>	Choice B <sup>o</sup>
	You get 13 point <sup>o</sup>	You get 14.5 point <sup>o</sup>
	Your partner get 7.5 point <sup>o</sup>	Your partner get 3.9 point <sup>o</sup>
6 <sup>o</sup>	Choice A <sup>o</sup>	Choice B <sup>o</sup>
	You get 14.5 point <sup>o</sup>	You get 15 point <sup>o</sup>
	Your partner get 3.9 point <sup>o</sup>	Your partner get 0 point <sup>o</sup>
7 <sup>o</sup>	Choice A <sup>o</sup>	Choice B <sup>o</sup>
	You get 15 point <sup>o</sup>	You get 14.5 point <sup>o</sup>
	Your partner get 0 point <sup>o</sup>	Your partner get -3.9 point <sup>o</sup>
8 <sup>o</sup>	Choice A <sup>o</sup>	Choice B <sup>o</sup>
	You get 14.5 point <sup>o</sup>	You get 13 point <sup>o</sup>
	Your partner get -3.9 point <sup>o</sup>	Your partner get -7.5 point <sup>o</sup>
9 <sup>o</sup>	Choice A <sup>o</sup>	Choice B <sup>o</sup>
	You get 13 point <sup>o</sup>	You get 10.6 point <sup>o</sup>
	Your partner get -7.5 point <sup>o</sup>	Your partner get -10.6 point <sup>o</sup>
10 <sup>o</sup>	Choice A <sup>o</sup>	Choice B <sup>o</sup>
	You get 10.6 point <sup>o</sup>	You get 7.5 point <sup>o</sup>
	Your partner get -10.6 point <sup>o</sup>	Your partner get -13 point <sup>o</sup>
11 <sup>o</sup>	Choice A <sup>o</sup>	Choice B <sup>o</sup>
	You get 7.5 point <sup>o</sup>	You get 3.9 point <sup>o</sup>
	Your partner get -13 point <sup>o</sup>	Your partner get -14.5 point <sup>o</sup>
12 <sup>o</sup>	Choice A <sup>o</sup>	Choice B <sup>o</sup>
	You get 3.9 point <sup>o</sup>	You get 0 point <sup>o</sup>
	Your partner get -14.5 point <sup>o</sup>	Your partner get -15 point <sup>o</sup>

Figure 1. Questions in Game 3 (Cont'd.)

13 <sup>a)</sup>	Choice A <sup>a)</sup>	Choice B <sup>a)</sup>
	You get 0 point <sup>a)</sup>	You get -3.9 point <sup>a)</sup>
	Your partner get -15 point <sup>a)</sup>	Your partner get -14.5 point <sup>a)</sup>
d)		
14 <sup>a)</sup>	Choice A <sup>a)</sup>	Choice B <sup>a)</sup>
	You get -3.9 point <sup>a)</sup>	You get -7.5 point <sup>a)</sup>
	Your partner get -14.5 point <sup>a)</sup>	Your partner get -13 point <sup>a)</sup>
d)		
15 <sup>a)</sup>	Choice A <sup>a)</sup>	Choice B <sup>a)</sup>
	You get -7.5 point <sup>a)</sup>	You get -10.6 point <sup>a)</sup>
	Your partner get -13 point <sup>a)</sup>	Your partner get -10.6 point <sup>a)</sup>
d)		
16 <sup>a)</sup>	Choice A <sup>a)</sup>	Choice B <sup>a)</sup>
	You get -10.6 point <sup>a)</sup>	You get -13 point <sup>a)</sup>
	Your partner get -10.6 point <sup>a)</sup>	Your partner get -7.5 point <sup>a)</sup>
d)		
17 <sup>a)</sup>	Choice A <sup>a)</sup>	Choice B <sup>a)</sup>
	You get -13 point <sup>a)</sup>	You get -14.5 point <sup>a)</sup>
	Your partner get -7.5 point <sup>a)</sup>	Your partner get -3.9 point <sup>a)</sup>
d)		
18 <sup>a)</sup>	Choice A <sup>a)</sup>	Choice B <sup>a)</sup>
	You get -14.5 point <sup>a)</sup>	You get -15 point <sup>a)</sup>
	Your partner get -3.9 point <sup>a)</sup>	Your partner get 0 point <sup>a)</sup>
d)		
19 <sup>a)</sup>	Choice A <sup>a)</sup>	Choice B <sup>a)</sup>
	You get -15 point <sup>a)</sup>	You get -14.5 point <sup>a)</sup>
	Your partner get 0 point <sup>a)</sup>	Your partner get 3.9 point <sup>a)</sup>
d)		
20 <sup>a)</sup>	Choice A <sup>a)</sup>	Choice B <sup>a)</sup>
	You get -14.5 point <sup>a)</sup>	You get -13 point <sup>a)</sup>
	Your partner get 3.9 point <sup>a)</sup>	Your partner get 7.5 point <sup>a)</sup>
d)		
21 <sup>a)</sup>	Choice A <sup>a)</sup>	Choice B <sup>a)</sup>
	You get -13 point <sup>a)</sup>	You get -10.6 point <sup>a)</sup>
	Your partner get 7.5 point <sup>a)</sup>	Your partner get 10.6 point <sup>a)</sup>
d)		
22 <sup>a)</sup>	Choice A <sup>a)</sup>	Choice B <sup>a)</sup>
	You get -10.6 point <sup>a)</sup>	You get -7.5 point <sup>a)</sup>
	Your partner get 10.6 point <sup>a)</sup>	Your partner get 13 point <sup>a)</sup>
d)		
23 <sup>a)</sup>	Choice A <sup>a)</sup>	Choice B <sup>a)</sup>
	You get -7.5 point <sup>a)</sup>	You get -3.9 point <sup>a)</sup>
	Your partner get 13 point <sup>a)</sup>	Your partner get 14.5 point <sup>a)</sup>
d)		
24 <sup>a)</sup>	Choice A <sup>a)</sup>	Choice B <sup>a)</sup>
	You get -3.9 point <sup>a)</sup>	You get 0 point <sup>a)</sup>
	Your partner get 14.5 point <sup>a)</sup>	Your partner get 15 point <sup>a)</sup>
d)		

subject ( $x$ ) and an amount to the partner ( $y$ ). Following Park (2000), we set up the pairs of amounts of points so that  $x^2 + y^2 = 15^2$ . Each subject was told that his total points would be the sum of the amount he kept for himself and the amount his partner gave to him. For example, in the case of Question 1, i) if a subject chooses Choice A and his partner chooses Choice A, both he and his partner receive 15 points, ii) if a subject chooses Choice A and his partner chooses Choice B, he receives 14.5 points and his partner receives 18.9 points, iii) if he chooses Choice B and his partner chooses Choice A, he receives 18.9 points and his partner receives 14.5 points, and iv) if he chooses Choice B and his partner chooses Choice B, both he and his partner receive 18.4 points.

We use each subject's allocation of points, calculate the tangent/vector, and classify him into one of 5 groups. In general, subjects with observed vectors lying between degrees  $-112.5$  and  $-67.5$  are classified as *aggressive* (or *Type 5*), subjects with vectors between  $-67.5$  and  $-22.5$  are classified as *competitive* (or *Type 4*), subjects with vectors between  $-22.5$  and  $22.5$  are classified as *individualistic* (or *Type 3*), subjects with vectors between  $22.5$  and  $67.5$  are classified as *cooperative* (or *Type 2*), and subjects with vectors between  $67.5$  and  $112.5$  are classified as *altruistic* (or *Type 1*). See Figure 2 for these classifications.

The second game is a PGG. It is important to investigate the relationship between preferences and behavior. In this game, each subject became a member of a group that consisted of 4 subjects. Each member decided how much he would contribute for a public/group project and how much he would use for herself/himself. In other words, in this game, he divided his money for two different purposes. This time, the amount of money was PHP 300: PHP 1 was approximately equal to JPY 2.5.<sup>6)</sup> The members

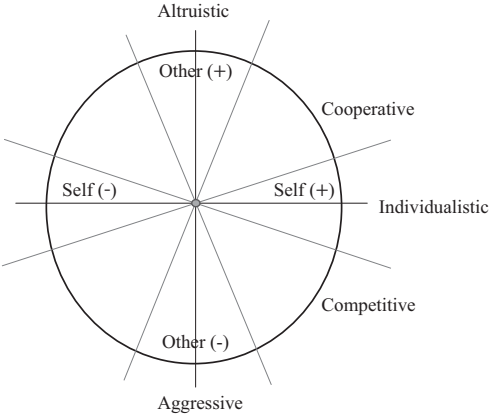
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6) PHP denotes the currency unit of the Philippines: the Philippine peso.

were chosen randomly. In addition, each member did not exactly know the other members of the group. The contribution became twice as much as the sum of the contribution by 4 members. Then, the doubled contribution was divided equally for each member of the group. This game was repeated 5 times/rounds in total in each session. They could not carry over the payoff to the next round.<sup>7)</sup>

After the experimental games were finished, we gave a questionnaire survey. We investigated (i) personal attributes, such as age, occupation, and income, (ii) community attributes, such as customs and biodiversity, and (iii) fishing activities, such as species, gears, and the experience of depletion of fish stocks. See Table 1 for the summary statistics of some of those personal and community attributes.

**Figure 2. Type Classification**



(Park, 2000, Figure 1, pp.409, and Offerman, 1996, Figure 1, pp.823)

7) After all of the survey were finished, we paid the reward to each subject: the amount was different among subjects depending on the records of the experimental games.



**Table 1. Summary Statistics of Questionnaire Survey**

	Maximum	Minimum	Average	Median	Stdev
Age	66	13	40.548	42	14.126
Monthly Income (PHP)	30000	875	6190.726	5000	5264.313
Educatoion (Years)	14	1	8.081	9	2.638
Fishing Area (distance, km)	640	0.02	67.857	18	121.044
Fishing Experience (Years)	52	0	22.129	19	14.626
Customs	1	0	0.629		
Migratory	3	1	2.623		

- Customs and Migratory are community attributes. The variable of *customs* is equal to 1 (0) when a subject answers that the community he belongs keeps (does not keep) traditional customs. The variable of *migratory* is equal to 3 (2) when a subject answers that many (some) people in his community historically migrated from the other areas, and equal to 1 when a subject answers that local people are basically indigenous.

- Basically, the sample number is 62. However, we observed some NAs. Thus, the sample number for Fishing Area is 57, and that for Migratory is 61.

### 3. Results

#### 3.1 Personal Attributes and Social Preference

We first examine the relationship between personal attributes and social preference. In particular, we focus here on *education*, *fishing experience*, and *income*. As the variable that represents the education level, we adopt the number of years that each subject received education. The minimum is 1, which implies that the fisher dropped out after he finished a first-year education at an elementary school. The maximum is 14, which implies that the fisher graduated from a two-year college. Fishing experience is the number of years that each fisher has been engaging in fishing activities. Moreover, we use monthly household income.

First, let us focus on the types of subjects. We classify the types of subjects according to the criteria noted in the previous section. We have 7 altruistic, 12 cooperative, 13 individualistic, 4 competitive, and 2 aggressive samples. This time, we have 24 samples that cannot be classified into any

of these 5 types. The vectors of 17 subjects are between 112.5 and 180, and those of 7 subjects are between  $-180$  and  $-112.5$ . We define the former subjects as *Type 0* and the latter subjects as *Type 6*.

We conducted a multinomial logit analysis for estimating the relationship between personal attributes and types. The result is shown in Table 2(a). In this estimation, Types 0 and 6 are excluded. It is verified that education influences the social preference of fishers. The more education a fisher received, the more likely it is that he is cooperative/altruistic rather than aggressive. On the other hand, there is no clear relationship between fishing experience and types.

We also conducted statistical tests to check the differences between types. To this end, we divided subjects of Types 1, 2, 3, 4, and 5 into two groups. The first group consists of altruistic and cooperative subjects and the second group consists of individualistic, competitive, and aggressive subjects. Table 2 (b) shows the results of both Mann-Whitney test and t-test. Both tests reveal that there is a significant difference in education between the two groups. Additionally, the t-test reveals that there is a significant difference in income between the two groups. The results imply that the income and education of the first group (altruistic and cooperative) are higher than those of the second group (individualistic, competitive, and aggressive).

Moreover, we examined the characteristics of Type 0 and 6. Although we do not show the statistical results, there is no significant difference between Type 0 and 1 when focusing on education level and income. On the other hand, there is a significant difference in income between Types 5 and 6 according to t-test: the average income of Type 6 subjects is higher than that of Type 5. There is also a significant difference in education between Type 0 and 6 according to the t-test: the education level of Type 6 is lower than Type 0. These results for Types 0 and 6 are interesting. A fisher

**Table 2(a). Estimation Results for Types (Multinomial Logit)**

Type	Type 1	Type 2	Type 3	Type 4
Education	0.730 (1.619)	0.792 (1.796)	0.615 (1.421)	0.587 (1.256)
Experience of Fishing	0.075 (0.868)	0.078 (0.916)	0.100 (1.182)	0.087 (0.986)
Constant	-5.081 (-1.420)	-5.133 (-1.492)	-4.022 (-1.214)	-4.701 (-1.260)

- Log-likelihood is -50.887
- The values in the parentheses are z-values.
- The reference category is Type 5.

**Table 2(b). Difference between Altruistic/Cooperative and Individualistic/Competitive/Aggressive**

	Mann-Whitney	t-test
Income	0.122	0.056
Education	0.099	0.734

- The values are p-values.

**Table 2(c). Estimation Results for Cooperative/Altruistic**

Dependent Variable	NQSUM
Education	0.211 (1.528)
Experience of Fishing	-0.048* (-1.939)
Constant	12.352*** (8.992)
Adjusted R-squared	0.076
F-statistic	0.037

- NQSUM: The number of questions in which a Choice that maximizes the sum of the points is chosen.
- The values in the parentheses are t-values.
- The superscripts \*\*\*, \*\*, and \* indicate statistical significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

whose income is high but whose education level is low is likely to be Type 6. On the other hand, in answering the questions of the social preference game, Type 0 behaved as Type 1 did. Moreover, compared with Type 1, Type 0 subjects possibly sacrificed themselves to a greater degree.

Second, using all of the samples, including Types 0 and 6, we examine the relationship between personal attributes and the number of questions that each subject chose so that the total points were maximized. The result is shown in Table 2(c). In this case, fishing experience has a significantly negative effect on the social preference: the more experience a fisher has, the more likely it is that he has less preference for cooperation. Although we also examined the number of questions that each subject chose so that the partner's points were maximized, we did not obtain any significant results.

### 3.2 Social Preference and Cooperative Behavior

Now let us consider the relationship between social preference and cooperative behavior. In this paper, we use the contributions in the PGG to extract the behavior of subjects in a situation in which non-cooperative behavior is rational. Having observed the results of the PGG, we find an interesting trend with regard to the contributions of subjects. As we did in the previous section, we divided all subjects into two groups: the group of altruistic and cooperative, and the group of individualistic, competitive, and aggressive. The average contribution of subjects of each group is shown in Table 3(a). Except for the second round, the average contribution of the latter group was larger than that of the former group. Moreover, the average contribution of the latter group increased as time passed. On the other hand, the average contributions of the former group in the last two rounds were greater than those of the second and third rounds. The trend of the altruistic/cooperative group is a relatively normal one in terms of rationality.

On the other hand, the behavior of individualistic/competitive/aggressive subjects does not seem to be rational.

We also conducted an estimation by the ordinary least-squares method. The dependent variable is the contribution for the group project. In addition to personal attributes used in the previous section, we add one community-attribute variable: *migratory*. This variable is equal to 3 (2) when a subject answers that many (some) people in his community historically migrated from the other areas, and equal to 1 when a subject answers that local people are basically indigenous. We also add a type dummy that is equal to 1 when a subject is classified into altruistic or cooperative. The results are shown in Table 3(b).

When we focus on the first round, it is verified that fishing experience and migration have significant effects on the contribution for the group project. The more experience a fisher has, the greater is his contribution. This result is interesting when compared with the result of the social preference. In the previous section, we obtain a negative effect of fishing experience on the preference for cooperation. However, when directly observing the behavior, fishing experience positively affects cooperative behavior. One possible story is as follows. The more experience a fisher has, the more likely it is that he considers his own benefit. In other words, he became a true fisher because fishers originally think about their own hauls. However, they have also learned that cooperation among fishers often benefits themselves in the future because cooperation avoids the depletion of resource stocks. Thus, they are able to behave cooperatively.

The migratory level has a negative effect on the contribution: the more migratory people of the community are, the less a fisher who belongs to the community contributes for the group project. This result is intuitive and reveals that the ties among local people through long-time relationships among neighbors are important for occurrence of cooperative behavior.

Type dummy also has a negative effect on the contribution. The possible reason is that education and income influence the contributions through social preference.

Although we cannot find any significant relationships between dependent and independent variables in the other rounds, the results of both Tables 3(a) and 3(b) reveal that a high preference for cooperation does not necessarily lead to highly cooperative behavior. For example, a higher

**Table 3(a). Avereage Contribution for Group Projects**

	Types 1/2	Types 3/4/5
Round 1	127.368	151.579
Round 2	160	149.474
Round 3	151.579	177.895
Round 4	134.737	186.316
Round 5	135.789	184.211

**Table Table 3(b). Estimation Results for Cooperative Behavior**

Dependent Variable	PGG-R1	PGG-R5
Education	-2.085 (-0.693)	-1.923 (-0.463)
Fishing Experience	1.002* (1.877)	0.938 (1.271)
Monthly Income	0.002 (1.178)	-0.000 (-0.414)
Migratory	-20.295* (-1.907)	-4.235 (-0.288)
Type 1/2 dummy	-30.061* (-1.746)	-39.571 (-1.663)
Constant	200.367*** (5.353)	193.699*** (3.744)
Adjusted R-squared	0.146	0.038
F-statistic	3.084	1.480

- The values in the parentheses are t-values.
- The superscripts \*\*\*, \*\*, and \* indicate statistical significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

education level is able to give rise to a higher preference for cooperation. However, at the same time, people with a higher education level behave more rationally than people with a lower education level do. Thus, it is possible that there is no clear difference in observed cooperative behavior between people with high and low education levels.

#### 4. Concluding Remarks

Using the data from the field experiments carried out in the fishing villages of Palawan Island in the Philippines, we extracted the social preference and cooperative behavior fishers. We also used data from a questionnaire survey that extracted the personal and community attributes of fishers/subjects.

First, we found interesting results about the relationship between personal attributes and social preference. It is verified that the more education a fisher received, the more likely it is that he would be cooperative/altruistic rather than aggressive. Mann-Whitney and t- tests also reveal that education and income influence the social preferences of fishers. It is also verified that fishing experience has a significantly negative effect on social preference: the more experience a fisher has, the more likely it is that he has less preference for cooperation.

Second, the results about cooperative behavior are also interesting. The behavior of altruistic/cooperative fishers is rational while that of other types of fishers is not rational. It is verified that the more experience a fisher has, the more likely it is that he will behave cooperatively. The migratory level has a negative effect on the contribution: the more migratory people of the community are, the less a fisher who belongs to the community contributes to the group project.

The sample size we used in this paper is relatively small. Therefore, this analysis can be considered as the first step for achieving our goal. In fact,

we have already conducted similar experimental and questionnaire surveys in Mindanao (the Philippines) and three areas in Indonesia. Combining all of these experimental data, we believe that we will obtain robust results.

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