On the Determinants of Risk and Pro-Social Preferences and their Role in Cooperation under Social Uncertainty

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Abstract

Managing common resources on local level based on voluntary cooperation is challenging since resource users face a conflict between immediate self-interest and longer term community interest. The aim of current research is to gain understanding into how social norms of cooperation can be preserved in times of increased resource scarcity and uncertainty. This study focusses on two main questions: (1) How does prior exposure to resource scarcity and environmental change determine risk and pro-social preferences and (2) to what extent can risk and pro-social preferences explain cooperative behaviour a situation involving social uncertainty. We conduct a lab-in-the-field experiment in 21 villages in Cambodia, where water and fishery governance relies largely on non-binding agreements. Determinants of risk and pro-social preferences are established by coupling decisions in economic games to survey items on their experiences of resource scarcity and environmental change. Second, survey answers, risk- and pro-social preferences are used as predictor variables to see if they explain cooperation in an unconditional public goods game and a threshold public goods game. The threshold public goods game adds an element of strategic uncertainty to the game, creating a situation of social uncertainty. Results show that risk aversion and pro-social preferences are to some extent determined by experiences of scarcity and shocks. Moreover, multiple factors explain cooperation in the unconditional public goods game whereas in the threshold game only pro-social preferences and information framing explain cooperation. This indicates that individuals adapt their cooperative behaviour to the situation and preferences alone are not sufficient to explain cooperative behaviour.

Content

1. Introduction

Over the last decades, governments in developing countries have been transferring resource management responsibilities to local communities (Araral, 2009). The reasoning behind this decentralization is that local common-pool resources are best managed by the resource users themselves due to their local knowledge (Andersson & Ostrom, 2008). In addition, decentralization policies are claimed to be more efficient, increase participation level and lower in organization costs (Agrawal & Gupta, 2005). Despite the advantages of decentralized resource management, it remains a challenge to govern natural resources due to the complex interaction between natural, socio-economic and institutional processes (Andersson & Ostrom, 2008). Natural resources that are common-pool, such as fisheries and river basins, are particularly challenging since these resources are characterized by rivalry of consumption and difficulty of exclusion (Araral, 2009). For example, when one person decides to harvest a fish, this fish is not available anymore to the rest of the community and excluding others from appropriating a fish is difficult or costly. The benefits of consuming the resource are private and immediately, whereas the benefits of conserving the resource are public and deferred. This means there is a conflict between immediate self-interest and longer term community interest, also called a social dilemma (Van Lange et al., 2013).

The conflict between self interest and collective interest is most salient when a society faces a resource crisis (Van Vugt & Samuelson, 1999). In this situation there is a need for conservation, while at the same time individuals may be motivated to benefit from the resource while it is still possible. At present, societies around the world are already facing problems regarding the availability of natural resources (United Nations Department of Economic and Social Affairs, 2013). In the future, resource availability may decline due to changing consumption patterns, worldwide population growth and an absolute loss in the availability of natural resources. While resource availability continues to decline, demand for natural resources increases (Matthew, 2008). This discrepancy between demand and supply for natural resources causes a situation of scarcity. Resource scarcity can affect the likelihood of collective action, however, little agreement exists on the nature of this effect (Araral, 2009). The overall aim of current research is to gain understanding into how social norms of cooperation can be preserved in times of increased scarcity and environmental change. More specifically, Cambodia is the background upon which we study the social norm of cooperation since Cambodia is expected to deal with less water availability and more resource scarcity in the future (Nhim et al., 2018).

Earlier research obtained mixed results about the effect of resource scarcity on cooperative behaviour (Prediger et al., 2013). On the one hand, it is often believed that resource scarcity will cause an increase in the willingness to cooperate for a mutually beneficial outcome. For example, Wolf (1998) found support for existence of willingness to cooperate in times of scarcity. He studied historical water conflict datasets and found that overall, shared interests along a waterway seemed strong enough to induce cooperation instead of violent interventions. On the other hand, scarcity might activate a more competitive orientation which promotes the advancement of one's own welfare and guides an individual towards selfish behaviour (Roux et al., 2015). Varghese et al., (2013) provide empirical support of this claim. Their research shows that the absence of sufficient water sources, induces more (unsustainable) groundwater abstraction. This indicates appropriation behaviour in times of scarcity.

According to Biel & Gärling (1995) egoistic individuals fail to cooperate in a social dilemma because they perceive the consequences of cooperation as an uncertain benefit, whereas defection is viewed as a sure gain. The term egoistic individual refers to a type of person, or a trait, which is fixed. On the other hand, cooperative behaviour is often assumed to

be adaptable to the situation or conditional to the behaviour of others (Boyd & Richerson, 2009). According to Bergmüller et al., (2010), cooperative behaviour is less flexible than expected and individuals show consistent differences in type of cooperative and non-cooperative behaviour. Feedback mechanisms by the (social) environmental might further promote the persistence of different behavioural types. Moreover, Bergmüller et al., (2010) highlight the importance of studying individual tendencies to cooperate in various environments and social circumstances.

Cooperation in a social environment can be perceived as risky due to social uncertainty. In a situation with social uncertainty, actors have incomplete information about the behaviour of others. This means that one is at risk of being taken advantage of if they decide to cooperate for collective interest while others show defection. Therefore, cooperation preferences for the collective good might be affected by risk preferences of individuals (Teyssier, 2012). Preferences refer to an individuals' predisposition towards certain behaviour and outcomes based on the expected utility derived from this behaviour (Everett et al., 2015).

Besides risk preferences, pro-social preferences might play an important role in the decision to cooperate for the collective good (Teyssier, 2012). Pro-social preferences refer to other-regarding preferences that take the well-being of others, fairness and reciprocity into account (Everett et al., 2015). It has become the accepted paradigm that humans have pro-social preferences that lead to higher levels of cooperation than expected for a profit maximizing individual (Burton-Chellew & West, 2013). At present, little is known about the determinants of preferences and how they are formed by events and circumstances in real life (Dietrich & List, 2013). Jang & Lynham (2015) suggest that pro-social preferences are partly shaped by work environments and institutions. Current research goes deeper into understanding how individual preferences are shaped by real life circumstances and to what extent individual preferences are able to explain differences in cooperative behaviour.

More specifically, in this paper we analyse to what extent prior exposure to resource scarcity and shocks affect risk and pro-social preferences. Second, we will analyse what explains cooperation in a public goods game using risk and pro-social preferences as predictor variables. In addition, we use risk and pro-social preferences to explain cooperation in a threshold game involving strategic uncertainty, creating a situation with social uncertainty. For this purpose, we conduct a lab in the field experiment among rural inhabitants of Cambodia where resource management relies largely on informal community agreements that stimulate the social norm of cooperation.

2. Literature Overview

2.1 Pro-Social Preferences

Social norms of cooperation are often studied in a situation involving a social dilemma. In the laboratory, a social dilemma is often simulated by using a public goods game. The dilemma in a public goods game is that it is socially optimal if everyone contributes to the public good, but that you maximise your own payoff by free riding. Standard economic theory suggests that defection is the most rational thing to do in a social dilemma for profit maximizing individuals (Fehr & Leibbrandt, 2008). However, empirical evidence shows that many individuals are willing to cooperate voluntarily to a public good to some extent. Typically, individuals contribute between 40-50 percent of their endowment to the public fund (Ledyard, 1995).

Pro-social preferences are assumed to partly explain the higher than expected contribution levels based on standard economic theory (Burton-Chellew & West, 2013). The concept of pro-social preferences is based on the notion that individuals care about the well-

being of others (Meier, 2006). Moreover, the utility of others can have a positive effect on one's own utility since individuals are able to enjoy the well-being of others, have inequality aversion or because helping produces a 'warm glow' (Andreoni, 1995).

Burton-Chellew & West (2013) conducted an experiment to test whether pro-social preferences are able to explain the higher than expected voluntary contributions to the public fund. They analysed how cooperation varies in a public goods game depending on the information participants receive about the consequences of their behaviour on others. Results show that individuals cooperate at similar levels, independent of the information they receive. Furthermore, increased awareness of how cooperation would benefit others even led to a reduction in the level of cooperation. This finding shows that pro-social preferences are not sufficient to explain the higher than expected level of cooperation in public goods games. According to Fischbacher & Gächter (2010) preferences alone are not sufficient to explain contribution level, beliefs about the contribution of others must also be taken into account. Beliefs are important since it might influence one's contribution behaviour. For example, if a participant believes that other group members will not contribute to the group fund, he might be inclined to reduce or stop his contributions too due to the risk of being taken advantage of.

Some researchers explain the fragility of cooperation by the existence of a certain type of pro-social preferences, namely conditional cooperation (Fischbacher & Gächter 2010). Conditional cooperators contribute to the public good if they observe or believe that other group members contribute too (Chaudhuri, 2011). Croson (2007) finds a correlation between what subjects believe that others contribute and their actual contribution in a public goods game, thereby supporting the existence of conditional cooperative preferences. However, Fischbacher & Gächter (2006) state that a correlation between belief and contribution is an imperfect indicator for preferences since a pessimistic cooperator and a free rider may exhibit the same behaviour for different reasons. In order to overcome this issue, they test the role of pro-social preferences in a one-shot game by asking subjects how much they want to contribute to the public good, conditional to the average contribution of other group members. By revealing the contribution of others, the risk of being taken advantage of is eliminated. Therefore, this provides a measure of cooperative preferences unaffected by strategic uncertainty, i.e. uncertainty about how others behave. Furthermore, Fischbacher & Gächter (2006) elicited contribution to the public good in a second experiment where participants made actual contribution decisions in a standard public goods game. Results show that cooperative preferences and actual contributions are highly consistent with each other. This framework allows for the establishment of different types of cooperative players.

In research of Fischbacher et al., (2001), 50 percent of the participants is classified as conditional cooperators, whereas 30 percent of the subjects is classified as free riders. Depending on game context and criteria, these values vary for different versions of public goods games (Kuzban & Houser 2001). Besides game context, cultural differences might influence the distribution of cooperative behavioural types. Kocher et al., (2008) investigated whether the existence of conditional cooperation is similar across three different continents. Results show that conditional cooperation is present in the United States of America, Australia and Japan but that the distribution of types of players varies across countries. This raises the question about the reason behind the observed differences in the distribution of cooperative behavioural types. The next subsection highlights some of the previous work on the determinants of pro-social preferences and cooperative behaviour.

2.2 Determinants of Pro-Social Preferences

The extent to which people are willing to cooperate varies across local cultures and economic environments (Henrich et al., 2001). One possible explanation for this difference is the existence of local social norms. These are patterns of behaviour that are based on shared

beliefs about how individuals ought to behave in a certain situation. Social norms arise within a (local) society and adapt to the local situation (Gneezy et al., 2015). For example, environmental pressure might have an influence on local cooperation norms. Some evidence that supports this idea is provided by Gneezy et al. (2015), who investigated two groups of fishermen that are forced by nature to either collaborate (sea fishermen) or work individually (lake fishermen). Due to the harsh conditions at sea, e.g. strong currents, and larger types of fish, sea fishermen need heavy fishing instruments that can only be handled by more than one person. Therefore, sea fishermen work on larger fishing boats in groups of two to eight people. In contrast, lake fishermen use lighter fishing equipment and small boats which makes it more efficient to work individually. Fishermen from both societies took part in several economic experiments, including the public goods game. Results show strong behavioural differences between the two fishing societies. Sea fishermen are significantly more cooperative, have more trust in others and possesses a better ability to coordinate risky activities. This indicates that situational factors influence one's cooperative preferences.

Another study that uses a public goods experiment to assess the relation between social norms, environmental context and cooperation is done by Ockenfels & Weimann (1999). This research is conducted seven years after the reunification of East and West Germany. Participants from former Eastern Germany are raised in a socialist planned economy while participants from the West are raised in a market-oriented environment. All participants played a standard public goods game in groups of five. After ten rounds of the public good game, subjects are instructed to play the game for a second time in different groups. The five players who invested the most in the public fund over the last ten games are grouped together to play the public goods game again (the cooperative group). The remaining five less cooperative participants form the other group. Participants are informed about the group they are in. Results show that Eastern subjects contribute significantly less to the public fund in comparison to the Western subjects. Moreover, information about the type of group (cooperative versus less-cooperative) does not have an effect on cooperation level for Western nor Eastern participants. Western subjects significantly reduce their contributions to the public fund after being pooled in the less cooperative group. In contrast, Eastern participants increase their contributions. However, Eastern participants still contribute less of their endowment relative to Western participants. One of the proposed reasons for this result is that Eastern subjects grew up in a socialist system where extra individual effort to expand production was not rewarded, therefore increasing the incentive to free ride on group efforts. It is possible that this situation led to the development of a coping strategy that is a bit more egoistic, leading to less cooperative behaviour in a group setting. Though this is a post hoc explanation, the key point here is that cooperation levels in various settings are different and that cooperative behaviour seems to depend strongly over culture-specific norms resulting from different socio-economic histories.

Other research that investigates environmental influences on cooperative preferences is conducted by Prediger et al., (2013). In their study, the main question is to see to what extent resource scarcity in real life affects behaviour of common-pool resource users. In addition, they test for the co-existence of two different behavioural strategies within one individual. They measure antisocial behaviour (spite) by using the joy-of-destruction game (JoD) and an unconditional public goods game to study cooperation. In the JoD game, a subject has to decide whether or not to reduce their (anonymous) partner's income at their own cost. They use a within-subject design to analyse a subject's behaviour across these games in order to see if their behaviour towards other players is consistent in two different experimental games. This study is conducted with pastoralists in Namibia. Resource scarcity is measured by average seasonal biomass production divided by population density of that area, resulting in higher and lower yield areas. They compared cooperation levels of

pastoralists living in areas that suffered high or low resource scarcity. Results show that levels of cooperation are very similar in both areas. This indicates that resource scarcity does not necessarily hamper cooperation rate, at least when scarcity does not reach sub-survival level. In contrast, there is a higher incidence of anti-social behaviour in areas that suffer high resource scarcity. Interestingly, the within-subject analysis showed that individuals that display spite behaviour in the JoD game, tend to behave more cooperatively in the unconditional public goods game, indicating that pro-social and anti-social behaviour co-exist within one individual.

One possible explanation for the existence of different behavioural strategies within one person is that both absolute and relative payoff considerations matter when individuals make decisions in different contexts. In the unconditional public goods game, high net gains from mutual cooperation might trigger absolute payoff considerations whereas the conflicting environment of the JoD game might trigger concern for relative outcomes since participants are at the risk of being threated in a bad way (Prediger et al., 2013). Individuals might expect the partner to destroy their money and act upon this expectation by destroying their partners' money too (Abbink & Sadrieh, 2009). Not knowing what others will decide and the fear of being taken advantage of might be an important driver behind the decision to cooperate or not. Teyssier (2012) suggest that besides pro-social preferences, risk preferences are important determinants of contributions to a public good. Therefore, the next subsection describes previous research on the role of risk preferences in cooperative behaviour.

2.3 Determinants of Risk Preferences

Decision making under uncertainty is characterized by risk since not all possible outcomes are equally desirable (Moschini & Hennessy, 2001). Risk preferences refer to the attitudes that individuals hold towards risk. Typically, risk preferences range from risk averse, risk neutral to risk seeking. Risk taking behaviour might be motivated by the perceived size of the risk and the benefits or returns from taking the risk. Decisions on risk taking behaviour are the result of deliberative and affective evaluations of choice options which vary in specific situations (Figner & Weber, 2011). Risk preferences help us understand why people insure and save (Bohnet et al., 2008). For example, risk aversion determines, to a large extent, how farmers will respond to water conservation policies (Groom et al., 2008). When resources become more scarce, are people inclined to save for the future or go for immediate gains now?

According to Fox & Tannenbaum (2011), the amount of risk that people take is determined by individual and situational factors. Situational factors are external factors that influences the individual. These factors may arise from the environment or other people. The most fundamental environmental influences that are associated with the development of behavioural strategies regarding risk, are the harshness and unpredictability of the environment (Ellis et al., 2009). The experience of environmental shocks might have an impact on behavioural strategies involving risky decisions. For example, Harrison et al., (2005) found evidence that individuals in rural areas of India and Ethiopia have an underweighting of probabilities. In this case, this means that when the participants are told that the outcome has a 50 percent chance of occurring, they behave as if the chance is as low as 10 percent. The authors speculate that general economic conditions and the experience of droughts in those areas could possibly account for the pessimism about uncertain events. Further support for the effect of environmental harshness on risk preferences comes from Cameron & Shah (2015). They investigated how prior exposure to a natural disaster affects risk taking behaviour. They conducted a study in rural Indonesia and found that people who

have experienced a natural disaster in the past three years, show higher levels of risk aversion in comparison to individuals who do not have this experience.

In rural developing communities, risks are more prevalent in comparison to the developed world because rural economies are characterized by a relatively high frequency of environmental hazards and periods of scarcity. In addition, in poor rural areas, household are often sustained by a business operated by one or more family members, for example, a farm or fishery. These types of businesses are susceptible to environmental changes like droughts or heavy rainfall (Bussolo, 2006). In poor rural areas, community members often rely on informal social ties to insure themselves against the impact of environmental shocks through the function of social capital (Mogues, 2006). Social capital is usually defined as a characteristic of communities described in terms of trust, norms and networks that enable collective action (Bouma et al., 2008). Social networks are an integral part of the risk coping strategies of households, and should be taken into account when investigating economic behaviour in rural areas (Mogues, 2006). Next subsection goes into the role of trust and norms in cooperative behaviour.

2.4 Social Capital and Cooperative Behaviour

Trust is based on the expectation that honest and cooperative behaviour will arise in a community with commonly shared norms (Bouma et al., 2008). Moreover, social norms influences people's preference to cooperate and are therefore important for successful community resource management. In support of that, Anderson et al., (2004) found that agreement with the statement 'most people can be trusted' is strongly associated with higher contributions to the public fund in a public goods game.

Trusting someone in a public goods game is a risky bet, since you are at risk of being the odd one out i.e. contributing to the public fund when other group members are not, or not contributing to the public fund when other group members do. So beliefs about the contributions of others might also play a role in cooperative behaviour. Kocher et al., (2015) analysed the role of beliefs about contribution of others, trust and risk preferences in shaping cooperative behaviour. Results show that risk preferences are not associated with cooperation and trust. Furthermore, beliefs about others' contribution and trust are significantly associated with cooperative behaviour.

In a public goods game, it is possible that one contributes a lot to the public fund because of the believe that others will do the same. On the other hand, it is also possible that one contributes a lot to the public fund due to a low level of risk aversion. Schechter (2007) ran two experimental games with the same payoff but various sources of risk. In the first task, a gambling game, the source of risk came from rolling a die. In the second task, the trust game, the source of risk comes from whether or not the partner decides to return money to sender. Results show that players make different decisions in the gambling game in comparison with the trust game, indicating that the source of risk influences the decision to cooperate. In support of that, Bohnet et al., (2008) differentiate between the source of uncertainty that makes a risk and define two categories. The first, natural risks, are independent of human decisions and caused by a random event, for example, by rolling a die. The second category is defined as social risks, where human beings are the main source of uncertainty. The term risk implies that the distribution of probabilities is known. However, the probability distribution of human decisions is often unknown. Therefore, we prefer to refer to social uncertainty instead of social risk to describe a situation where the cooperative intention of the interaction partner(s) is uncertain (Ishiguro & Okamoto, 2013). In a public goods game, social uncertainty might effect cooperative behaviour since the final outcome of the game depends on the actions of all players. The next subsection goes into the role of social uncertainty in cooperative behaviour.

2.5 Cooperation under Social Uncertainty

In this research, we use the more general term social uncertainty to describe situations where actors have incomplete information about the behaviour of others. In game theory, the term 'strategic uncertainty' is used more specifically to refer to uncertainty about the actions *and* beliefs about the actions of others (Morris & Shin, 2002). Assuming that people are aiming for an optimal response based on their expectation about the behaviour of others, this uncertainty leads to various contribution strategies. Standard economic theory predicts that a rational, self interested individual would make the same contribution decision independently of the source of uncertainty that makes the risk (Bohnet et al., 2008). To test this, Bohnet et al., examined to what extent people are willing to take a risk depending on the agent of uncertainty. They conducted two experiments involving different sources of risk but the same expected payoff. In the first task, the trust game, the agent of uncertainty is another person. In the second task, the risky dictator game, a chance device determines the pay-off. Results show that individuals sacrifice more money to avoid being betrayed by another person than to avoid losing a lottery game with the same expected payoff. This means that people are less willing to take a risk in a situation involving decisions of other human beings in comparison to decisions by a device, indicating betrayal aversion. The key point here is that cooperative behaviour in a social setting may be influenced by expectations and beliefs about the behaviour of others.

The threshold public goods game provides an interesting tool to study cooperation in a setting with social uncertainty. In this game, the public good is only provided if the sum of the individual contributions exceeds a certain threshold. If the threshold is not met, contributions will be lost. This type of game differs from the unconditional public goods game in terms of the social and private optimum. In an unconditional public goods game, the social optimum is reached when all the participants show full cooperative behaviour. The private optimum is reached when you invest all your endowment in the private fund, whereas your partner invests all his endowment into the public fund. In a threshold public goods game, there is a more complex equilibrium structure since the threshold can be reached by many different contribution schemes. In the fair social optimum, every group member contributes an equal amount to the public fund, just enough to reach the threshold. The private optimum depends on the decisions of others. Since the contributions of others are not revealed, there is a situation of social uncertainty. Reaching the threshold is a team effort, so a more cooperative player may contribute more than necessary to increase the probability of successful provision (Cadsby et al., 2007).

One of the first threshold experiments is conducted by Van de Kragt et al., (1983). They studied binary (all-or-nothing) contributions in a threshold public goods game. Results show that provision of the public good occurs in all cases if communication between group members is allowed. In contrast, in the absence of communication, participants fail to generate a sufficient number of contributions 35 percent of the time. According to Cadsby & Maynes (1999), continuous rather than binary contributions better represent situations outside laboratory. They studied particularities of the threshold effect by manipulating the size of the threshold, raising reward level and by implementation of a money-back guarantee mechanism in a threshold public goods game with continuous contributions. Results show that raising the reward level substantially encourages contributions. In addition, they found that a high threshold discourages provision in the absence, but not in the presence of a money-back guarantee mechanism. This indicates that participants are more willing to cooperate if potential losses can be reversed.

In social psychology, the effect of various threshold ranges and social uncertainty on contributions in a public good game is investigated by manipulating information that the participants receive. For example, Wit & Wilke, (1998), manipulated the information that

participants receive about the range of possible thresholds. Social uncertainty is manipulated by giving subjects false information about the range of contribution of other group members. Results indicate that a wider range threshold decreases the level of cooperation under high social uncertainty, but not under low social uncertainty. This means that threshold widening (or increasing uncertainty) only decreased cooperation when there is also uncertainty about the contribution of others.

Dannenberg et al., (2011) studied the effect of threshold uncertainty on coordination to prevent a public bad from happening. The success of preventing the public bad was assessed after multiple stages of contribution. They allowed for the possibility to communicate, so players could propose non-binding contribution targets. Results show that threshold uncertainty has a negative effect on success to prevent the public bad. However, if a group shows early signalling of willingness to contribute and contributed equally in the first rounds, it is more likely that they reach an overall high contribution level. So successful collective action varies widely between different groups under uncertainty. The key point here is that fairness and early signs of willingness to cooperate are important factors to increase success level in the presence of uncertainty.

Rustagi et al., (2010) also noted that the composition of a group is decisive for the potential level of cooperation. In their research, they combine data on management outcomes of forest user groups in Ethiopia with experimental measures on pro-social behaviour to find out to what extent variation in pro-social behaviour can account for differences in commons forest management. Based on conditional and unconditional decisions in a public goods game the participants made, they are classified into one of six behavioural types: altruist, conditional co-operators, weak conditional co-operators, hump-shaped contributors, free riders and others. Results show that groups with a larger share of conditional cooperators are more successful in common forest management. This research shows how heterogeneity of individual characteristics within groups has got an effect on the group outcome.

The finding of Rustagi et al., (2010) is particularly valuable because the research is conducted in a field setting. Earlier research is done mostly on student populations that do not know each other. However, in reality, common resources in rural areas are often shared among community members that do know each other. Furthermore, university students differ from rural community members in terms of education and socio-economic status.

3. Research Questions and Hypothesis

The overall aim of current research is to gain understanding into how social norms of cooperation can be preserved in times of increased scarcity and uncertainty. This study focusses on two main questions: (1) How does prior exposure to resource scarcity and shocks determine risk and pro-social preferences and (2) to what extent can risk and pro-social preferences explain cooperative behaviour a situation involving social uncertainty. First, individual risk preferences are established by using a risk elicitation task based on the method of Gneezy & Potters (1997). The unconditional public goods game is used to measure pro-social preferences (Rustagi et al., 2010). Furthermore, decisions in these economic games will be linked to individual answers to survey questions concerning their experiences of resource scarcity and environmental change. Second, survey answers, risk- and pro-social preferences will be used as predictor variables to see if they explain cooperation in an unconditional public goods game and a threshold public goods game. Cooperation is measured in two versions of the public goods games that differ in level of social uncertainty. In the threshold

public goods game, social uncertainty is higher due to a larger group size and the presence of strategic uncertainty.

This lab-in-the-field study allows for research on cooperative behaviour in a situation where community management of common resources is daily business, using a research population other than university students. Furthermore, by coupling individual experiences in real life to behaviour in economic games, this study allows to zoom in on the heterogeneity of preferences and their effect on behaviour. Moreover, this paper adds to existing literature by studying determinants of cooperation in settings that vary in terms of social uncertainty, thereby aiming for gaining insight into the mechanisms behind cooperation. The two main questions are divided into four sub questions:

1. To what extent are risk preferences determined by previous experiences on resource scarcity and environmental change?
2. To what extent are pro-social preferences determined by previous experiences on resource scarcity and environmental change?
3. To what extent do risk and pro-social preferences explain cooperation in a game involving low or higher social uncertainty?
4. To what extent do risk and pro-social preferences determine beliefs about the contribution of others?

The remainder of the paper is organized as follows. Section 4 describes the experimental design and survey followed by the empirical model in section 5. In section 6, results are presented. At last, in section 7 finding are discussed and the conclusion of the paper is given.

4. Experimental Design and Survey

4.1 Study Site

Current research is conducted in three rural communes in Cambodia among local fishermen and farmers. Cambodia is an interesting field setting because the Royal Government of Cambodia decentralized the management of natural resources to local communities about 20 years ago. Cambodia adopted the national Policy Irrigation Management and Development (PIMD) to stimulate community participation in irrigation water system management (Perera, 2006). From the year 2000 onwards, the responsibility for water operations were devolved to the Farmer Water User Communities (FWUCs). The main responsibilities of this committee consists of development, operation and maintenance of irrigation schemes. In addition, in 2001, the government implemented a policy that allocated fishing lots to local communities (Ratner, 2006).

Since access to water and fish is an institutional right in Cambodia, water and fisheries governance in Cambodia relies largely on informal arrangements of community groups, organized per village. These informal arrangements are important since they stimulate social norms and behaviour, such as cooperation and sharing. At present, Cambodian communities vary in terms of successful local resource management. There are divergent opinions about the FWUC and cooperative behaviour among farmers is not always present, causing potential conflicting situations (Chea et al., 2011).

Cambodia's background of informal resource management arrangements together with uncertainty about resource availability in the future, provides an interesting background to study cooperation in a rural context.

4.2 Experimental Setup

The experimental design of this research consists of four economic experimental tasks and a survey. The economic games are played in the following order: (1) Risk Elicitation Task (RET) for natural risk preferences (2) Unconditional Public Goods Game (UPGG) for cooperation under lower social uncertainty, (3) Conditional Public Goods Game (CPGG) for strategy elicitation without social uncertainty, (4) Threshold Game (TG) for cooperation under higher social uncertainty. Lower and higher social uncertainty in the UPGG and TG means that these games differ in terms of riskiness. The UPGG is less risky since the game is only played by two participants and the content of the public fund is always increased and divided equally between the players. In contrast, in the TG there is a higher risk since this game is played by three players and the public fund is only disbursed if the threshold is reached. Whether or not the threshold is reached, depends on the decisions of other group members and the beliefs about the contribution of others, adding an element of strategic uncertainty to the game.

Each game is a one-shot game, meaning that participants only make one contribution decision. The reason for this type of game is that subjects can only reason about the behaviour of their group members based on their life experiences, and are not influenced by previous game outcomes (Dufwenberg et al., 2011). During and after the experiment, participants are not aware of the identity of other group members to whom they are matched. Moreover, participants are not allowed to communicate during the experimental games. In order to ensure that participants are able to make their contribution decisions privately, card board boxes are put up during the decision making. In order to make the decisions in each game as independent as possible, no feedback is given after each game. Due to possible illiteracy, all instructions are given orally in Khmer and are supported by posters showing a visual representation of the task. The economic games are followed up by an individual structured interview (survey) containing items for assessing background characteristics, experience of resource scarcity and shocks and trust in community.

4.3 Procedure

The experiment is conducted in May 2019 in the province Kampong Chhang, Cambodia. The research took place in 21 villages in three communes; Tuel Phpos, Tank Krasang and Kouk Bonteay. Participants were recruited through the village chief. Only one participant per household was allowed for this research, preferably, but not necessarily the household head.

An experimental session began with an introduction of the research team. The participants are told that this study aims at understanding livelihood improvements such as those related to farming and fishing. Furthermore, they are instructed about the duration and the monetary reward for this research. Participants received a show up fee of 4000 Cambodian Riel (KHR) and 6000 KHR (1000 KHR is about 22 eurocents) for their effort to stay until the end of the meeting. In addition, a contribution decision in one of the economic games is paid out to the individual participant, decided by throwing a dice at the end of all the experimental tasks.

The verbal consent also includes information about the confidentiality and anonymity of the decisions and answers that the participants give. Moreover, subjects are made aware that participation is voluntary and that they can quit at any time without negative consequences. Participants are stimulated to ask questions at all time. After the verbal consent, identity cards are handed out to the participants. If the participants have no further questions, the experimental tasks start. Participants play the four economic games in the following order: RET, UPGG, CPGG and the TG. Before the TG, subjects answered survey questions. Finally, subjects are paid their individual payoff in cash. All instructions are attached in Appendix 5.

4.4 Experimental Tasks

Each of the four economic games contain a few elements that remain unchanged during each game. For each game, the participants receive an endowment of six bills of 1000 KHR, a white and a green envelope. Envelopes are used as a tool for participants to make their contribution decisions. The advantage of using envelopes is that it doesn't require the participants to be literate and it ensures saliency of decisions. Participants can decide to invest their endowment in the white and/or the green envelope. The total payoff in each game is the return from the white and green envelope.

4.4.1 Natural Risk Preferences

The Risk Elicitation Task (RET) is used to give an indication of risk tolerance when the payoff only depends on chance (natural risk). The concept behind RET is based on the risk elicitation method of Gneezy and Potters (1997). This method provides a measure of risk preferences in the context of decision making with monetary payoffs (Charness et al., 2013). Subjects are presented with an investment decision in a risky or a safe asset. The safe asset, the white envelope in this research, returns the invested amount always. For the amount invested in the risky asset, the green envelope, there is a 50 percent chance that the payoff will be tripled or reduced to zero, decided by flipping a coin. If the participant invests x in the risky asset, the expected return is $1.5x$. Therefore, the expected payoff for investing in the risky asset provides a net gain. Risk tolerance is indicated by the decisions that participants make. Individuals with risk neutral or risk seeking preferences are more likely to invest in the risky asset, whereas risk averse participants are more likely to invest in the safe asset. The number of bills invested in the white envelope can be used as an indication of risk aversion. If the participant contributed 6 bills to the white envelope, this indicates that this person is highly risk averse, whereas a contribution of 0 bills indicates no risk aversion at all.

Subjects are given the instructions of RET followed by four examples of how the game is played in practice. To be sure that the participants understood the game, they have to answer two control questions privately on paper. After the control questions, subjects are instructed to distribute the bills to the envelopes according to their own preferences. If RET is randomly selected to be paid out to the participant, the researchers flip a coin to determine whether the investment in the green envelope is tripled or reduced to zero.

4.4.2 Unconditional Public Goods Game

The Unconditional Public Goods Game (UPPG) is used to assess cooperation in a situation with little social uncertainty. In this game, the linear payoff function (π_i) of subject i is indicated with expression (1):

$$\pi_i = 6000 - c_i + 0.75 \sum_{j=1}^{2} c_j \qquad (1)$$

Each subject receives an endowment of 6 bills of 1000 KHR, so the total initial endowment is 6000 KHR. The subjects can decide to contribute (part of) their endowment to the public fund (c_i). The marginal per capita return (MPCR) is 0.75. If MPCR < 1, the dominant strategy for a rational player is to contribute zero to the public fund. The social optimum is reached if all players contribute their entire endowment to the public fund, since MPCR*n >1.

During the actual task, subjects are divided into groups of two community members whose identities remain unknown. Their task is to decide how much of their endowment they want to contribute to the public fund, the green envelope, and how much they prefer to keep in their private fund, the white envelope, by putting the bills in the envelopes. The return of the investment in the private fund is equal to the investment. For every 1000 KHR in the public fund, 500 KHR is added by the researchers. After the increase of money in the public

fund, the total amount of money is divided equally between the two group members. If this game is randomly chosen to be paid out, the participant receives the total return from the private and the public fund.

4.4.3 Conditional Public Goods Game

The Conditional Public Goods Game (CPGG) is used for strategy elicitation when there is no social uncertainty. The strategy elicitation in current research is based on the method used by Fischbacher & Gächter (2001). The linear payoff function for subject *i* in this game is the same as in the unconditional public goods game, see expression (1). The difference between the unconditional and the conditional public goods game is, that in the latter, there is no social uncertainty since the participant has to make a contribution decision conditional on the contribution of the other player.

The task consists of seven succeeding decisions that are formulated as follow: *'Your partner puts out of six bills… (0 to 6) bills in the fund. Now, out of your six 1000 KHR bills, how much would you like to put in the fund?'*. This instruction is repeated seven times where each time the partner contributes one 1000 KHR bill more. After each contribution decision, the envelopes are collected and new envelopes and another set of 6000 KHR are provided to the participants. The strategy of participants in the CPGG is incentivised by making the decision in this game potentially payoff relevant. Following Rustagi et al., (2010) we randomly divide the participants into two groups. From the first group, or first players, we take their unconditional contribution decision in the UPGG. Subsequently, player one is randomly matched to a second participant. For the second player, we take the conditional contribution in the CPGG, based on the unconditional contribution decision of the first player. So for example, if player one decides to contribute 3000 KHR to the public fund in the UPGG, the payoff relevant decision for player two is his conditional contribution to 3000 KHR in the CPGG.

4.4.4 Threshold Game

The Threshold Game (TG) is used to assess cooperative behaviour in a situation with higher social uncertainty. In the TG, there is a higher social uncertainty in comparison to the UPGG since the game is played by three instead of two players. Moreover, in the TG, participants face strategic uncertainty since provision depends on decisions of other group members and their beliefs about the contribution of others, hence creating a situation of higher social uncertainty. In the TG, a minimum amount of contributions needs to be raised by *n* group members for provision of the public good to occur. The individual payoff function π_i in this game is as follows:

$$\pi_{i} = \begin{cases} (E_i - c_i) + 0 & \text{If } \sum_{j=1}^{3} c_j < T \\ (E_i - c_i) + R & \text{If } \sum_{j=1}^{3} c_j \geq T \end{cases} \qquad (2)$$

Where E_i represents the initial endowment, c_i the individual contribution to the public good, R the reward that every player receives if the threshold is met, $\sum_{j=1}^{3} c_j$ is the total amount in the public fund and, T the threshold for provision. The threshold is met if the public fund contains 9000 KHR or more. The threshold cannot be met solely by one participant since their endowment of E_i = 6000 KHR is lower than the required threshold. If the threshold is met, every group member receives a reward of R = 6000 KHR. If not, contributions to the public fund will be lost and participants receive 0 KHR from the public fund. If the public fund contains more money than necessary for provision, provision will still occur. Nevertheless, this extra money will be lost to the contributor(s). The endowment that a participant invests in

the private fund $E_i - c_i$, is always a safe return. If this game is chosen to be paid out, the individual pay-off consists of the return from the private and the public fund.

The TG in this research allows for discrete contribution in steps of 1000 KHR. The fair social optimum is reached if every player contributes 3000 KHR to the public fund. The MPCR to the public good in the social optimum is 2. This strategy is the best response for players who believe that other group members will contribute to the public fund too. It is not necessary that contributions of every individual in a group are equal, since the threshold can also be met with heterogeneous contributions. Half of the participants (n = 147) played the game framed as the Threshold Public Goods Game. In this frame, emphasis is put on the amount of money in the green envelopes (public fund). The other half of the participants (n = 156) played the Threshold Public Bad Game, where the total amount of money in the white envelopes (private fund) was central in the explanation.

In the TG, participants are divided into groups of three players ($n=3$). Before each player made their contribution decision, belief about the contribution of others is elicited. Participants have to guess how much the other two group members will jointly put in the public fund by ticking a box on a paper slip. The paper slip contains 13 options, depicted by bills of 1000 KHR ranging from 0 to 12 bills. To incentivize believe elicitation, subjects receive an additional 1000 KHR if their guess is equal to the actual contribution of the other two group members.

4.5 Survey

The survey questions are used to gain insight into the determinants of risk and pro-social preferences and as control variables. The survey is conducted in the form of a structured interview, since part of the participants might be illiterate. The interview is conducted individually with each participant. Following sections describe the themes that are addressed during the structured interview. A detailed list of the questions used for this research is given in Appendix 6.

4.5.1 Background Characteristics

Respondent characteristics are basic questions to control for demographic variables and to provide an overview of the study population. Questions include: relation to household head, marital status, gender, age, years of schooling and primary occupation.

4.5.2 Experience of Resource Scarcity and Shocks

Experience of resource scarcity and shocks start with asking whether or not their household is engaged in cultivating rice and/or fishing. Moreover, follow-up questions are posed about their experience of scarcity. If participants engaged in farming, the next question is if they had enough water for irrigating their paddy land. For households that engaged in fishing, the follow-up questions were if they had experienced a decline in fish catch over the past five years and whether or not they experienced a collapse of a fish stock in the past five years. Moreover, participants can indicate what they think are the reasons behind their experienced scarcity. Following these questions about scarcity, two general questions about shocks are asked. First whether they experienced a sudden income shock and if they experienced any major natural disasters last year. All questions are based on the recall of events by the participants, therefore giving an indication of the subjective experience of resource scarcity and shocks.

4.5.3 Trust in Community

Trust in collective community action is assessed by three items of the survey. The first question is *'Do you think most people in this community can be trusted?'*. Followed by a

question on community support: *'Do you think most people in this community are willing to help if someone is in need?'.* At last there is a question about community action: *Suppose that 10 of your neighbours are invited to help in community activities (e.g. repairing a dam or canal). How many would show up?'.*

5. Empirical model

5.1 Determinants Risk Preferences

To test to what extent risk preferences are influenced by previous experiences on resource scarcity and shocks, a linear regression model is used:

$$Y_i^R = a + \beta X_i + \varepsilon_i \quad (3)$$

Where Y_i^R represents risk aversion, X_i a vector of variables and ε_i an error term. In total four models are run, each time adding more variables to the model. The fist three models include variables on gender, age, years of schooling, being engaged in fishing, having enough water for irrigation, the experience of an income shock and the experience a natural disaster. At last, Model 4 includes two extra variables on the experience of a catch decline in fish and a collapse of stock which is only used to indicate the determinants of risk aversion for fishers.

It is possible that individual traits are similar for groups within villages because they rely on informal agreements for natural resource governance within community groups, organized per village. Moreover, inhabitants share the same socio-economic background. To ensure robustness, we therefore cluster the standard errors at village level (21 clusters) for each regression model in this paper.

5.2 Classifying Behavioural Types

Strategy elicitation without social uncertainty is measured by assessing the seven decisions that participants makes during the CPGG. For identifying behavioural types, we follow adjusted criteria of Rustagi et al., (2010) based on the Fischbacher Gächter Fehr method (FGF) method (see Fischbacher et al., 2001). Subjects are categorized into five behavioural types: (1) unconditional cooperators; constitute consistently the same amount to the public fund, regardless the partner's contribution. (2) Conditional cooperators; have a contribution that is exactly diagonal to the contribution of the other. Subject fall into this category if the Spearman's ρ is positive and significant at $P \leq 0.001$. (3) Weak conditional cooperators; if the Spearman's ρ is positive and significant at $0.001 < P < 0.05$. (4) Free riders; consistently contribute zero of their endowment, independent of the contribution of the other or contribute at most the smallest positive amount in only one of the seven decisions. (5) Others; all the participants that do not fall within these categories

Based on contribution patterns in the CPGG, participants are classified into five behavioural types. This gave the following results: 23 (8%) unconditional cooperators, 22 (7%) conditional cooperators, 61 (20%) weak conditional cooperators, 0 (0%) free riders and 197 (65%) participants are categorized into the group other. Using this method, the majority of the participants is categorized into the group other, therefore this might not be an optimal method for current population. Fallucchi et al., (2018) points out that in an experimental setting outside the lab and a population other than students the heterogeneity in behavioural responses in a conditional public goods game increases.

An alternative way to the standard approach (FGF) is the hierarchical cluster analysis proposed by Fallucchi et al., (2018). We follow Fallucchi et al. 2018 by using Ward's minimum variance method with the Manhattan distance as a dissimilarity measure. Cluster

analysis matches variables into groups by analysing their similarities to each other. Two contribution strategies are more similar if the distance separating them is smaller. While Fischerbacher et al., (2001) have 4 behavioural types, Rustagi et al. 2010 already extended the behavioural types to 6. Yet, there is no reason to assume that those are the only relevant strategies. Hence, we analyse which number of behavioural types seems appropriate. The coherence within clusters and the number of clusters that can be handled in a meaningful way is always a trade-off. Following the method of Fallucchi et al., (2018), we come to five behavioural types to categorize pro-social preferences: (i) High Unconditional Cooperator (HUC), (ii) Conditional Cooperator (CC), (iii) Medium Unconditional Cooperators (MUC), (iv) Low Unconditional Cooperators (LUC) and (v) Others. For a detailed description of the categorization method, see Appendix 1.

5.3 Determinants of Behavioural Types

The second sub question addresses to what extent pro-social preferences are influenced by previous experiences on resource scarcity and environmental change. As Kocher et al., (2011) do, we use a multinomial logit model to see if there is a relation between the answers that participants gave to the survey questions and behavioural types that are based on the CPGG. More specifically, this model is used to see which factors make it more likely that someone is categorized as a certain behavioural type relative to a reference group. The reference in this analysis is the group 'other'. The coefficients of the model show how variables as risk aversion, gender, age, years of schooling, being engaged in fishing, having enough water to irrigate, the experience of a natural disaster or and income shock, trust and support in community and collective action increase or decrease the likelihood of being classified as a HUC, CC, LUC or MUC.

5.4 Cooperation under Social Uncertainty

The third sub question addresses to what extent risk and pro-social preferences explain cooperation in a game involving low or higher social uncertainty. To test this, two linear regressions are used to assess cooperation in the UPGG and the TG using the following model:

$$Y_i^C = a + \beta X_i + \varepsilon_i \qquad (4)$$

Where Y_i^C represents contribution to the public fund, X_i a vector of variables and ε_i an error term. In total four models are used for both contributions in the UPGG and the TG. The variables are added stepwise. Model 5 includes only risk preferences and behavioural types. Model 6 adds demographics, Model 7 adds variables on trust and support in community and collective action and at last, model 8 includes an interaction term for being engaged in fishing and risk aversion and behavioural types. The regression analysis is the same for cooperation in the UPGG (lower social uncertainty) and the TG (higher social uncertainty). In contrast to the UPGG, where the social optimum is reached by full cooperation by all group members, the fair social optimum in the TG is reached if each group member contributes three bills of 1000 KHR to the public fund. If a participant contributes more than three bills to the public fund, the chance of reaching the target increases. Therefore, in this analysis we assume that a higher contribution to the public fund in the TG means higher levels of cooperation, just as in the UPGG. The only difference between the regressions, is that in the TG analysis, an extra dummy variable on framing treatment is used to control for treatment effect.

5.5 Beliefs

At last, the fourth sub question addresses to what extent risk and pro-social preferences determine beliefs about the contribution of others. To test this, a linear regression on beliefs about the contribution of others in the TG is conducted using the following model:

$$Y_i^H = a + \beta X_i + \varepsilon_i \quad (5)$$

Where Y_i^H represents beliefs about the contribution of others in the TG, X_i a vector of variables including risk aversion, behavioural types, demographics, framing treatment and trust in community support and collective action, and ε_i an error term.

6. Results

6.1 Descriptive Results

A total of 12 subjects are excluded from the dataset before analysis. For nine subjects, survey identities were assigned twice, therefore it was unclear which identity number belonged to which decisions in the experimental tasks. In addition, five survey identities were lost during data transmission. Moreover, due to time restrictions, two participants did not take part in the structured interview. At last, one participant is excluded from the dataset since that player had to leave after the first task. In the final sample, 303 participants are included for the experimental tasks and 282 participants are included for the survey plus the experimental tasks. In total, 21 villages are visited in three communes, Kouk Banteay (n = 113), Taing Krasaing (n = 91) and Tuol Phpous (n = 99). The individual payoff varied, depending on their decisions in the game and on which of the games was randomly chosen to be paid out. The average final earning is about 17000 Cambodian Riel which is equal to 3.75 euro.

Socio-economic characteristics are presented in Table 1. The research population includes 104 males and 177 females. Their age varies between 18 and 80 years old with a mean of 46.1 (SD=13.3) years old. Moreover, half of the participants have had only up to three years of education. The main primary occupation of the subjects is rice farming (85%). About 22 percent of the participants owns farmland. The average size of the farmland is 1.03 hectare (SD = 1.1). Moreover, 63 of the households are engaged in fishing for household consumption and for sale.

Table 1. Socio-Economic Characteristics of Households

Variable	**Characteristics**	**Frequency (%)**
Gender	Male	104 (37%)
	Female	177 (63%)
Age	18 – 33	51 (18%)
	34 – 49	108 (38%)
	50 – 65	104 (37%)
	66 – 81	19 (7%)
Relation to household head	Household head	128 (45%)
	Spouse	121 (43%)
	Child	3 (1%)
	Parent	25 (9%)
	Other relative	5 (2%)
Marital Status	Single	21 (8%)
	Married	231 (82%)
	Divorced	4 (1%)
	Widow(er)	26 (9%)
Years of schooling	0 – 3	141 (50%)
	4 – 7	95 (34%)
	8 – 11	32 (12%)
	12 – 16	12 (4%)
Primary occupation	Rice farmer	239 (85%)
	Fisher	1 (0%)
	Housewife	12 (4%)
	Other	30 (11%)
Primary occupation mother	Rice farmer	200 (71%)
	Fisher	2 (0%)
	Housewife	19 (7%)
	Other	61 (22%)
Primary occupation father	Rice farmer	219 (79%)
	Fisher	3 (1%)
	Other	57 (20%)
Owns farmland	Yes	63 (22%)
	No	219 (78%)
Cultivate rice	Yes	265 (94%)
	No	17 (6%)
Engaged in fishing	Yes	63 (22%)
	No	219 (82%)
Receives remittance	Yes	89 (32%)
	No	193 (68%)
Income through wages	Yes	142 (50%)
	No	140 (50%)
Income through salary	Yes	123 (44%)
	No	159 (56%)

The second part of the survey contains questions about situational factors and experiences of resource scarcity and shocks, see Table 2. About 20 percent of the participants did not have enough water for irrigating. People that experienced this water scarcity rated it as somehow scarce (34%), moderately scarce (23%) or extremely scarce (43%). The number of times that they experienced this water scarcity over the last five years varied widely from 0 to 20 times with an average of 6.11 times (SD = 4.89). Participants have divergent opinions about the cause of water scarcity in their community. About half of the participants mentions drought as the reason for water scarcity. In addition, climate change, people overuse and increasing demand for water are mentioned.

From the 64 participants whose family is engaged in fishing, 54 (86%) experienced a decline in fish catch over the last 5 years. The main reasons that are mentioned are overfishing (17%), illegal fishing (31%) and natural causes (24%). The remaining participants gave a combination of these reasons or had another reason for the decline in fish catch. Moreover, 56 percent of the families that are engaged in fishing experienced a collapse of a certain type of fish over the last five years.

The majority (57%) of the families experienced a sudden drop in income, last year. Crop loss, loss of fishing or agricultural equipment are mentioned as the main reasons for this income shock. Furthermore, 127 (45%) families experienced a natural disaster last year. Most people experienced drought (69%), flood (12%), storm (11%), other (2%) or a combination of these natural disasters.

The last part of the survey contains questions about trust in community and collective action. The majority of the participants (56%) thinks that most people in the community can be trusted. Even more people (81%) think that most people in the community are willing to help if someone is in need. For the last question about collective action participants had to estimate how many of their neighbours (out of 10) would show up when they are invited to help in community activities like repairing a canal or a dam. Answers are quite diverse and rang from 0 to 10 with a mean of 7.3 (SD=2.3).

Table 2. Survey Questions on Living Conditions and Experiences

Variable	**Characteristics**	**Frequency (%)**
Did you have enough water for irrigating?	Yes No	174 80%) 44 (20%)
If not enough irrigation water, how scarce was it last year?	Somehow scarce Moderately scarce Extremely scarce	15 (34%) 10 (23%) 19 (43 %)
How would you rate the degree of water scarcity in your community?	Somehow scarce Moderately scarce Extremely scarce I cannot rate	15 (34%) 14 (32%) 14 (32%) 1 (2%)
Did your family experience a decline in fish catch over the last 5 years?	Yes No	54 (86%) 9 (14%)
Over the last 5 years, did your family observed a collapse of certain type of fish?	Yes No	35 (56%) 27 (44%)
Did your family experience any sudden drop in income (income shock) last year?	Yes No	162 (57%) 120 (43%)
Did your family experience any major natural disasters last year?	Yes No	127 (45%) 155 (56%)
Do you think most people in this community can be trusted?	Yes No	158 (56%) 124 (44%)
Do you think most people in this community are willing to help if someone is in need?	Yes No	228 (81%) 54 (19%)
Suppose that 10 of your neighbours are invited to help in community activities (e.g. repairing a canal or dam). How many would show up?	0 1 2 3 4 5 6 7 8 9 10	1 (0%) 2 (1%) 2 (1%) 14 (5%) 9 (3%) 57 (20%) 19 (7%) 23 (8%) 54 (19%) 20 (7%) 81 (29%)

6.2 Risk Preferences

For the elicitation of risk preferences, decisions in the RET task are used. About 76 percent of the participants answered both control questions correctly. During the actual task, the average contribution to the white envelope (safe asset) is 3.2 bills (SD = 1.00) and the average contribution to the green envelope (risky asset) is 2.8 bills (SD = 1.00). The decisions in RET give an indication of the degree of risk aversion. Figure 1 shows the different degrees of risk aversion and the percentage of this preference for participants. Zero means low risk aversion and six means high risk aversion.

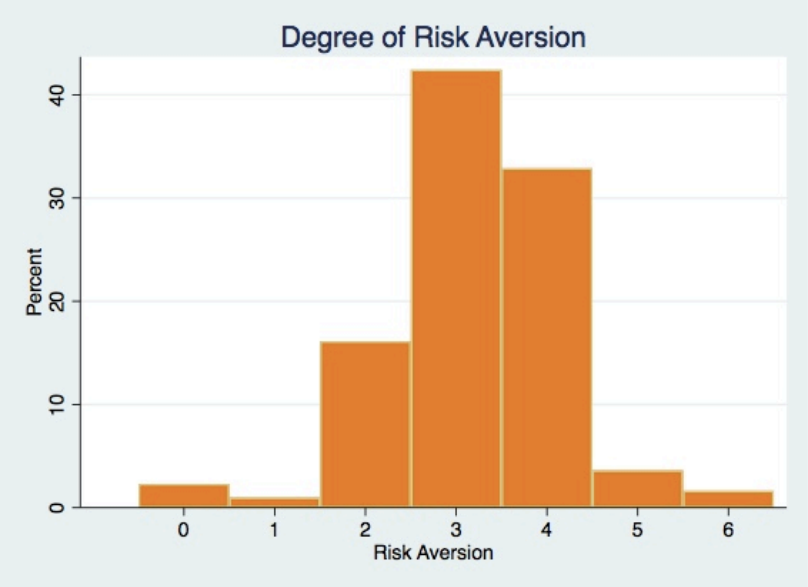

Figure 1. Percentage of Participants with a Certain Degree of Risk Aversion

6.2.1 Determinants of Risk Preferences

To better understand the effect of events and circumstances on risk preferences, we test to what extent risk preferences are determined by previous experiences on resource scarcity and shocks. The data is analysed using four linear regression models with risk aversion as the dependent variable, see equation 3, section 5.1. As shown in Table 3, Model 3 explains about 9 percent of the variance in risk aversion. The only significant predictor of risk aversion in this model is gender. Males contribute on average 0.519 bills less to the white envelope in comparison with females ($p < 0.01$). This means that risk aversion is lower among males than among females. Moreover, Model 4 shows predictors of risk aversion for individuals that are engaged in fishing only ($n = 54$). Male fishers contribute 0.479 bills less to white envelope in comparison with females ($p < 0.1$). Moreover, Model 4 shows that as years of schooling increases with one year, the amount that fishers invest in the white envelope increases with 0.083 bills. This means that risk aversion is higher among fishers who have had more years of schooling. At last, Model 4 shows that fishers who have experienced a natural disaster contribute on average 0.523 bills more to the white envelope ($p < 0.05$), indicating higher risk aversion among fishers that have experienced a natural disaster last year.

Table 3. Linear Regression of Demographics and Experiences on Risk Aversion

Risk aversion	(1)	(2)	(3)	(4)
Male	-0.445***	-0.518***	-0.519***	-0.479*
	(-3.24)	(-3.39)	(-3.53)	(-2.11)
Age	-0.00309	-0.00474	-0.00485	0.00403
	(-0.47)	(-0.66)	(-0.69)	(0.68)
Years of schooling	0.0138	0.0231	0.0252	0.0864***
	(0.74)	(1.07)	(1.11)	(3.09)
Engaged in fishing	-0.0354	-0.0225	-0.0346	0
	(-0.23)	(-0.16)	(-0.24)	(.)
Enough water for irrigation		-0.0197	-0.0417	-0.295
		(-0.07)	(-0.16)	(-1.06)
Income shock			-0.110	-0.232
			(-0.95)	(-1.11)
Natural disaster			0.227	0.523**
			(1.50)	(2.20)
Catch decline				-0.450
				(-1.12)
Collapse stock				-0.327
				(-1.32)
Constant	3.474***	3.522***	3.504***	3.489***
	(8.24)	(9.37)	(8.89)	(8.14)
N	281	217	217	54
R^2	0.051	0.078	0.091	0.356

Controlled for cluster effects on village level
t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

6.3 Pro-social Preferences

Using hierarchical cluster analysis following Fallucchi et al., (2018), we came to the following distribution of behavioural types: High Unconditional Cooperators (HUC), Conditional Cooperators (CC), Medium Unconditional Cooperators (MUC), Low unconditional cooperators (LUC), other. The average contribution per behavioural type is depicted in Table 4.

Table 4. Mean Contribution and Standard Deviation per Behavioural Type

Behavioural type	N	Mean Contribution	Standard Deviation contribution
High unconditional cooperators	56	4.44	0.90
Conditional cooperators	73	3.17	1.55
Medium unconditional cooperators	42	2.54	0.77
Low unconditional cooperators	53	1.78	0.89
Other	79	3.37	1.19

6.3.1 Determinants of Behavioural Types

Following the analysis of Kocher et al., (2011) we use a multinomial logit model to asses the factors that influence being classified as a HUC, CC, MUC and LUC. Table 5 shows the results per behavioural type using the group 'others' as the reference group. Years of schooling ($p < 0.1$) and the experience of a natural disaster ($p < 0.01$) decreases the likelihood that someone is classified as a HUC compared to the group other. In contrast, having trust that the community will help when someone is in need, increases the likelihood that someone is classified as a HUC ($p < 0.05$). Moreover, the experience of a sudden drop in income decreases the likelihood that someone is classified as a CC compared to the group others ($p < 0.05$). Furthermore, a higher level of risk aversion increases the likelihood of being classified as a LUC ($p < 0.05$) whereas the experience of a natural disaster decreases the likelihood of being classified as LUC in comparison to other ($p < 0.01$).

Table 5. Results Multinomial Logit Model per Behavioural Type

Behavioural type	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
High Unconditional Cooperators							
Risk aversion	-0.151	0.222	-0.68	0.498	-0.586	0.285	
Male	0.413	0.495	0.83	0.404	-0.557	1.383	
Age	0.005	0.018	0.26	0.797	-0.031	0.041	
Years of schooling	-0.129	0.072	-1.78	0.075	-0.271	0.013	*
Engaged in fishing	0.292	0.544	0.54	0.591	-0.774	1.358	
Enough water for irrigation	-0.625	0.577	-1.08	0.278	-1.756	0.505	
Natural disaster	-1.576	0.487	-3.23	0.001	-2.531	-0.621	***
Income shock	-0.116	0.470	-0.25	0.805	-1.038	0.806	
Trust community	-0.425	0.507	-0.84	0.402	-1.419	0.569	
Support community	3.051	1.179	2.59	0.010	0.740	5.362	**
Collective action	0.061	0.112	0.54	0.588	-0.159	0.280	
Constant	-1.711	1.707	-1.00	0.316	-5.057	1.635	
Conditional Cooperators							
Risk aversion	0.087	0.212	0.41	0.683	-0.330	0.503	
Male	-0.351	0.453	-0.78	0.439	-1.239	0.537	
Age	0.012	0.016	0.74	0.458	-0.020	0.043	
Years of schooling	0.056	0.060	0.93	0.351	-0.061	0.172	
Engaged in fishing	0.638	0.459	1.39	0.164	-0.261	1.536	
Enough water for irrigation	-0.277	0.528	-0.52	0.600	-1.312	0.758	
Natural disaster	-0.282	0.413	-0.68	0.495	-1.092	0.528	
Income shock	-0.850	0.410	-2.07	0.038	-1.653	-0.046	**
Trust community	0.040	0.489	0.08	0.935	-0.919	0.999	
Support community	0.095	0.639	0.15	0.881	-1.156	1.347	
Collective action	-0.036	0.093	-0.38	0.702	-0.218	0.147	
Constant	-0.258	1.318	-0.20	0.845	-2.841	2.324	
Low Unconditional Cooperators							
Risk aversion	0.608	0.247	2.46	0.014	0.123	1.093	**
Male	0.299	0.506	0.59	0.555	-0.693	1.290	
Age	-0.007	0.018	-0.40	0.687	-0.044	0.029	
Years of schooling	0.000	0.066	0.00	0.997	-0.129	0.130	
Engaged in fishing	-0.069	0.572	-0.12	0.904	-1.190	1.052	
Enough water for irrigation	-0.339	0.584	-0.58	0.561	-1.484	0.805	
Natural disaster	-1.657	0.508	-3.26	0.001	-2.653	-0.661	***
Income shock	-0.179	0.462	-0.39	0.699	-1.084	0.727	
Trust community	0.080	0.552	0.15	0.884	-1.002	1.163	
Support community	0.208	0.725	0.29	0.774	-1.213	1.630	
Collective action	0.087	0.110	0.80	0.427	-0.128	0.302	
Constant	-2.088	1.573	-1.33	0.184	-5.170	0.994	
Medium Unconditional Cooperators							
Risk aversion	0.274	0.247	1.11	0.266	-0.209	0.758	
Male	-0.580	0.510	-1.14	0.255	-1.578	0.419	
Age	0.004	0.018	0.21	0.832	-0.032	0.039	
Years of schooling	-0.089	0.072	-1.25	0.211	-0.230	0.051	
Engaged in fishing	0.379	0.523	0.72	0.469	-0.646	1.403	
Enough water for irrigation	0.066	0.596	0.11	0.911	-1.102	1.235	
Natural disaster	-0.376	0.453	-0.83	0.407	-1.265	0.512	
Income shock	-0.561	0.452	-1.24	0.214	-1.447	0.324	
Trust community	-0.045	0.526	-0.09	0.932	-1.075	0.985	
Support community	0.785	0.717	1.09	0.274	-0.621	2.191	
Collective action	-0.040	0.103	-0.39	0.697	-0.242	0.162	
Constant	-0.942	1.512	-0.62	0.533	-3.904	2.021	

Mean dependent var	2.783	SD dependent var	1.416
Pseudo r-squared	0.098	Number of obs	217
Chi-square	67.636	Prob > chi2	0.013
Akaike crit. (AIC)	718.484	Bayesian crit. (BIC)	880.719

** p<0.1, ** p<0.05, *** p<0.01*

6.4 Cooperation

In this subsection, risk and social preferences are used as predictor variables to analyse to what extent they are able to predict cooperation in the UPGG (low social uncertainty) and the TG (higher social uncertainty). First, the regression of cooperation in the UPGG is discussed, followed by the regression analysis of cooperation in the TG, see equation 4, section 5.4.

6.4.1 Determinant Cooperation in Unconditional Public Goods Game

The UPGG gives an indication of cooperative preferences under low social uncertainty. Uncertainty is low since the game is played by only two players and the amount in the public fund is always increased, independently of the total amount of contributions. The average contribution to the green envelope is 3.11 (SD = 1.11). The social optimum is reached if every player contributes 6 bills to the public fund. Only three percent of the participants contributed exactly this amount, most players (38%) contributed half of their endowment.

Table A.2 (Appendix 2) shows four regression models that include risk preferences, behavioural types, demographics, trust in community and the interaction effect between preferences and being engaged in fishing as predictor variables for cooperation in the UPGG. Model 8 explains about 32 percent of the variance in cooperation. Results show that when risk aversion increases with one unit, the amount that participants invest in the public fund decreases with 0.17 bills (p <0.01). This means that higher risk aversion predicts lower levels of cooperation. Not surprisingly, HUC contribute on average 0.830 bills more to the public fund ($p < 0.01$) and LUC contribute on average 0.815 bills less to the public fund in the UPGG ($p < 0.01$). Moreover, the regression model shows that as years of schooling increases with one year, the amount that participants contribute to the public fund increases with 0.046 ($p < 0.05$). Trust in collective action is also a predictor of an increased contribution to the public fund. If people estimate a higher level of attendance of neighbours who are willing to help in community activities, contribution increases with 0.067 bills ($p < 0.01$). Furthermore, individuals that are engaged in fishing contribute on average 1.141 bills more to the public fund in comparison with people who do not fish ($p < 0.1$). The interaction term of the dummy variable engaged in fishing and risk aversion shows that if someone is engaged in fishing, a higher level of risk aversion predicts a decreased contribution of 0.440 bills to the public fund.

6.4.2 Determinants Cooperation in Threshold Game

The TG measures cooperation in a situation with higher social uncertainty. For participants in the public good treatment, the average contribution to the green envelope is 2.62 (SD = 1.25) and to the white envelope 3.38 (SD = 1.25). The average contribution in the public bad treatment is 2.93 (SD = 1.05) to the green envelope and 3.07 (SD = 1.04) to the white envelope. The fair social optimum is reached is every group member contributed three bills to the public fund. About 49 percent of the participants contributed exactly this amount.

Table A.3 (Appendix 3) shows four regression models that include risk preferences, behavioural types, demographics and trust in community and the interaction effect between preferences and being engaged in fishing as predictor variables for cooperation in the TG. Model 12 explains about 12 percent of the variance in cooperation in the TG. Results show that LUC contribute on average 0.638 bills less to the public fund ($p < 0.05$). Moreover, participants that played the threshold game framed as a public bad contribute on average 0.460 bills less to the public fund, in comparison with participants who played the game framed as a public good ($p < 0.05$).

6.4.3 Cooperation under Social Uncertainty

Previous subsections described the factors that predict cooperation in the UPGG (low social uncertainty) and the TG (higher social uncertainty). Table 6 provides an overview of the models that predict contribution to the public fund in the UPGG (Model 8) and the TG (Model 12). Under low social uncertainty, in the UPGG, risk aversion, behavioural type, years of schooling, trust in community and being engaged in fishing predicts cooperation. In contrast, significant predictors for cooperation under higher social uncertainty, in the TG, include only behavioural type and the treatment framing. The same model is used to predict contribution to the public fund in the UPGG and the TG. However, in the situation with lower social uncertainty, the model explains cooperation to a larger extent in comparison to the situation involving higher social uncertainty.

6.5. Determinants Belief

Belief about the contribution of others was elicited by using an incentivized question on what they belief the rest of their group will contribute to the public fund. The average guess was equal to 6.21 (SD = 3.10). Moreover, average belief plus contribution is equal to 9.37 bills (SD = 3.31). This means that on average, real contributions and beliefs about the contributions of others are sufficient to reach the threshold.

The determinants of beliefs are assessed by a linear regression of preferences and experiences on the belief about the contribution of others to the public fund in the TG, see table A.4, Appendix 4. Model 15 shows that an increase in level of risk aversion predicts a lower belief about the contribution of others ($p < 0.1$). Moreover, model 15 shows that participants who have played the threshold game framed as a public bad game, believe that others will contribute on average 1.46 bills more to the public fund in comparison with participants who played the game framed as a public goods threshold game ($p < 0.01$).

Table 6. Comparison Contribution to Public Fund UPGG and TG

Contribution to public fund	(8) UPGG	(12) TG
Risk aversion	-0.170***	0.000597
	(-3.23)	(0.01)
HUC	0.830***	0.0572
	(4.45)	(0.15)
CC	-0.0730	-0.308
	(-0.39)	(-1.27)
LUC	-0.815***	-0.665***
	(-4.36)	(-3.00)
MUC	-0.188	-0.348
	(-1.15)	(-1.21)
Male	-0.156	0.00368
	(-0.89)	(0.02)
Age	0.00388	0.00194
	(0.59)	(0.25)
Years of schooling	0.0462**	0.0432
	(2.10)	(1.67)
Trust community	-0.243	-0.200
	(-1.44)	(-1.29)
Support community	-0.0380	0.352
	(-0.21)	(1.41)
Collective action	0.0676***	-0.0390
	(3.11)	(-1.56)
Engaged in fishing	1.141*	-1.168
	(1.90)	(-1.52)
Engaged in fishing # risk aversion	-0.440**	0.322
	(-2.43)	(1.44)
Engaged in fishing # HUC	-0.0844	0.553
	(-0.22)	(0.98)
Engaged in fishing # CC	0.114	0.00514
	(0.39)	(0.02)
Engaged in fishing # LUC	0.0706	0.431
	(0.15)	(0.84)
Engaged in fishing # MUC	0.120	0.237
	(0.43)	(0.64)
Public bad treatment		-0.460**
		(-2.30)
Constant	3.085***	3.214***
	(7.74)	(7.09)
N	281	281
R^2	0.322	0.124

Controlled for cluster effects on village level
t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

7. Conclusion and Discussion

By using a lab in the field experiment, we have investigated how risk preferences and prior exposure to environmental change and shocks determine risk and pro-social preferences and to what extent these preferences explain cooperative behaviour in a situation involving social uncertainty. In support of the findings of Charness & Gneezy (2012) we find that risk aversion is higher among females in comparison to males. In addition, we find that fishers who have experienced a natural disaster show higher levels of risk aversion which is in line with Cameron & Shah (2015).

Second, we tested to what extent risk preferences and experiences of resource scarcity and environmental change explain differences in pro-social preferences. First we applied the widely used classification method of Fischbacher et al., (2001) to categorize behavioural types based on their pro-social preferences. This method did not apply to our non-western, non-student population. Instead, hierarchical cluster analysis following Fallucchi et al., (2018), allowed us to categorize five distinct behavioural types in a more satisfactory way. Based on cluster analysis, we came to the following behavioural types: HUC, CC, MUC, LUC, and other. Following Kocher et al., (2011) we conducted a multinomial logit model to asses the factors that influence the likelihood that someone is classified as a certain behavioural type.

In accordance with Kocher et al., (2001) our results show that risk aversion does not significantly determine the likelihood that someone is classified as a CC. However, we did find evidence that risk aversion increases the likelihood that someone is classified as a LUC. The experience of a natural disaster decreases the likelihood that someone is classified as a HUC or a LUC. This indicates that individuals are not inclined towards a more extreme contribution strategy after experiencing a natural disaster. Moreover, in line with Anderson et al., (2004), we find that having trust in the willingness to help of other community members increases the likelihood that someone is a HUC. At last, the experience of a sudden drop in income decreases the likelihood that is classified as a CC. This analysis shows that diverse factors influence the likelihood that someone is classified as a certain behavioural type. Our results support Cassar et al., (2017) who state that preferences can be affected by events and circumstances in the long term.

In the second line of research we include risk and pro-social preferences as predictor variables in regression analysis to see to what extent they can explain cooperation in the UPGG (low social uncertainty) and the TG (higher social uncertainty). Factors that predict cooperation under low social uncertainty include, risk preferences, pro-social preferences, years of schooling, trust in collective action and being engaged in fishing. This finding is in contrast with Kocher et al., (2015) who do not find evidence that elicited risk preferences explain cooperation in an unconditional public goods game. Furthermore, cooperation under higher social uncertainty is only predicted by being classified as LUC and framing treatment. This result is not surprising, since a LUC always has a low contribution strategy, independently of behaviour of the other. This results indicates that LUC still contribute low, even in an other game context. Moreover, information framing is an important determinant of cooperation under higher social uncertainty. The TG framed as a public bad predicts lower levels of cooperation. In contrast, beliefs about the contribution of others is actually higher for participants who played the game framed as a public bad instead of a public goods game.

Our results have some relevant methodological implications and inferences for the world outside laboratory. We find support that the hierarchical cluster method of Fallucchi et al., (2018), is a valuable alternative to the FGF method for categorizing behavioural types. In addition, current research contributes to the existing body of literature on public goods games and cooperation by broadening the research population to a non-student, non-western

population. Moreover, this study contributes to the understanding of the mechanisms behind cooperation and shows that preferences do not explain cooperation in the same way across different experimental settings. This indicates that individuals adapt their cooperative behaviour to the situation and preferences alone are not sufficient to explain cooperative behaviour, which is in line with Boyd & Richerson (2009). Moreover, information framing is an important determinant of cooperation in a situation involving higher social uncertainty, suggesting the adaptive nature of cooperative behaviour too. Further research could continue to increase our understanding about the effect of environmental and social changes to the individual tendency to cooperate. Overall, it can be concluded that social norms of cooperation are influenced by a complex web of interactions between natural, socio-economic and institutional processes.

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9. Appendices

Appendix 1. Hierarchical Cluster Analysis

We use, as do Fallucchi et al., (2018), the Duda – Hart index ($\frac{Je(2)}{Je(1)} = W(t_1) + W(t_2)/W(t_1 \cup t_2)$) complemented by a silhouette analysis. Duda and Hart propose to pick the number of clusters which corresponds to a large $\frac{Je(2)}{Je(1)}$ and a low pseudo T-squared value with a much larger T-squared value next to it. At the same time the Calinski/Harabasz pseudo-F should be high. We can see that in Figure A1-1 $\frac{Je(2)}{Je(1)}$ is the second highest for 5 clusters (0.8550) which corresponds to a significant drop in the pseudo T-squared (12.04) compared to 4 clusters (23.86) whilst at the same time corresponding to the pseudo-F of 75.91 (see Figure A1-2).

Hence, we will also use 5 groups to categorize pro-social behaviour. The silhouette analysis confirms those clusters (see figure A1-3). The silhouette value measures how well an object fits into the cluster it is assigned to and how different it is to other clusters. High values indicate that an object is similar to the other objects within the cluster and that it is distinctly different from the objects in other clusters. Negative values mean that the object is not well matched to the objects within a cluster and that it is not clearly separated from other clusters.

In our clustering we only have few boarder line cases apart from cluster one. The distribution between the 5 groups ranges from 42 individuals in group 5 to 79 individuals in group 1 (figure A1-4). We plotted heat maps to see the different behavioural patterns (see figure A1-5 –figure A1-9). We also check for the average contribution within each of the clusters as well as the level of the spearman coefficient (table A1). We also ran a Kruskal-Wallis test which confirms that the clusters are different (p=0.0001).

Number of clusters	Duda/Hart Je(2)/Je(1)	Duda/Hart pseudo T-squared
1	0.7208	116.59
2	0.7836	56.88
3	0.7868	36.05
4	0.7958	23.86
5	0.8550	12.04
6	0.8496	13.63
7	0.7817	16.48
8	0.8007	12.69
9	0.8122	12.49
10	0.7612	12.55
11	0.7127	11.69
12	0.6866	11.87
13	0.7477	9.45
14	0.7722	11.80
15	0.9173	3.79

Figure A1-1. Duda Hart index and corresponding pseudo T-squared

Number of clusters	Calinski/ Harabasz pseudo-F
2	116.59
3	102.17
4	90.67
5	75.91
6	64.97
7	60.36
8	57.18
9	52.94
10	49.83
11	47.99
12	45.86
13	43.96
14	42.64
15	40.98

Figure A1-2. Calinski/Harabasz pseudo F

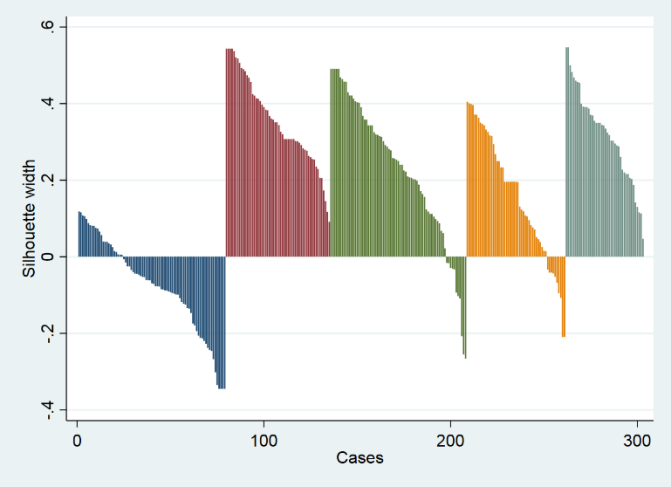

Figure A1-3. Silhouette Analysis

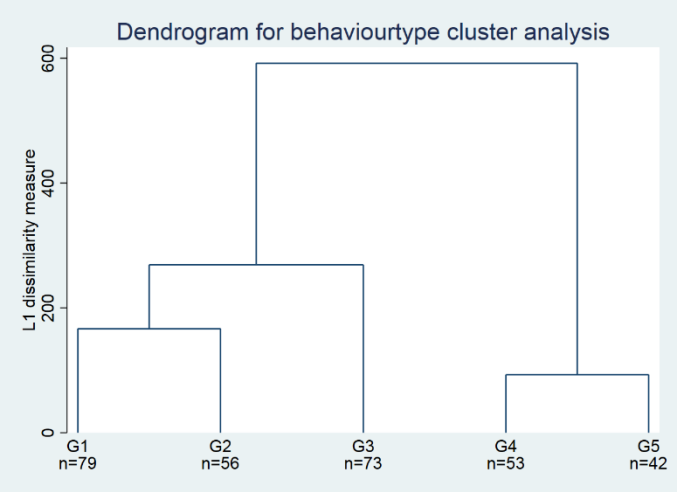

Figure A1-4. Distribution of Behaviour Types

Figure A1-5. Group 1: Other

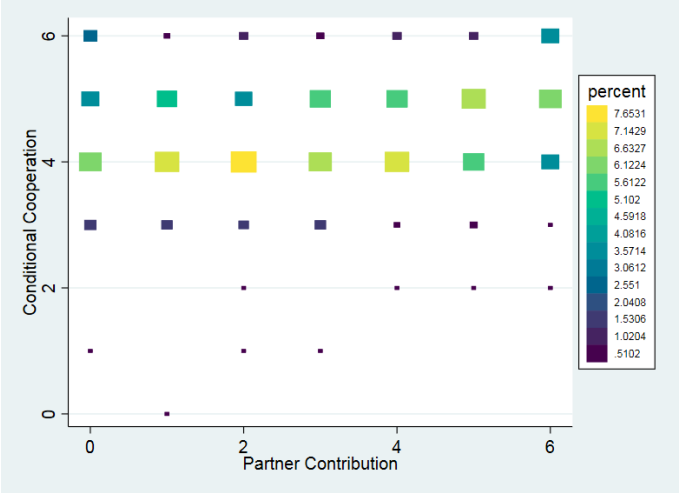

Figure A1-6. Group 2: HUC

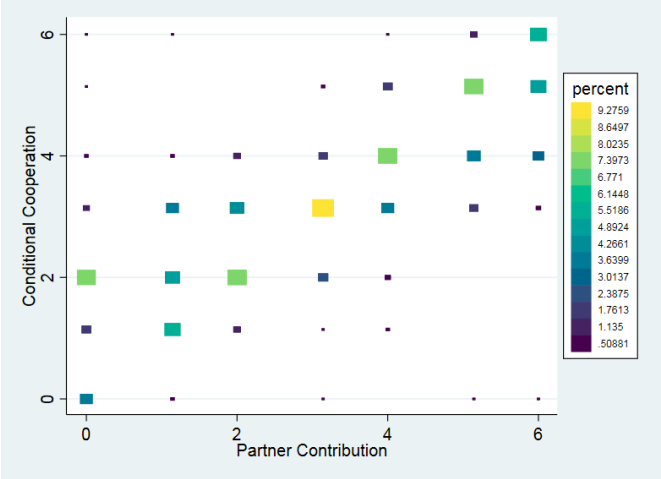

Figure A1-7. Group 3: CC

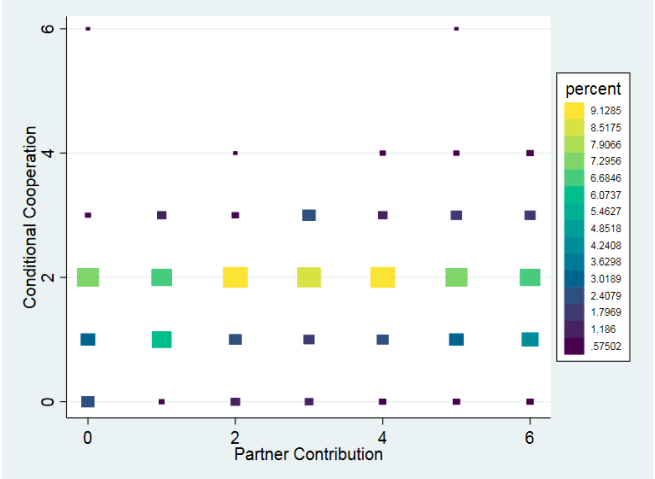

Figure A1-8. Group 4: LUC

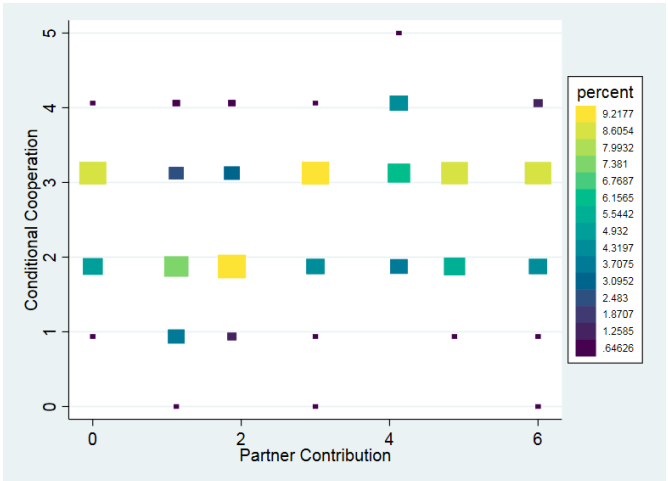

Figure A1-9: Group 5: MUC

Appendix 2. Determinants Cooperation Low Social Uncertainty

Table A.2. Linear Regression of Preferences, Behavioural Types and Demographics on Contribution to the Public Fund in the Unconditional Public Goods Game

Contribution to public fund UPGG	(5)	(6)	(7)	(8)
Risk aversion	-0.201***	-0.237***	-0.231***	-0.170***
	(-3.82)	(-4.34)	(-4.39)	(-3.23)
HUC	0.828***	0.882***	0.855***	0.830***
	(5.48)	(5.99)	(5.94)	(4.45)
CC	-0.103	-0.0612	-0.0801	-0.0730
	(-0.78)	(-0.39)	(-0.50)	(-0.39)
LUC	-0.740***	-0.734***	-0.769***	-0.815***
	(-4.48)	(-3.90)	(-4.20)	(-4.36)
MUC	-0.230	-0.146	-0.150	-0.188
	(-1.53)	(-1.03)	(-0.99)	(-1.15)
Male		-0.168	-0.133	-0.156
		(-1.00)	(-0.78)	(-0.89)
Age		0.00437	0.00286	0.00388
		(0.69)	(0.43)	(0.59)
Years of schooling		0.0427**	0.0430*	0.0462**
		(2.10)	(1.98)	(2.10)
Engaged in fishing		-0.136	-0.195	1.141*
		(-0.81)	(-1.22)	(1.90)
Trust community			-0.245	-0.243
			(-1.40)	(-1.44)
Support community			-0.0238	-0.0380
			(-0.14)	(-0.21)
Collective action			0.0664***	0.0676***
			(2.89)	(3.11)
Engaged in fishing # risk aversion				-0.440**
				(-2.43)
Engaged in fishing # HUC				-0.0844
				(-0.22)
Engaged in fishing # CC				0.114
				(0.39)
Engaged in fishing # LUC				0.0706
				(0.15)
Engaged in fishing # MUC				0.120
				(0.43)
Constant	3.786***	3.577***	3.314***	3.085***
	(16.22)	(8.67)	(8.34)	(7.74)
N	303	281	281	281
R^2	0.255	0.281	0.305	0.322

Controlled for cluster effects on village level
t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix 3. Determinants Cooperation Higher Social Uncertainty

Table A.3. Linear Regression of Preferences, Behavioural Types and Demographics on Contribution to the Public Fund in the Threshold Game

Contribution to public fund TG	(9)	(10)	(11)	(12)
Risk aversion	0.0400	0.0257	0.0152	-0.0163
	(0.56)	(0.37)	(0.22)	(-0.20)
HUC	0.144	0.151	0.138	0.0238
	(0.51)	(0.49)	(0.45)	(0.06)
CC	-0.226	-0.269	-0.261	-0.272
	(-1.22)	(-1.32)	(-1.23)	(-1.14)
LUC	-0.629***	-0.614***	-0.593***	-0.638**
	(-3.26)	(-3.00)	(-3.02)	(-2.80)
MUC	-0.340	-0.336	-0.346	-0.375
	(-1.56)	(-1.36)	(-1.39)	(-1.24)
Male		0.0171	-0.0129	0.000167
		(0.09)	(-0.07)	(0.00)
Age		0.00213	0.00260	0.00168
		(0.31)	(0.36)	(0.24)
Years of schooling		0.0462*	0.0458*	0.0425
		(1.79)	(1.74)	(1.68)
Engaged in fishing		0.0264	0.0548	-1.087
		(0.19)	(0.41)	(-1.45)
Public bad treatment		-0.475**	-0.457**	-0.460**
		(-2.45)	(-2.35)	(-2.30)
Trust community			-0.169	-0.178
			(-1.31)	(-1.33)
Support community			0.296	0.305
			(1.26)	(1.30)
Collective community			-0.0358	-0.0357
			(-1.43)	(-1.44)
Engaged in fishing # Risk aversion				0.302
				(1.37)
Engaged in fishing # HUC				0.664
				(1.21)
Engaged in fishing # CC				-0.0114
				(-0.04)
Engaged in fishing # LUC				0.329
				(0.70)
Engaged in fishing # MUC				0.157
				(0.45)
Constant	3.205***	3.198***	3.322***	3.510***
	(14.04)	(7.85)	(7.61)	(7.64)
N	303	281	281	281
R^2	0.103	0.103	0.114	0.124

Controlled for cluster effects on village level
t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix 4. Beliefs about Contribution of Others

Table A.4. Linear Regression of Preferences, Behavioural Types and Demographics on Beliefs on Contribution of Others to the Public Fund in the Threshold Game

Beliefs	(13)	(14)	(15)
Risk aversion	-0.399**	-0.336**	-0.311*
	(-2.57)	(-2.21)	(-1.95)
HUC	-0.474	-0.350	-0.279
	(-0.85)	(-0.60)	(-0.48)
CC	0.0859	0.0257	0.0199
	(0.16)	(0.04)	(0.04)
LUC	-1.074**	-0.942*	-0.966
	(-2.13)	(-1.73)	(-1.69)
MUC	-0.238	-0.161	-0.129
	(-0.36)	(-0.27)	(-0.21)
Male		-0.109	-0.0614
		(-0.32)	(-0.19)
Age		-0.00552	-0.00547
		(-0.37)	(-0.35)
Years of schooling		0.0554	0.0567
		(0.93)	(0.94)
Engaged in fishing		0.520	0.495
		(1.30)	(1.17)
Public bad framing		1.512***	1.458***
		(4.16)	(3.78)
Trust community			0.701
			(1.59)
Support community			-0.804
			(-1.09)
Collective action			0.0379
			(0.51)
Constant	7.778***	6.730***	6.628***
	(11.06)	(5.43)	(5.31)
N	301	279	279
R^2	0.037	0.106	0.118

Controlled for cluster effects on village level
t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix 5. Informed Consent and Instructions

[1. Informed consent]

Our names are Tum Nhim and Esther Schuch. We are PhD students at Wageningen University in the Netherlands. Together with our study supervisor, Andries Richter, we are conducting a research study with about 300 villagers in Kampong Chhnang province, Cambodia. Our study aims to understand livelihoods in villages in Kampong Chhnang. In particular, we are interested in practices of farming and fishing and how livelihoods could be improved. Please stop me at any time if you have any questions.

We would like to invite you to participate in this study by attending today's meeting. We will give you all necessary information about this study, and then you can decide if you want to participate in this study or not.

- The meeting has two parts and takes about three hours. In the first part, you play six decision games upon which you may win some money. In the second part, we ask you some questions about the daily livelihood of your own household.

- Participating in this meeting, you will get paid 4000 KHR for your effort to come here and 6000 KHR for your effort to stay until the end of the meeting. In addition, we will roll a dice to decide which one out of the six games is chosen. You will receive money depending on what you decide in the game. All of the payment is paid once at the end of the meeting, and is sponsored by the European Union.

- The information we collect today is private and confidential. We will not share any details from the survey or about the decision games with anyone besides the research team. These data will be stored at Wageningen University researcher's computers. The researchers will use the information collected in policy reports, as well as scientific articles that might be published and presented. No publications will include names or other identifiable information on participants. The participation is anonymous and you can refuse to give us any information including your name.

- Your participation is purely voluntary and you are free to leave at any time or skip any questions if you feel you want to, for whatever reasons. Doing so will not have any negative consequences for you.

- There are no correct or incorrect responses, so please express your opinions freely. If you have any questions, concerns or requests, feel free to ask us at any time. We will try our best to address them.

- If you have any questions regarding this research or your rights as a research study participant, you may contact Mr. Tum Nhim at the phone number: 017 886785.

- I repeat again, please do not hesitate to ask any questions. Until now, do you have any questions? May we have your permission to ask these questions, and would you be willing to participate?

[Continue with discussion only if all respondents give their consent. Allow anyone who does not wish to participate to leave before beginning of the decision games]

I repeat again, please do not hesitate to ask any questions. Until now, do you have any questions?

Before we start the games, we will give each of you an identification card. Please keep it with you all the time, don't lose it.
[distribute the ID cards]

[2. Instructions Economic decision games][1]

Before we start the games, we will give each of you an identification card. Please keep it with you all the time, don't lose it.
[distribute the ID cards]

[Section 1]

[Task 1: Risk elicitation]

Now we read the instructions and give examples for the first task. Then, we will do a test to see if you understand the task or not. Once we are sure you understand your task, you will begin the actual decision. Now I explain your task.

For this task, we give each participant an endowment of 6000 KHR, containing 6 bills of 1000 Riel. ***[show the notes]*** With this endowment of 6000 KHR, you have to decide how much you want to put in the white envelope and how much you want to put in the green envelope. ***[show both envelopes]***. For the white envelope, the amount of money you put in you will get for sure. For example, if you put in 1000 KHR, you will get 1000 KHR for sure. If you put in 6000 KHR, you will get 6000 KHR for sure.

The green envelope is different. For every bill you put in the green envelope, you may get it tripled or you get zero Riel. If you put 1000 KHR in the green envelope, you may get 3000 KHR or you get zero Riel. If you put in 6000 KHR in the green envelope you may get 18000 KHR or you get zero Riel. To know whether you get the money tripled or get zero Riel, we will flip the coin. If the coin shows head ***[show coin's head]***, you will get the money you put in tripled. If the coin shows tail ***[show coin's tail]***, you will get zero Riel.

[1] **The text in [] is only for instructions and at no case to be read out.**

What you will earn from this task is your return from the white envelope plus the return from the green envelope.

You can put all the 6 bills in the white envelope or all the bills in the green envelope, or some in the white and some in the green.

[Example]
Now we will provide you with an example of how it is done in practice. Please note that since this is an example, we will tell you how many bills to put in the green envelope. For the actual task, you will have to decide this on your own, without any help from us.

[Randomly select a player and give him six bills of 1000 KHR . Please make sure that each time YOU tell the person how much he should put into the green envelope. Do not allow the player to take the decision because this may influence the decision of other potential players.]
[Record the coin tosses]

Suppose you are the participant in this task. Now we give you an endowment of 6000 KHR, containing six bills of 1000 KHR.
Now let us assume that out of six bills, you put zero in the green envelope. Please put zero bills in the green envelope and the remaining in the white envelope. ***[Ask the group;]*** Can you tell me how many KHR are in the green envelope? How many KHR are in the white envelope? ***[Flip the coin and show the result to the participants].*** Now the coin shows [head/tail]**.** How much will you get from the green envelope? You get nothing from it because you put in nothing. Have you understood this? How much do you get from the white envelope? [6000]. How much do you get in total? [6000]

Do you have any questions?
[If it is understood, please ask the person to take bills out of the envelopes. If it is not understood, repeat this example again]
Please take the bills out of the envelopes again.

Now, let us assume that out of 6 bills you put 2 bills in the green envelope. Please put two bills in the green envelope and the remaining in the white envelope. ***[Ask the group;].*** How many bills are in the green envelope? How many bills are in the white envelope? ***[Flip the coin and show the result to the participants].*** Now the coin shows [head/tail]. How much will you get from the green envelope (tripled or nothing?)? You thus get [6000/0 KHR]. How much do you get from the white envelope? [4000]. How much do you get in total? [4000/10000]

Do you have any questions?
[If it is understood, please ask the person to take bills out of the envelopes again]
Please take the bills out of the envelopes again.

Now, let us assume that out of 6 bills you put 4 bills in the green envelope. Please put four bills in the green envelope and the remaining in the white envelope. ***[Ask the group;].*** How many bills are in the green envelope? How many bills are in the white envelope? ***[Flip the coin and show the result to the participants*]. Now the coin shows [head/tail]. How much will you get from the green envelope then (tripled or nothing?)? You thus get [12000/0 KHR].How much do you get from the white envelope? [2000]. How much do you get in total? [2000/14000]

Do you have any questions?
[If it is understood, please ask the person to take bills out of the envelopes again]
Please take the bills out of the envelopes again.

Now, let us assume that out of 6 bills you put 6 in the green envelope. Please put six bills in the green envelope and the remaining in the white envelope. ***[Ask the group;].*** How many bills are in the green envelope? How many bills are in the white envelope? ***[Flip the coin and show the result to the participants] .*** Now the coin shows [head/tail]. How much will you get from the green envelope then (tripled or nothing?)? You thus get [18000/0 KHR]. How much do you get from the white envelope? [0]. How much do you get in total? [0/18000]

Have you understood this part? Do you need additional examples? ***[If yes, select another person and repeat the examples in the same order.]***

[Control questions]

Now we will ask you two questions which each of you have to answer privately. To answer these two questions we will provide you each with two pieces of paper. We will ask you the questions and then you will answer by ticking the box next to the correct answer ***[show how the paper looks and which boxes to tick]***. The answer has only two choices. It is either white envelope ***[point to the picture]*** or the green envelope ***[point to the picture]***. We will collect the pieces of paper to see whether you answered correctly. In order to make sure each of you answers privately, please put up the card board boxes.
[Show the participants how to set up the card board boxes.
Distribute the pieces of paper. Make sure everyone has two pieces of paper and the card board boxes up].

1) From which of the envelope will you get the same amount of money as what you put in for sure?
   Please tick the correct answer. Once you ticked the box, please fold the paper inward. We will then come to collect it and continue to the next question.

2) From which envelope will you get a return of three times of what you put in or you get nothing?

   Please tick the correct answer. Once you ticked the box, please fold the paper inward. We will then come to collect it.

[Collect the pieces of paper]

We will now provide you each with 6000 RIEL and the two envelopes. Now please decide how many bills you put in the white envelope, and how many in the green envelope. Please don't leave any money out of the envelopes. Remember, it is your own choice how you want to distribute the 6000 KHR. If you have finished putting the bills into the envelopes, please signal the instructor. We then come and collect the envelopes. After all the tasks have been completed each of you will role a die to decide which task will be paid out. If this task is chosen you will flip the coin to determine whether the money in the green envelope is tripled or zero.

[Collect the envelopes].

[Section 2 PGG]

[TASK 2: Unconditional Public Goods game]

Now we will read the instructions and give examples for the second task. Once we are sure that you understand your task, we will begin.

In this task, we will divide you into groups of two: you and another person in your community. You will not come to know to which group you belong. Likewise, you will not come to know the identity of the other member of your group. Similarly, he will not come to know your identity either.

We will give each of you an endowment of 6000 KHR, containing six bills of 1000 KHR. With this endowment of 6000 KHR, you have to decide how much you want to keep for yourself and how much you want to contribute to a group fund. The group fund is the money contributed by you and your partner. The difference between the money you keep for yourself and the group fund is that the money you keep to yourself remains the same, but the group fund is increased. For every 1000 RIEL in the group fund, there will be 500 RIEL added. After the money in the group fund has been increased, the total money will be divided equally between you and your partner, irrespective of how much you or your partner have put into the group fund ***[Please repeat this again].***

Please note that, when you make the actual decision, the money you want to keep for yourself is to be put in the white envelope ***[show the white envelope]***, and the money you want to contribute to the group fund is to be put in the green envelope ***[show the green envelope]***. With this endowment of 6000 KHR, you are free to contribute whatever amount to the group fund, without knowing how much your partner would contribute.

Examples:

[Have an assistant showing with the money what is actually happening. Put money on the green envelope, add the correct amount, divide into two piles]

Now my assistant will demonstrate you some examples how the return from the group fund work.

1) If both group members put zero KHR each in the group fund, **[ask the group]** how much will be in the group fund? There will be zero KHR in the group fund. **[ask the group]** By how much will the group fund be increased? The group fund will be increased by zero RIEL. **[Ask the group]** How much is in total in the group fund? In total the group fund contains now zero RIEL**. [Ask the group]** How much does each member get from the group fund? Each gets zero RIEL from the group fund.
2) If both group members put 3000 KHR each in the group fund, **[ask the group]** how much will be in the group fund? There will be 6000 KHR in the group fund. **[ask the group]** By how much will the group fund be increased? The group fund will be increased by 3000 RIEL. **[Ask the group]** How much is in total in the group fund? In total the group fund contains now 9000 RIEL**. [Ask the group]** How much does each member get from the group fund? Each gets 4500 RIEL from the group fund.
3) If both group members put 6000 KHR each in the group fund, **[ask the group]** how much will be in the group fund? There will be 12000 KHR in the group fund. **[ask the group]** By how much will the group fund be increased? The group fund will be increased by 6000 RIEL. **[Ask the group]** How much is in total in the group fund? In total the group fund contains now 18000 RIEL**. [Ask the group]** How much does each member get from the group fund? Each gets 9000 RIEL from the group fund.

Have you understood this part? Do you have any questions? If there are no questions we continue with the examples.

[EXAMPLES]

Now we will show you with examples how the task is done in practice. In these examples you can see the decision of both participants. In the actual task, you will not know what the other person in your group decides.

[**Randomly select 2 players and give each of them six bills of 1000 RIEL and a white and a green envelope. Assign who takes the role as participant I & II. Please make sure that each time YOU tell the persons on how much he should put into the project. Do not allow the players to take the decision because this may influence the decision of other potential players.**]

In the following we give you two examples.

Example 1:

Suppose you two are in the same group who perform this task. As mentioned before, each of you receives an endowment of 6000 KHR. Member I decides to contribute 4000 RIEL into the group fund and keeps 2000 KHR for himself. Member I, please put 4000 KHR on top of the green envelope, and the remaining 2000 RIEL on top of the white envelope.

Now suppose that member II decides that he contributes zero Riel to the group fund and keeps 6000 KHR for himself. Member II, please put zero Riel on top of the green envelope, and 6000 KHR on top of the white envelope.

[Ask the group;]
Now, can you tell me how much did member I put in the green envelope? **[Take the money out and put it on the table]** How much did he put in the white envelope? **[Take the money out and put it on the table]**
How much did member II put in the green envelope? **[Take the money out and put it on the table]** How much did he put in the white envelope? **[Take the money out and put it on the table]**
How much money is in the group fund before it is increased? **[Count the bills for everyone to see].** We have 4000 KHR in the green envelopes. By how much will the group fund be increased? **[Put another 2000 KHR on the project fund pile and count each pile for people to see].** This will be increased by 2000 RIEL. In total there are now 6000 KHR in the group fund. Finally, how much does each member get from the group fund then? **[Divide the pile into two piles of 3000]**
Each member will thus get 3000 KHR from the group fund since the group fund has to be equally divided regardless how much each contributes.

[Ask the group]
How much does member I get in total? **To know how much he earns, we count the money in his green and white envelopes.**
Member I keeps 2000 KHR for himself (in his white envelope) and gets 3000 KHR from the group fund (in his green envelope). In total, member I gets 5000 KHR.
[Ask the group;]
How much does member II get in total? **To know how much he earns, we count the money in his green and white envelopes.**
member II keeps 6000 KHR for himself (in his white envelope) and gets 3000 KHR from the group fund (in his green envelope). In total member II gets 9000 KHR.
[Ask the group;]
Can you tell me, who earned more? Member I or member II?[member 2]

[**Randomly select 2 players and give each of them six bills of 1000 RIEL and a white and a green envelope. Assign who takes the role as participant I & II. Please make sure that each time YOU tell the persons on how much he should put into the project. Do not allow the players to take the decision because this may influence the decision of other potential players.**]

Example 2:
Now suppose that member I decides that he contributes 5000 RIEL into the group fund and keeps 1000 KHR for himself. Member I, please put 5000 KHR on top of the green envelope, and 1000 KHR on top of the white envelope.

Now suppose that member II decides that he contributes 3000 KHR to the group fund and keeps 3000 KHR for himself. Member II, please put 3000 KHR on top of the green envelope and the remaining 3000 KHR on top of the white envelope.

[Ask the group;]
Now, can you tell me how much money did member I put in the green envelope? **[Take the money out and put it on the table]** How much did he put in the white envelope? **[Take the money out and put it on the table]**
How much did member II put in the green envelope? **[Take the money out and put it on the table]** How much did he put in the white envelope? **[Take the money out and put it on the table]**
How much money is in the group fund before it is increased? **[Count the bills for everyone to see].** We have 8000 RIEL in the green envelopes. By how much will the group fund be increased? **[Put another 4000 KHR on the group fund pile and count each pile for people to see].** This will be increased by 4000 RIEL. In total there are now 12000 KHR in the group fund. Finally, how much does each member get from the group fund then? **[Divide the pile into two piles of 6000]**
Each member will thus get 6000 KHR from the group fund since the group fund has to be equally divided regardless how much each contributes.

[Ask the group]
How much did member I get in total? **To know how much he earns, we count the money in his green and white envelopes.**
Member I keeps 1000 KHR for himself (in his white envelope) and gets 6000 KHR from the group fund (in his green envelope). In total, member I gets 7000 KHR.
[Ask the group;]
How much does member II get in total? **To know how much he earns, we count the money in his green and white envelopes.**
Member II keeps 3000 KHR for himself (in his white envelope) and gets 6000 KHR from the group fund (in his green envelope). In total member II gets 9000 RIEL.
[Ask the group;]
Can you tell me, who earned more? Participant I or participant II? [member 2]

Are there any questions? Do you need more examples? **[If more examples are needed pick two other participants and do the examples again. If not, collect the money and proceed.]**

Please remember that any money that you put into the group fund is first increased by half and then divided equally with your partner. Any amount that you keep for yourself remains the same. If you keep 1000 KHR for yourself, it remains 1000 KHR. It neither increases nor is it divided. Your final earning from the task is the sum of the amount you keep for yourself and the amount you get from the group fund.

Are there any more questions? If there are no questions anymore please sit down and put up the blinds. We will provide each of you with an endowment of 6000 KHR, containing 6 bills of 1000 KHR and a green and a white envelope.

[Distribute the money and the envelopes]

Please decide now how much you want to put into the group fund (green envelope) and how much you want to keep for yourself (white envelope). Once you are done, we will come and collect the envelopes.

[When everyone is done, please collect the envelopes and make sure that on both envelopes the ID number is written down]

[TASK 3: Conditional Public Good Game]

Now we will read the instructions and give examples for the third task. This task is only slightly different from task 2, which we have just finished. As before you are in groups of two: you will be matched with a new partner who is someone in your community. In the last task, you did not know how much your partner put into the group fund. In this task, we allow you to make a plan about how much to contribute given how much your partner puts into the group fund. For every 1000 KHR in the group fund (the green envelope), we will add 500 KHR extra. The group fund will be divided equally between you and your partner.

Do you have any questions? If there are no further questions we will distribute the money and the envelopes to you.

[The TASK]

Now it's time to make 7 decisions. Please think carefully about those decisions.

[Distribute 6000 RIEL and a green and a white envelope to the participants. Make sure the blinds are put up.]

Decision 1: Out of an endowment of 6000 KHR, your partner in the group contributes 0 Riel to the group fund ***[put the money on the green envelope and show to everyone].*** Now, out of an endowment of 6000 KHR, how much would you like to contribute to the group fund? Please put the money you want to contribute to the group fund in the green envelope and the money for yourself in the white envelope. Now this decision is over. Please wait till we have collected the envelopes.

[Collect the envelopes, ensure that the id numbers are on them. Distribute new envelopes and another set of 6000 RIEL]

Decision 2: Out of an endowment of 6000 KHR, your partner in the group contributes 1000 KHR to the group fund ***[put the money on the green envelope and show to everyone].*** Now, out of an endowment of 6000 KHR, how much would you like to contribute to the group fund? Please put the money you want to contribute to the group fund in the green envelope and the

money for yourself in the white envelope. Now this decision is over. Please wait till we have collected the envelopes.

[Collect the envelopes, ensure that the id numbers are on them. Distribute new envelopes and another set of 6000 RIEL]

Decision 3: Out of an endowment of 6000 KHR, your partner in the group contributes 2000 KHR to the group fund ***[put the money on the green envelope and show to everyone]*.** Now, out of an endowment of 6000 KHR, how much would you like to contribute to the group fund? Please put the money you want to contribute to the group fund in the green envelope and the money for yourself in the white envelope. Now this decision is over. Please wait till we have collected the envelopes.

[Collect the envelopes, ensure that the id numbers are on them. Distribute new envelopes and another set of 6000 RIEL]

Decision 4: Out of an endowment of 6000 KHR, your partner in the group contributes 3000 KHR to the group fund ***[put the money on the green envelope and show to everyone]*.** Now, out of an endowment of 6000 KHR, how much would you like to contribute to the group fund? Please put the money you want to contribute to the group fund in the green envelope and the money for yourself in the white envelope. Now this decision is over. Please wait till we have collected the envelopes.

[Collect the envelopes, ensure that the id numbers are on them. Distribute new envelopes and another set of 6000 RIEL]

Decision 5: Out of an endowment of 6000 KHR, your partner in the group contributes 4000 KHR to the group fund ***[put the money on the green envelope and show to everyone]*.** Now, out of an endowment of 6000 KHR, how much would you like to contribute to the group fund? Please put the money you want to contribute to the group fund in the green envelope and the money for yourself in the white envelope. Now this decision is over. Please wait till we have collected the envelopes.

[Collect the envelopes, ensure that the id numbers are on them. Distribute new envelopes and another set of 6000 RIEL]

Decision 6: Out of an endowment of 6000 KHR, your partner in the group contributes 5000 KHR to the group fund ***[put the money on the green envelope and show to everyone]*.** Now, out of an endowment of 6000 KHR, how much would you like to contribute to the group fund? Please put the money you want to contribute to the group fund in the green envelope and the money for yourself in the white envelope. Now this decision is over. Please wait till we have collected the envelopes.

Collect the envelopes, ensure that the id numbers are on them. Distribute new envelopes and another set of 6000 RIEL]

Decision 7: Out of an endowment of 6000 KHR, your partner in the group contributes 6000 KHR to the group fund ***[put the money on the green envelope and show to everyone].*** Now, out of an endowment of 6000 KHR, how much would you like to contribute to the group fund? Please put the money you want to contribute to the group fund in the green envelope and the money for yourself in the white envelope. Now this decision is over. Please wait till we have collected the envelopes.

[Collect the envelopes, ensure that the id numbers are on them.]
So far, we have finished 3 tasks. We will have a 15-minute break now.

[Section 3: Threshold PGG]

[Treatment 1 – Framed as public good]

[Task 4]

Now we will read the instructions and give examples for the fourth task. Once we are sure that you understand the task, we will begin.

In this task, we will divide you into groups of three participants: you and two other persons who are members in your community. You will not come to know to which group you belong. Likewise, you will not come to know the identity of the other two members of your group. Similarly, the other two members will not come to know your identity either.

In this task, each participant will receive an endowment of 6000 RIEL consisting of 6 bills of 1000 RIEL. With this endowment of 6000 RIEL, you have to decide how much you want to keep for yourself and how much you want put into the group fund. The group fund is the money contributed by you and by two other members in your group.
The money you want to keep for yourself you put in the white envelope. The amount of money you put in the white envelope remains the same, does not increase or decrease, and you will get it for sure.

The money you want to contribute to the group fund, you put in the green envelope. The amount of money you get from the group fund can change, depending on how much you and the other two group members put into the green envelopes. Each group member either get zero Riel or 6000 KHR from the group fund. If 9000 KHR or more are in the green envelopes, each group member will get 6000 Riel from the group fund. If less than 9000 KHR are in the green envelopes, each group member will get zero Riel from the group fund.

[Ask the group]

1) If the total money in the green envelopes is 8000 RIEL which is less than 9000, how much will each member get out of the group fund? The answer is 0 RIEL.

[Ask the group]

2) If the total money in the green envelopes is 9000 RIEL which is exactly 9000, how much will each member get out of the group fund? The answer is 6000 RIEL.

[Ask the group]

3) If the total money in the green envelopes is 10000 RIEL which is more than 9000, how much will each member get out of the group fund? The answer is 6000 RIEL.

Have you understood what I have just explained so far? If you have any doubts or questions at this point, please raise your hand and ask the questions.

Remember: The money you want to keep for yourself you put in the white envelope, and the money that you want to put into the group fund you put in the green envelope. Your total earning is the sum from the white envelope and the money you get from the group fund. The money you get from the group fund is 6000 KHR each if the total amount in the green envelopes is 9000 RIEL or more. In contrast, the money you gets from the group fund is zero Riel each if the total amount in the green envelopes is less than 9000 RIEL.

[EXAMPLES]

We will show you with an example how the task is done in action. In these examples you can see the decision of all the three participants. In the actual task, however, you will not know what the other two in your group decide.

[**Randomly select 3 players and give them six bills of 1000 Riel and a white and a green envelope each. Assign who takes the role as participant I & II & III. Please make sure that each time YOU tell the persons on how much he should put into the green and white envelope. Do not allow the players to take the decision because this may influence the decision of other potential players.**]

In the following we give you two examples:

Example 1:

Now we will see what happens if member I puts 3000 RIEL in the green envelope, member II and member III put 0 RIEL in the green envelope. member I, please put 3000 RIEL on top of the green envelope and the remaining 3000 KHR on top of the white envelope. Member II and III, please put 0 RIEL on top of the green envelope and the remaining 6000 KHR on top of the white envelope.

[Ask the group;]

Now, can you tell me how many RIEL are in the green envelopes?

We have 3000 RIEL in the green envelopes. The green envelopes contain less than 9000 RIEL. Each member will thus get 0 RIEL from the group fund **[take away all bills on top of the green envelopes].**

[Ask the group;]

How many RIEL does member I get in total?

member I gets 3000 RIEL in total, since he has 3000 RIEL his white envelope and gets zero from the group fund.

[Ask the group;]
How many RIEL does member II get in total?
member II gets 6000 RIEL in total, since he has 6000 RIEL in his white envelope and gets zero from the group fund.
[Ask the group;]
How many RIEL does member III get in total?
member III gets 6000 RIEL in total, since he has 6000 RIEL in his white envelope and gets zero from the group fund.

[Ask the participants to take the money of the envelopes again]

If you have any questions, please raise your hand and ask them now.

Example 2: Now we will see what happens if member I puts 6000 RIEL in the green envelope, member II puts 3000 RIEL in the green envelope, and member III puts 0 RIEL in the green envelope. Member I, please put 6000 RIEL on top of the green envelope and the remaining 0 KHR on top of the white envelope. Member II, please put 3000 RIEL on top of the green envelope and the remaining 3000 KHR on top of the white envelope. Member III, please put 0 RIEL on top of the green envelope and the remaining 6000 KHR on top of the white envelope.
[Ask the group;]
Now, can you tell me how many RIEL are in the green envelopes?
We have 9000 RIEL in the green envelopes. Each member will get 6000 RIEL from the group fund. ***[add bills to each green envelope so the total is 6000 RIEL]***
[Ask the group;]
How many RIEL does member I get in total?
Member I gets 6000 RIEL in total, since he has 0 RIEL in his white envelope and gets 6000 RIEL from the group fund.
[Ask the group;]
How many RIEL does member II get in total?
Member II gets 9000 RIEL in total, since he has 3000 RIEL in his white envelope and gets 6000 RIEL from the group fund.
[Ask the group;]
How many RIEL does member III get in total?
Member III gets 12000 RIEL in total, since he has 6000 RIEL in his white envelope and gets 6000 RIEL from the group fund.

If you have any questions, please raise your hand and ask them now.
Since there are no questions anymore, we are ready to make the decisions now.

[Distribute the envelopes (make sure that in the green envelope is a paper slip) and the 6 bills and make sure that the blinds are up]

The difficulty about making this decision is that you do not know how much your two group members will put into the green envelope. You can only guess how much you need to put in

the green envelope to have jointly at least 9000. We would like to know what you think how much your partners will put in the green envelope. Therefore, we included a paper slip in the green envelope **[show the paper slip].** This paper shows you the thirteen options of how much your other two group members could jointly put into the green envelopes. The first option (the top one which has 0 Riel in the green envelope) means that the other two members jointly put 0 Riel in the green envelope. The last option (the bottom one which has 12000 Riel in the green envelope) means the other two members jointly put 12000 Riel in the green envelope. There is no way of knowing how much the other two group members will put in the green envelope. You have to guess. If you guess correctly, we will pay you another 1000 KHR.
How much do you think **both of your group members** will put jointly in the green envelope? Please tick the box. **[Show how to tick the box].** Once you ticked the box, please put the paper strip back into the green envelope.

Now we are ready to make the decision. Please distribute the 6000 KHR between the green and the white envelope.

[Collect the envelopes and make sure that the ID number is on both envelopes.]

Treatment 2 – public bad framing

[Task 4]

Now we will read the instructions and give examples for the fourth task. Once we are sure that you understand the task, we will begin.

In this task, we will divide you into groups of three participants: you and two other persons who are members in your community. You will not come to know to which group you belong. Likewise, you will not come to know the identity of the other two members of your group. Similarly, the other two members will not come to know your identity either.

In this task, each participant will receive an endowment of 6000 RIEL consisting of 6 bills of 1000 RIEL. With this endowment of 6000 RIEL, you have to decide how much you want to keep for yourself and how much you want put into the group fund. The group fund is the money contributed by you and by two other members in your group.
The money you want to keep for yourself you put in the white envelope. The amount of money you put in the white envelope remains the same, does not increase or decrease, and you will get it for sure.

The money you want to contribute to the group fund, you put in the green envelope. The amount of money you get from the group fund can change, depending on how much you and the other two group members put into the white envelope. Each group member either gets zero KHR or 6000 KHR from the group fund. If 9000 KHR or less are in the white envelopes, you get 6000 Riel each from the group fund. If more than 9000 KHR are in the white envelopes, each of you gets zero from the group fund.

[Ask the group]
1) If the total money in the white envelopes is 10000 RIEL which is more than 9000, how much will each member get out of the group fund? The answer is 0 RIEL.
[Ask the group]
2) If the total money in the white envelopes is 9000 RIEL which is exactly 9000, how much will each member get out of the group fund? The answer is 6000 RIEL.
[Ask the group]
3) If the total money in the white envelopes is 8000 RIEL which is less than 9000, how much will each member get out of the group fund? The answer is 6000 RIEL.

Have you understood what I have just explained so far? If you have any doubts or questions at this point, please raise your hand and ask the questions.
Remember: The money you want to keep for yourself you put in the white envelope, and the money that you want to put into the group fund you put in the green envelope. Your total earning is the sum from the white envelope and the money you get from the group fund. The money you get from the group fund is 6000 KHR if the total amount in the white envelopes is 9000 RIEL or less. Each of you gets zero from the group fund if the total amount in the white envelope is more than 9000 RIEL.
[EXAMPLES]
We will show you with examples how the task is done in action. In this example you can see the decision of all the three participants. In the actual task, however, you will not know what the other two in your group decide.

[**Randomly select 3 players and give them six bills of 1000 Riel and a white and a green envelope each. Assign who takes the role as participant I & II & III. Please make sure that each time YOU tell the persons on how much he should put into the envelopes. Do not allow the players to take the decision because this may influence the decision of other potential players.**]
In the following we give you two examples:

Example 1:
Now we will see what happens if member I puts 3000 RIEL in the white envelope, member II and member III put 6000 RIEL in the white envelope. Member I, please put 3000 RIEL on top of the white envelope and the remaining 3000 KHR on top of the green envelope. Member II and III, please put 6000 RIEL on top of the white envelope and the remaining 0 KHR on top of the green envelope.
[Ask the group;]
Now, can you tell me how many RIEL are in the white envelopes?
We have 15000 RIEL in the white envelopes. The white envelopes contain more than 9000 RIEL. Each member will thus get 0 RIEL from the group fund **[take away all bills on top of the green envelopes]**
[Ask the group;]
How many RIEL does Participant I get in total?

Member I gets 3000 RIEL in total, since he has 3000 RIEL his white envelope and gets zero from the group fund.
[Ask the group;]
How many RIEL does member II get in total?
member II gets 6000 RIEL in total, since he has 6000 RIEL in his white envelope and gets zero form the group fund.
[Ask the group;]
How many RIEL does member III get in total?
Member III gets 6000 RIEL in total, since he has 6000 RIEL in his white envelope and gets zero form the group fund.

[Ask the participants to take the money of the envelopes again]

Example 2: Now we will see what happens if member I puts 0 RIEL in the white envelope, member II puts 3000 RIEL in the white envelope, and member III puts 6000 RIEL in the white envelope. Member I, please put 0 RIEL on top of the white envelope and the remaining 6000 KHR on top of the white envelope. Member II, please put 3000 RIEL on top of the white envelope and the remaining 3000 KHR on top of the green envelope. Member III, please put 6000 RIEL on top of the white envelope and the remaining 0 KHR on top of the green envelope.
[Ask the group;]
Now, can you tell me how many RIEL are in the white envelopes?
We have 9000 RIEL in the white envelopes. Each participant will get 6000 RIEL from the group fund. ***[add bills to each green envelope so the total is 6000 RIEL]***
[Ask the group;]
How many RIEL does member I get in total?
Member I gets 6000 RIEL in total, since he has 0 RIEL in his white envelope and gets 6000 RIEL from the group fund.
[Ask the group;]
How man RIEL does member II get in total?
Member II gets 9000 RIEL in total, since he has 3000 RIEL in his white envelope and gets 6000 RIEL from the group fund.
[Ask the group;]
How man RIEL does member III get in total?
Member III gets 12000 RIEL in total, since he has 6000 RIEL in his white envelope and gets 6000 RIEL from the group fund.

If you have any questions, please raise your hand and ask them now. **[If necessary, repeat the examples in the same order]**

Since there are no questions anymore, we are ready to make the decisions now.

[Distribute the envelopes (make sure that in the white envelope is a paper slip) and the 6 bills and make sure that the blinds are up]

The difficulty about making this decision is that you do not know how much your two group members will put into the white envelope. You can only guess how much you need to put in the white envelope to have jointly not more than 9000. We would like to know what you think how much your partners will put in the white envelope. Therefore, we included a paper slip in the white envelope **[show the paper slip].** This paper shows you the thirteen options of how much your other two group members could jointly put into the white envelopes. The first option (the top one which has 0 Riel in the white envelope) means that the other two members jointly put 0 Riel in the white envelope. The last option (the bottom one which has 12000 Riel in the white envelope) means the other two members jointly put 12000 Riel in the white envelope. There is no way of knowing how much the other two group members will put in the white envelope. You have to guess. If you guess correctly, we will pay you another 1000 KHR.
How much do you think **both of your group members** will put jointly in the white envelope? Please tick the box. **[Show how to tick the box].** Once you ticked the box, please put the paper strip back into the white envelope.

Now we are ready to make the decision. Please distribute the 6000 KHR between the green and the white envelope.

[Collect the envelopes and make sure that the ID number is on both envelopes.]

Appendix 6. Survey Items

Survey

1) Session ID

2) Identification number of the participant

3) What is your relation to the head of the family?
   a) I am the household head
   b) Spouse
   c) Child
   d) Parent
   e) Other relative

4) What is your marital status?
   a) Single
   b) Married
   c) Divorced
   d) Widow(er)

5) Gender
   a) Male
   b) Female

6) How old are you (years)?

7) How many years did you attend school?

8) What is your primary occupation?
   a) Rice farmer
   b) Fisher
   c) Other

9) Did your family cultivate rice last year?
   a) Yes
   b) No

10) [If Q9 yes] How many hectares of paddy land with access to irrigation does your family own?

11) [If Q11>0] For that water source, did you have enough water for irrigating?
   a) Yes
   b) No

12) [If Q11 no] How scarce was it last year?
   a) Somehow scarce
   b) Moderately scarce
   c) Extremely scarce

d) I cannot rate

13) [If Q11 no] Overall, how many times did you face such a scarcity in the last 5 years?

14) [If Q11 no] Overall, how would you rate the degree of water scarcity in your community?
a) Somehow scarce
b) Moderately scarce
c) Extremely scarce
d) I cannot rate

15) [If Q11 no] What do you think are the reasons for this water scarcity? [Pick multiple]
a) Drought
b) Climate change
c) People overuse
d) Increasing demand for water
e) Other reasons

16) Did your family engage in fishing in the last year (2018)?
a) Yes
b) No

17) [If Q16 yes] Has your family experienced a decline in fish catch in the past 5 years?
a) Yes
b) No

18) [If Q16 yes] What do you think are the reasons for a decline in the fish catch? [pick multiple]
a) Overfishing
b) Illegal fishing
c) Natural causes
d) Other

19) [If Q16 yes] In the past 5 years, has your family observed a collapse of certain type of fish?
a) Yes
b) No

20) Did your family experience any sudden drop in income (income shock) last year?
a) Yes
b) No

21) [If Q20 yes] What was the reason for that sudden drop in income? [Pick multiple]
a) Crop loss
b) Livestock loss
c) Land loss
d) Fishing equipment loss
e) Agricultural equipment loss
f) Other

22) Did your family experience any major natural disasters last year?
    a) Yes
    b) No

23) [If Q22 yes] What was it? [Pick multiple]
    a) Drought
    b) Flood
    c) Fish dying
    d) Storm
    e) Other

24) Do you think most people in this community can be trusted? [Pick one]
    a) Yes
    b) No

25) Do you think most people in this community are willing to help is someone is in need?
    a) Yes
    b) No

26) Suppose that 10 of your neighbours are invited to help in community activities (e.g. repairing a canal or dam). How many would show up?

We have reached the end of the survey. Thank you in the name of the team for your participation.