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Intertemporal Decisions for Oneself and for a Group and Conservation Decisions: Evidence from a Thai Coastal Village

Suparee Boonmanunt, Thomas Lauer, Bettina Rockenbach, and Arne Weiss

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Front cover photo: Coastal villagers in Naithung village, Nakhon Si Thammarat province, Southern Thailand. Photo by Suparee Boonmanunt

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September, 2016

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Suparee Boonmanunt, Thomas Lauer, Bettina Rockenbach, Arne Weiss

EXECUTIVE SUMMARY

This study investigates the effects of others' time preferences on the subjects' decisions for a group. We conduct a lab-in-the-field experiment with Thai coastal villagers, in which we elicited time preferences. First, the participants decide for themselves and results show that on the average, their choices show a present bias. The participants then decide for a group (composed of three members) that include themselves. Prior to this decision, the participants are informed about the choices that the other members made in the individual setting. Results show that the choices made for the group are significantly less present-biased. The mechanism driving this result is that the information about a more patient member is more influential than the information about a less patient member.

This study also examines the relationship between intertemporal decisions and conservation. We then organize a mangrove-planting activity to observe the participants' actual contribution to a conservation activity. We use the number of mangrove seeds planted and the participants' membership status in a conservation group as proxies for their individual conservation decisions. Our results suggest that less present-biased participants contribute more to the planting activity and seem to be more likely to be members of the conservation group, although conservation decisions are unrelated to the villagers' long-run discounting.

STUDY 1

THE EFFECTS OF OTHERS' PREFERENCES ON INDIVIDUAL INTERTEMPORAL DECISIONS FOR GROUPS: EVIDENCE FROM A THAI COASTAL VILLAGE

Suparee Boonmanunt, Thomas Lauer, Bettina Rockenbach, Arne Weiss

EXECUTIVE SUMMARY

We conducted a lab-in-the-field experiment with Thai coastal villagers to compare the intertemporal decisions for oneself and for a group. In the experiment, the subjects first decide for themselves, with the result showing that their choices have a present bias. Participants then decide for a randomly created group of three members, which includes themselves. Prior to this decision, the participants are informed about the choices that the other group members made for themselves. Results show that the choices made for the group are significantly less present-biased than the choices made for oneself. The mechanism driving this result is that the information about a more patient member is more influential than that about a less patient member. We also find a strong correlation between the present bias elicited by our experimental measure and the membership in an informal savings group. This provides external validity of the experimental measures of time preferences on saving behavior in the informal financial sector, which plays an important role in developing countries.

1.0 INTRODUCTION

People are confronted with intertemporal decisions all the time. They are forced to trade off costs and benefits at different points in time. In many cases, they have to compare an option that provides a long-term stream of benefits with another option that offers a high one-time benefit. Examples are decisions on savings and on extraction of natural resources. Often, people give in to a tempting short-term option instead of choosing a long-term option that offers higher overall utility, as judged by the individuals themselves. For example, they plan to save tomorrow, but when tomorrow arrives, they end up spending all their money on shopping or partying. Such self-control problems can be modeled as present-biased preferences (O'Donoghue and Rabin 1999) in the quasi-hyperbolic discounting model described by Laibson (1997), where discount rates decline over time. A large body of work shows discounting with declining trend (e.g., Frederick, Loewenstein, O'Donoghue 2002).

The failure to save may be particularly detrimental for poor households in developing countries, where both the market and the state often fail to provide them with access to credit and adequate protection against income or expenditure shocks. One response of poor households all over the developing world is to join savings groups, which consist of two types: rotating funds and nonrotating funds (Bouman 1995). In this study, we focus on the savings groups with nonrotating funds, which are characterized by the mutual dependence between members. One member's savings and investment decisions affect the amount others will be able to borrow. Furthermore, the savings club in our study site makes joint investments (e.g., conservation activities or infrastructure investments), in which the members have to incur some cost now for the prospect of larger benefits in the future. In this study, we ask how this structure of mutual dependence influences the members' individual decisions.

A large body of literature (Gugerty 2007; Anderson, Baland, and Moene 2009) offers mainly the following two explanations as to how savings clubs can help overcome self-control problems: (1) these groups work as commitment devices or (2) there is peer pressure within groups. Our study examines one mechanism by which groups might affect intertemporal decisions, which has hitherto only been lightly touched upon in the existing literature.

The change in individual intertemporal decisions in group settings is unclear. Group membership changes individual decisions in both strategic (Charness, Rigotti, and Rustichini 2007) and non-strategic games (Sutter 2009). In both studies, delegates try to get a higher payoff for all group members.

However, other studies that focus on intertemporal decisions by an agent (who decides for a group) yields different findings. Jackson and Yariv (2014) model that given heterogeneity of time preferences in a group, an agent chooses a present-biased option for the group, excluding him/herself, when s/he fully considers the time preferences of the group members. By contrast, Shapiro (2010) models a delegate as altruistic over payoffs (and not utility) of other group members. Hence, s/he will have a higher discount factor and be more time-consistent when s/he decides for all the group members even when s/he is him/herself present-biased. These two models show that any difference in the intertemporal decisions of a delegate, compared to the intertemporal decisions of the group members themselves, depends crucially on how other group members enter the delegate's utility function. To our best knowledge, no study has yet tackled this empirical question.

In this study, we investigate how the information about others' time preferences influences the intertemporal decisions that affect other group members. In order to answer this question, we need two sets of intertemporal decisions for every individual: one in isolation and one after being exposed to group members' time preferences. As this data set is virtually impossible to collect with happenstance data, we conduct a controlled experiment and elicit the time preferences of our participants in both individual and a group setting.

First, participants decide for themselves in the individual setting. In the group setting, prior to making choices for a group, the subjects are informed about the choices that the other group members made for themselves in the individual setting. By providing the delegates with information on the decisions that the other group members took for themselves, we can see first whether or not the delegates will consider the group members' preferences. Second, we can test whether any convergence away from the delegate's own preferred options toward the preferred options of others depends on whether others are more or less patient than the delegate. Third, by looking at cases in which the delegate is as patient as the other group members, we can test whether or not merely deciding on behalf of others changes one's decisions.

We conduct the experiment in the field, particularly in a Thai coastal village. The field setting has clear advantages for our research purposes. First, the setting promises higher external validity than the typical laboratory study with students in rich countries. We draw inference from a subject pool who consider savings groups as an important means to save and for whom the structure of mutual dependence is actually relevant. The field setting is furthermore characterized by a higher degree of heterogeneity among participants with respect to age, income, and education. Therefore, time preferences might vary more among our participants than among student subject pool. We can also directly assess the external validity of the experimentally elicited time preferences by testing as to what extent they correlate with savings behavior in the field, as represented by the membership status of an informal savings group.

In this savings group, members have to save a constant small amount every month. All savings are used for all members, e.g., for micro-loans, health insurance, and life insurance. Thus, one's own saving decision benefits the whole group. Once a month, members gather together to make all transactions, including saving as the most important activity. This provides the members with information about the saving behavior of the other members.

We find that the participants are on average present-biased. When they decide for a group, however, they tend to choose more patient options and become less present-biased. The mechanism driving this result is that the information about a more patient group member is more influential than that about a less patient member. In addition, we find that the members of the savings group in our study site are significantly less present-biased than the nonmembers. Our study provides some evidence for the external validity of the experimental measure of time preferences on the decisions to enroll in an informal savings group.

2.0 SUBJECT POOL

The participants of our study are the villagers of Naithung village in Nakhon Si Thammarat province, Southern Thailand. The village is located along the coast of the Gulf of Thailand. The major economic activities in the area are related to fisheries, such as fishing with their own boats, selling fish, making fish nets, working on boats, etc. Although there is open access to fishing grounds, the fishermen in Naithung practice sustainable fishing by using fishing instruments that allow small aquatic animals to escape, then grow and reproduce (Patkaew and Chaiyarak 2010). In 2002, a few fishermen founded the Naithung's Fisherfolk Conservation Group (hereafter, the conservation group) to organize conservation activities regularly, such as the annual building of offshore shelters for aquatic animals and mangrove planting on the coast (Fisherfolk Network Sichon-Thasala 2012).

In general, fishermen find it hard to save long-term because their income is extremely volatile due to the seasons (wind, storms, etc.), and they have to regularly invest in fishing equipment. When they urgently need money, many fishermen take loans from informal moneylenders who demand much higher interest rates than do formal sources (Chuaychoo 2002). To help its members financially and to encourage other villagers to join in conservation activities, the conservation group also manages a savings fund called the Naithung's Rizq savings group (hereafter, the savings group).

The savings group works as follows: members save THB 50 (around USD 1.53)[1] monthly into the fund. After being a member for at least 12 months, members are eligible to take a micro-loan. The savings group does not charge formal interest when members borrow money and does not give interest to savings. It does charge, however, an administration fee for receiving a loan, which is paid once at the beginning and depends in size on the amount of the loan. Considering this fee as a de facto interest, the range of the interest rates is 0.175%–0.55% per month. This is low compared to other informal sources, which can be around 20% per month. Furthermore, members also receive micro health insurance and life insurance (See Appendix A1 for more details).

Note that all loans and insurances come from the savings that every member puts into the fund monthly. Therefore, one's own saving behavior and loan default affects the whole fund and the benefits of other members.[2]

3.0 THEORETICAL FRAMEWORK AND EXPECTED BEHAVIORS

In this study, we use the convex time budget (CTB) method introduced by Andreoni and Sprenger (2012) to elicit time preferences. Participants are given a budget, and they have to split the given budget between two given dates at a given gross interest rate.

3.1 Theoretical Framework for Time Preference Elicitation

We adopt the standard theoretical framework for the CTB method from Andreoni and Sprenger (2012). By including present-biased preferences into a standard intertemporal utility function, the total utility function is

$$U_t = u(c_t) + \beta \sum_{k=1}^{T} \delta^k u\,(c_{t+k}) \qquad \text{Equation (1)}$$

[1] USD 1 is equal to THB 32.62 when the experiment was conducted.

[2] Some members might save monthly just to be able to borrow money from the fund; however, this is exactly the same rationale as a normal saving decision, i.e., to save money today for the amount of money that can be used in the future. These people forgo an opportunity to spend money now so that they will be able to borrow money when they need it.

where:

t = present period,
k = time span,
δ = long-run discounting (a discount factor), and
β = parameter for present-biased preference with $0 \leq \beta < 1$.

In particular, $\beta = 1$ corresponds to the case of standard exponential discounting. The one-period discount factor between the present and a future period is $\beta\delta$, while the one-period discount factor between two future periods is δ. Maximizing the utility function subject to a budget constraint, $Px_t + x_t + x_{t+k} = M$, gives the following first-order condition:

$$\frac{x_t}{x_{t+k}} = \left(P\,\beta^{t_0}\,\delta^k\right)^{\frac{1}{\alpha-1}}, \qquad \text{Equation (2)}$$

where:

x_t = budget allocated to the sooner date,
x_{t+k} = budget allocated to the later date,
t_o = indicator for whether the sooner date is immediate or not ($t = 0$),
P = gross interest rate, and
α = utility function curvature.

Rewriting the equation by substituting the budget constraint gives

$$x_t = \frac{Y\left(P\,\beta^{t_0}\delta^k\right)^{\frac{1}{\alpha-1}}}{1+P\left(P\,\beta^{t_0}\,\delta^{k\vartheta}\right)^{\frac{1}{\alpha-1}}}. \qquad \text{Equation (3)}$$

Equation (3) tells us that the higher present bias parameter β and/or the higher long-run discounting δ leads to the higher fraction of the budget allocated to the sooner date x_t.

Then, we extend this model to capture the situation where the decisions of a delegate also affect other people. Assume that there is an agent *i* who is delegated to decide for the whole group. Agent *i*'s decision binds for all the other group members (x^G), and *i* cares about the utility of the other group members. The other group members could have the same more or a less patient time preference than *i*. Agent *i* then takes the utility of others into account with weights for each type of others. The weights for the other types could be zero or the same for all types or different across types. The weights are zero if the agent is purely self-oriented. If the agent is a (neutral) conformist, then s/he has weights greater than zero for all types of others. If the agent is a conformist with a paternalistic[3] bias, then s/he will weigh the more patient others more heavily than the less patient others.

Agent *i* then maximizes the weighted discounted utility. As a result, agent *i* might change his/her decisions when deciding for the group, depending on how *i* weighs the different types of others. The model predicts that *i* decides more (or less) patiently for the group when *i* weighs the more patient type more (or less) heavily than the less patient type.[4]

3.2 Expected Behaviors

We use this experiment to investigate our hypotheses, which are based on our theoretical predictions and on existing literature. Regarding the comparison between intertemporal decisions for oneself and for a group, the null hypothesis is that decisions for oneself and for a group are not different, as people only care about their own utility in the standard economic model.

The symmetric conformity hypothesis states that subjects change their decisions toward decisions of others when they decide for a group. It is based on the assumption that individuals weigh different types of others equally. Subjects will thus change decisions similarly to a more patient and a less patient type.

[3] Patience is considered to be a socially desirable characteristic across regions and cultures. Proverbs from different parts of the world encourage people to be patient, as do various religions and philosophers.

[4] See detailed formal calculation in Appendix A2.

Previous experiments comparing intertemporal decisions for oneself and for a group suggest, however, that group decisions are more patient and less present-biased (Abdellaoui, L'Haridon, and Parashiv 2013; Shapiro 2010). Shapiro (2010) interprets his findings as evidence for the assumption of his model that delegates are altruistic over payoffs and not over utility. Nevertheless, the mechanism driving behind the difference, especially the effect of information about other members' preferences on one's own decisions for a group has never been the focus of any study.

The closest in spirit to our study is the independent and unpublished work of Denant-Boemont, Diecidue, and L'Haridon (2015). Our study differs from theirs in the aspect of how decisions for groups are made, the type of subject pools, and, most importantly, we study explicitly how the time preferences of other group members influence one's decisions for the group. Denant-Boemont, Diecidue, and L'Haridon (2015) let each student-participant decide both individually and in groups under majority voting with a deliberation period of mock voting for five rounds. Group decisions are calculated by the median of all five choices by all five members. Their results show that group members converge their decisions toward higher patience and time consistency.

Regarding the effects of others' preferences on one's behavior that affect others, Bolton, Ockenfels, and Stauf (2015) find that subjects become more conservative (i.e., more risk-averse) when they are responsible for the payoff of a passive player. Further, a decision maker tends to adjust his/her decisions toward risk aversion when s/he is informed that a passive player is more risk-averse than s/he is. On the other hand, a decision maker does not adjust his/her decisions when a passive player is less risk averse. This indicates that having responsibility matters, and that decision makers conform asymmetrically toward the preferences of others. Risk aversion in a risky situation and patience in an intertemporal situation might be considered to be more socially desirable than other kinds of preferences in those situations. Hence, people might put more weight on a more patient than a less patient type when they decide as a group.

The asymmetric conformity hypothesis states that subjects conform more strongly to the decisions of a more patient type than to those of a less patient type. It is based on the assumption that delegates weigh the more patient others more heavily than the less patient others. When subjects are informed that others are more patient, they change their choices for the group toward the more patient direction. By contrast, they would not change their choices for the group as strongly toward the less patient direction when they are informed about the less patient others. When subjects get conflicting information, they should change their choices for the group toward a more patient direction.

Another aim of our field study is to examine the relationship between the subjects' time preferences elicited by experimental measures and their field financial decisions, which is the membership status in the savings group described above. Although Ashraf, Karlan, and Yin (2006) find that higher present-biased participants in hypothetical questions are more likely to open a commitment savings account, it is unclear that the same relationship would apply in our case. The savings group in our study is not just a simple commitment device—it requires regular self-control from its members. In exchange, it offers a number of long-term benefits to the members as well. Moreover, some previous studies in developed countries find that discount rate predicts self-reported saving behaviors in adolescents and children (Sutter 2009; Lührmann, Serra-Garcia, and Winter 2014), as well as a present bias in children (Lührmann, Serra-Garcia, and Winter 2014). We expect that our subjects who are members of the savings group to be more patient and less present-biased than the nonmembers.

4.0 THE EXPERIMENT

4.1 Experimental Design

The design of this experiment is based on Andreoni and Sprenger (2012); Andreoni, Kuhn, and Sprenger (2015); and Lührmann, Serra-Garcia, and Winter (2014). There are three time frames: (I) today and two weeks, (II) today and four weeks, and (III) two weeks and four weeks.

Equation (4)[5] shows that the degree of present bias (β)can be identified by comparing (I) and (III), while the long-run discounting (δ) can be identified by comparing decisions in time frame (I) and (II). Subsequently, the types of decisions are pinpointed.

$$ln\left(\frac{x_t}{x_{t+k}}\right) = \frac{\ln\beta}{\alpha - 1} t_0 + \frac{\ln(\delta)}{\alpha - 1} k + \frac{1}{\alpha - 1} \ln(P) . \qquad \text{Equation (4)}$$

The amounts allocated to sooner and later dates in each decision can already reveal information about the patience and present bias of a decision maker. The more patient a subject is, the less she allocates to the sooner date. Furthermore, a subject is present-biased if she allocates more of the budget to the sooner date in the short run (time frame 1) than in the long-run time frame (time frame 3) for a given gross interest rate. The bigger this difference is, the larger is the present bias.

The experimental budget (*M*) is always THB 300 (around USD 9.2),[6] which is the minimum daily wage in Thailand. Thus, a subject has THB 300 for each decision to allocate between sooner and later dates. There are five gross interest rates for each time frame, from 1.05 to 2.00, which corresponds to interest rates of 5% to 100% for two weeks.[7] These are much larger than the market interest rate at commercial banks (the informal savings group does not pay any interest on savings). Since the villagers are predominantly Muslim, the informal savings groups in the village follow the Muslim rule of not paying any interest on savings and not collecting any interest from loans. Some villagers do have savings accounts at commercial banks and can expect annual interest rates of around 2%, which was the average deposit interest rate in Thailand in 2014 (The World Bank 2016).

4.1.1 Decisions

Table 1.1 summarizes all five decisions (rows in the table) for time frame 1 (today, +2 weeks). The corresponding parameters are shown in the last three columns. The options stay the same in time frame 2 (today, +4 weeks) and time frame 3 (+2 weeks, +4 weeks), with only the timing of payments changing. The subjects have to choose one favorite budget allocation out of four allocation options for each decision. Option 4 always gives the highest total payoff of THB 300, which is the full budget, but subjects have to wait to get money at the later date. Option 1 gives the whole payoff on the sooner date, but the amount is the budget discounted by the corresponding gross interest rate. The total amount of payoff on both sooner and later dates in each option increases with the option number, but the subjects have to be more patient for a higher total payoff. Hence, option 4 is the most patient option, and option 1 is the least patient option. All subjects have to go through all 15 decisions. The subjects are presented with one decision at a time.

Table 1.1. Decisions in time frame 1 (today, +2 weeks)*

No.	Payment Dates	Option 1 (THB)	Option 2 (THB)	Option 3 (THB)	Option 4 (THB)	*t* (Sooner Date)	*k* (Delay Days)	*P* (Gross Interest Rate)
1	TODAY	285	190	95	0	0		
	AND in 2 WEEKS	0	100	200	300		14	1.05
2	TODAY	270	180	90	0	0		
	AND in 2 WEEKS	0	100	200	300		14	1.11
3	TODAY	240	160	80	0	0		
	AND in 2 WEEKS	0	100	200	300		14	1.25
4	TODAY	210	140	70	0	0		
	AND in 2 WEEKS	0	100	200	300		14	1.43
5	TODAY	150	100	50	0	0		
	AND in 2 WEEKS	0	100	200	300		14	2.00

Note: * See the complete decisions for all three time frames in Appendix A4.

[5] Given by taking logs to Equation (2).

[6] USD 1 was equal to THB 32.62 at the time of the experiment.

[7] Appendix A4 provides more details about the standardized daily rate and the annual rate of decisions in our experiment.

4.1.2 Treatments

All subjects are told at the beginning of the experiment that there are two decision situations, and that the rules of the second situation will only be explained after all the subjects have finished the first situation. We next describe each treatment in detail.

Main treatment. To see whether an individual can change choices when deciding for a group instead of just for oneself, we employ a within-subject design. In the first situation, the subjects decide individually, just for oneself. The subjects are given an answer sheet for each decision (a row in Table 1.1). The subjects see four calendars, with each calendar representing each of the four options. The calendars show clearly on what dates and how much money the subjects will get. Thereafter, the subjects choose one favorite option by circling the number of their favorite calendar.

In the second situation, the subjects decide as a group member. They are randomly put into groups of three members. To keep the identities of the group members anonymous,[8] we use symbols to represent the members. Each group consists of a "Shrimp," a "Crab," and a "Fish." The subjects make 15 decisions in each situation, so 30 decisions in total.

In order to study how the information about the other members' choices affect the choices that the subjects make for the group, we inform the subjects about the options that the other two group members have made for themselves, before they make a choice for their groups. Hence, the time preferences of the other two group members are revealed.[9] Figure 1.1 shows an example of an answer sheet for a decision for a group. In the answer sheet, a subject's symbol is on the top right corner (a "Crab" in Figure 1.1). On the bottom right corner, the subjects can see the choices that the other two group members have made for themselves in the corresponding decision (the decisions of "Fish" and "Shrimp" in Figure 1.1). An answer sheet for a decision for oneself looks similar but there are no symbols and no information about other group members' choices.

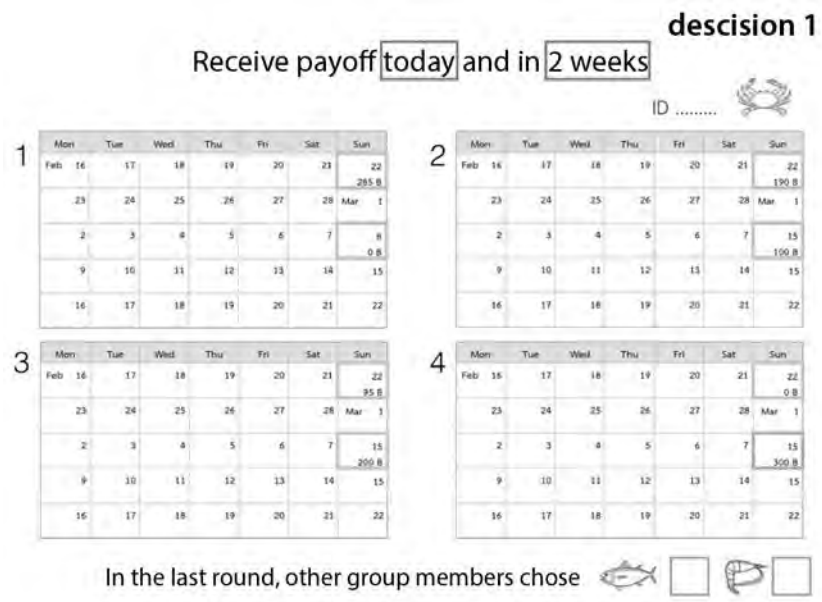


Figure 1.1 Example of an answer sheet for a decision for a group

[8] Since we cannot control for outside-lab relationship between the participants and the prior experience that participants had with each other.

[9] Some groups have opportunities to exchange free-form messages with the other two group members once before the second round starts. However, the exchanged messages do not have any additional effect on the subjects' choices for the group. Hence, we pool the groups with and without an exchange of messages into the main treatment.

One randomly selected group member is a delegate of the group (random dictator), whose choice is binding for all the members of the group. We decide to implement the random-dictator mechanism to determine group decisions instead of, for instance, majority voting. This mechanism aims to eliminate possible strategic concerns that would make it difficult to answer our research questions. If a subject has beliefs about his preferences relative to other group members, then he has an incentive to misrepresent his preferences in the group setting toward extreme options in order to make it more likely that the group decision will be closer to his ideal point.

Control treatment. Subjects decide individually only for oneself twice.

4.2 Procedure

The lab-in-the-field experiment was conducted on 21–22 February, 2015, in school classrooms in Naithung village. In total, 180 villagers participated in the experiment, of which 90% are from fishing families and 63.33% are fishermen. Some 38.33% of all participants are members of the savings group, the rest are nonmembers. The participants' ages range between 19 and 80 years old, with an average age of 44.24 years. The participants were randomly selected into treatments: 165 participants in the main treatment and 15 participants in the control treatment.

In the experiment, after all the participants have made their 30 decisions, a randomly selected participant in each session randomly draws from a box one lot (out of the 30 number lots) to determine the decision that is paid out. The participants are informed about this random lottery mechanism. With this mechanism, all decisions are relevant for the payoff, and income effects can be avoided. If a decision for a group in the main treatment (i.e., decisions 16–30), is drawn, another randomly selected participant makes another random draw to determine a delegate by drawing a lot out of the three symbol lots (fish, crab, and shrimp).

Further, participants receive THB 100 (around USD 3.07) as a fee for showing up and an additional THB 100 for answering a post-experimental questionnaire. This additional payment for the questionnaire is announced after the experiment. Hence, it does not influence the choices made in the experiment.

The experiment takes around 80 minutes for the main treatment, and 60 minutes for the control treatment. Additionally, an interview for the post-experimental questionnaire takes around 30 minutes. The total average earning is THB 480.42 (USD 15.73), which is 60% higher than the minimum daily wage of THB 300.

4.3 Implementation of Payments

The most concerning issues in the experiment involving the payments at different points of time are (1) the trust of the subjects that payments will be made in the future and (2) the unequal transaction costs across payment dates. We try to eliminate these concerns as much as possible by implementing the procedure discussed in this section.

Introduction to community leaders. During the first field survey, NGO officers who have been working in the area for over 10 years introduced us to the community leaders.

Stay in the field. The researcher who conducted the experiment had stayed in the village for around two months before the experiment period, so she was not a stranger to the participants. During this period, the researcher conducted interviews and focus groups with various villagers. However, to avoid biases regarding those participants who knew the researcher, she told them that the money they would get from the experiment was not hers, but came from a foreign-granting organization.

Announcement. The community leaders, who are also the committee members of the savings group, announced the experiment. The community leaders are trustworthy with regard to money issues, and they assured the participants that the researcher will pay according to what she had promised.

Contract. After the experiment, the participants received a contract signed by the researcher, stating how much and on what dates they will get their payments. The researcher stressed to them that they could sue her if she does not pay them according to the contract.

Transaction costs. The fee of THB 100 given for showing up was divided equally and paid in cash on both payment dates to compensate for transaction costs equally across both dates.

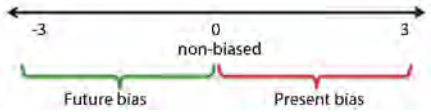
Delivery of payments. The participants received the "today" payment in cash after the experiment to make the payment schedule immediate. For "later" payment, the participants were asked to pick up the money at the community shop by the pier, where everyone knows, passes by, and hangs around every day. The traveling expenses and time should be equal for participants between the experiment locations and the community shop.

4.4 Measures of (Revealed) Time Preferences

First, we look at the actual choices that the subjects made in the experiment. Then, we use nonparametric measures of time preferences in order to avoid making assumptions on the utility function that can happen if we estimate the parameters for time preferences in a parametric framework (Sutter et al. 2013 use the nonparametric measures due to this argument).[10] Further, using the nonparametric measures of time preferences allows us to have measures for all participants.

The measure of present bias is calculated as the difference between the average of the five choices made for time frame 3 (+2 weeks, +4 weeks) and the average of five choices made for time frame 1 (today, +2 weeks). Both time frames have the same time span of two weeks, but the sooner payment date is immediate in time frame 1. If a participant is present-biased, then s/he is more patient for the future time frame (time frame 3), chooses the higher options, and then the measure is positive. The opposite holds for a future-biased participant. If a participant is non-biased, then s/he chooses the same option in both time frames, and the measure of present bias is zero.[11]

Measure of present bias = Average choice in time frame 3 – Average choice in time frame 1



The measure of long-run discounting is calculated as the average of the five choices made in time frame 3, in which both payment dates are in the future (+2 weeks, +4 weeks), so that only long-run discounting exists but without any present bias. Another way to observe whether subjects discount or not is to compare decisions made in time frame 1 (today, +2 weeks) and time frame 2 (today, +4 weeks).

Measure of long-run discounting = Average choice in time frame 3 (scale from 1–4)

[10] We also estimate parameters β_i and δ_i of the utility function based on Equations (2) and (4). However, we cannot estimate the individual parameters of those participants who did not alter the choice at all (i.e., those who always chose the same option across 15 decisions) since no variation in choices make it insufficient for the estimation. For decisions for oneself, our sample is reduced by 55 subjects (out of 180). For decisions for a group, the sample is additionally reduced by 25 subjects. The main results of this method are not different from using the actual choices and nonparametric measures. Appendix A6 shows our results for this estimation.

[11] The problem with this measure of present bias is that participants could be present-biased for some decisions and future-biased for others, leading to a bias of 0 on average. In our sample, there are few cases falling into this situation: 10 out of 72 non-biased individuals and 11 out of 92 non-biased participants when deciding for a group. Excluding these participants, results remain qualitatively the same. Thus, we include them in the analysis.

5.0 RESULTS

First, we check the rationality of choices according to the law of demand. Choices are rational when participants allocate less to the sooner date—which means choosing a higher option—when the interest rate increases. We find that there is little evidence of an extremely irrational shift, which happens when participants change from option 4 (the most patient) to option 1 (the least patient) as the interest rates increase. Only 5% of all participants make such an extreme shift. However, there are small, non-extreme shifts in choices when participants opt to a less patient choice while the interest rate increases. The share of rational choices is 79.77% of all choices made for oneself, and 85.51% of choices made for a group.
We include all decisions in the analysis, since all main results stay the same when we exclude the irrational choices.

5.1 Individual Time Preferences: Comparing Choices between Time Frames in the Individual Setting

When participants make 15 choices just for themselves, the decision situation is identical in the main and control treatments. Therefore, we pool all data for this analysis. According to the law of demand, subjects should allocate less to a sooner date when the gross interest rate increases and when the time span is shorter. Figure 1.2 shows the mean share of budget allocated to sooner dates in time frame 1 (today, +2 weeks) and time frame 3 (+2 weeks, +4 weeks), the present and future time frames with the same time span of two weeks. We see that the mean share of budget allocated to sooner dates decreases with higher interest rates, which is consistent with the law of demand.

We see that for every given interest rate, the mean share of budget allocated to the sooner date in time frame 1 (today, +2 weeks) is higher than that allocated to the sooner date in time frame 3 (+2 weeks, +4 weeks). This means that the participants are less patient when the sooner date is immediate, which generally indicates a present bias. The overall difference between choices made in time frames 1 and 3 is statistically significant (Wilcoxon signed-rank test, $p = 0.002$).[12]

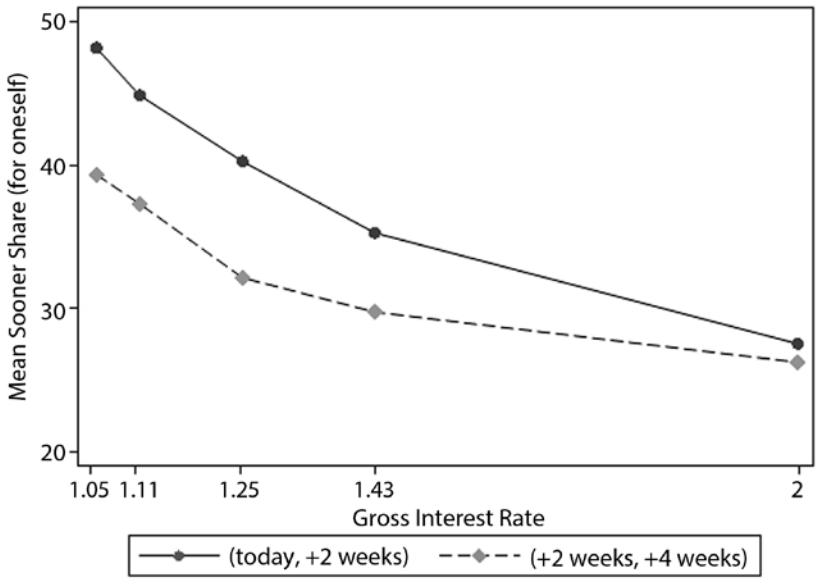


Figure 1.2. Mean share to sooner dates in time frame 1 and time frame 3

[12] Regarding the pairwise comparison for each gross interest rate, the differences in choices made for both time frames are statistically significant for the gross interest rates from 1.05 to 1.43, but not significant for the gross interest rate of 2 (Wilcoxon signed-rank test, p-values are 0.009, 0.01, 0.005, 0.008, 0.62). This is what we expected, since the higher the interest rate, the more patient people should be, and the harder we find the difference in choices for both time frames.

We now look at the individual level. Some 20% of participants are future-biased,[13] 40% are non-biased, and 40% are present-biased. The measure of present bias is significantly different from 0 (Wilcoxon signed-rank test, p = 0.002), indicating as well that participants are generally present-biased. Then, we run a regression of choices on the immediacy of sooner payment (today), the longer time span (time span = four weeks), interest rates, and interaction effects. The OLS regression results in Table 1.2 show that, controlling for interest rates and interaction effects, the participants allocate an average of 17.04% more share to the sooner date when it is immediate. The ordered logit regression also gives qualitatively the same results. Results for both models are robust also when we control for sociodemographic characteristics.[14]

Result 1. Participants are generally present-biased when they decide just for themselves. Figure 1.3 shows the mean share of budget allocated to sooner dates in time frame 1 (today, +2 weeks) and time frame 2 (today, +4 weeks), which differ in time spans. The differences between the mean share of budget allocated to sooner dates in time frame 1 and 2 are small and not significant overall as well as for every interest rate.[15] The regression results in Table 1.2 also show that time span does not have any significant effect on choices. Therefore, participants do not discount in our experiment. This might look surprising at first, but this can be explained by the fact that the participants are not familiar with the concept of interest, since all of them are Muslim and are not allowed to explicitly charge and pay interest for money according to the Islamic law (see e.g., Saeed 1996for the prohibition of interest in Islam). Unfortunately, we do not have data to compare different religions to test this explanation.

Result 2. Participants do not discount on average.

Table 1.2. Regression results of choices for oneself as share of budget allocated to the sooner dates

Dependent Variable: Share of Budget Allocated to the Sooner Dates (Ranging from 0 – 100)	OLS
Today	17.040***
	(4.544)
Time span = four weeks	–6.900
	(4.981)
Interest rate	–12.880***
	(2.024)
Interest rate * Today	–7.850***
	(2.672)
Interest rate * Delay = four weeks	4.150
	(3.273)
Constant	50.660***
	(4.007)
No. of participants	180
R^2	0.0284

Notes: (1) * p < 0.1, ** p < 0.05, *** p < 0.01 (2) Robust standard errors clustered at the individual level are in the parentheses.

[13] Future bias is also found in other studies (e.g., Balakrishnan et al. 2016; Shapiro 2010)

[14] See the regression results in Appendix A5.

[15] Wilcoxon signed-rank test, p-values are 0.65 (for the overall difference), and 0.65, 0.58, 0.37, 0.58, 0.28 (for each five interest rate).

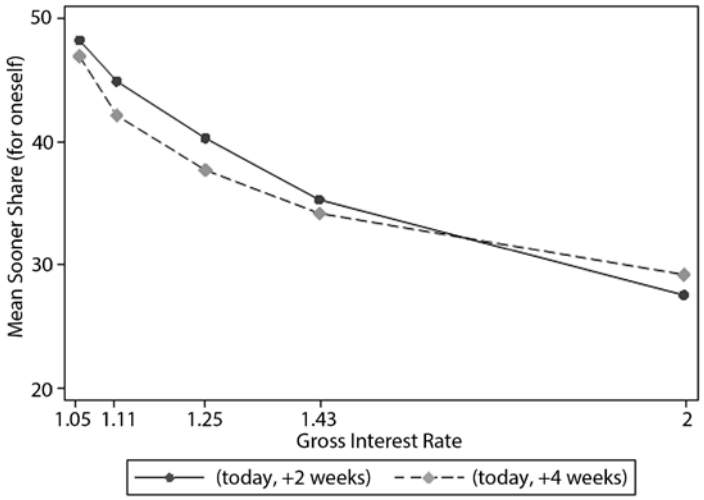


Figure 1.3. Mean share to sooner dates in time frames 1 and 2

5.2 Comparison of Choices for Oneself and for a Group

In the main treatment, participants then decide for a group in the second situation. In this section, we compare choices made for oneself and for a group, as well as the present-biased behaviors of each participant in both situations. Recall that the choices are more patient when higher options are chosen for the same decision, and that a present bias exists when there is a choice in time frame 1 (today, +2 weeks) that is less patient than in time frame 3 (+2 weeks, +4 weeks). Non-biasedness is observed when the same option is chosen for both time frames 1 and 3, for example, also when this option is the most impatient option 1. So, the subject in this situation is non-biasedly impatient.

We find that participants significantly choose more patient options in time frame 1 (today, +2 weeks) and time frame 2 (today, +4 weeks), but not in time frame 3 (+2 weeks, +4 weeks) at group level (Wilcoxon signed-rank test, p-values are 0.002, 0.078 and 0.414, respectively), as shown in column (1) of Table 1.3. Furthermore, the measure of present bias from the choices for a group converges toward 0 from both present-biased (right) and future-biased (left) sides compared to the measure in the individual setting, as shown in Figure 1.4. The distribution of present bias from choices for oneself and for a group is significantly different (Kolmogorov-Smirnov test, $D = 0.283$, $p = 0.016$).

Table 1.3. Difference of means of options chosen in the second round and the first round

Period	(1) Main Treatment	(2) Control Treatment	P-Values of Difference between Treatments*
Time frame 1 (today, +2 weeks)	0.156	0.054	0.14
Time frame 2 (today, +4 weeks)	0.071	–0.280	0.05
Time frame 3 (+2 weeks, +4 weeks)	0.022	–0.533	0.27

Note: * Mann-Whitney rank sum test

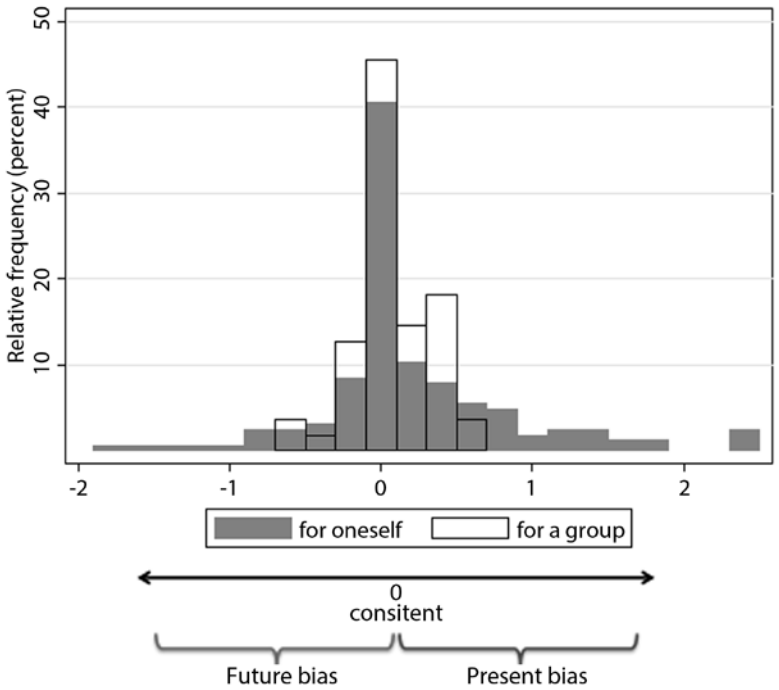


Figure 1.4. Measure of present bias from choices for oneself and for a group in the main treatment

On the average, participants are less present-biased when deciding for a group than when deciding for themselves (Wilcoxon signed-rank test, $p = 0.01$). Looking more closely, the magnitude of the present bias of present-biased participants is significantly smaller (average measures of present bias are 0.76 and 0.09 for individual and group setting, respectively, Wilcoxon signed-rank test, $p < 0.001$). The magnitude of the future bias of future-biased participants is also significantly smaller (average measure of present bias are −0.54 and 0.07 for individual and group settings, respectively, Wilcoxon signed-rank test, $p < 0.001$).

Regarding long-run discounting as another dimension of time preferences, participants do not discount differently when deciding for a group than when deciding for themselves (Wilcoxon signed-rank test, $p = 0.94$). Given that that they do not discount when they decide for themselves, this is not a surprise.

The explanations for the findings that there are changes in present bias and no changes in long-run discounting are as follows: the asymmetric changes toward more patient choices are significantly stronger in choices for time frame 1 than for time frame 3 (Wilcoxon signed-rank test, $p = 0.03$), but changes in choices for time frame 1 and time frame 2 are not significantly different (Wilcoxon signed-rank test, $p = 0.31$). We will investigate the changes in choices exclusively in the next section.

Participants in the control treatment (choices for oneself twice) do not choose different options in all time frames (Wilcoxon signed-rank test, p-values are 0.396, 0.104, 0.225, respectively). These results show that participants do not somehow learn to choose more patient options when they decide just for themselves for the second time. Actually, they even tend to make less patient choices, as shown in column (2) of Table 1.3. The difference in the differences in choices between both situations across treatments indicates that participants in the main treatment choose more patient choices when they decide for a group than participants in the control treatment deciding for themselves for the second time. However, the difference is significant only for time frame 2 (Table 1.3). In the control treatment, as participants decide for the second time, we also observe a smaller magnitude of present bias in choices of present-biased participants (Wilcoxon signed-rank test, $p = 0.033$), but the difference is not as high as in the main treatment, and future-biased participants exhibit no difference in the magnitude of future bias (Wilcoxon signed-rank test, $p = 0.85$). Regarding discounting behavior, participants in the control treatment do not discount differently either (Wilcoxon signed-rank test, $p = 0.410$).

Result 3. Participants choose more patient options and are less present-biased when they decide for a group.

5.3 Effects of Information about Other Group Members' Choices

We now turn to the question of how information about the choices of others influences choice. In order to answer this question, we need to compare situations where the subjects took similar decisions in the individual setting but received different information in the group setting. The random composition of the groups provides exogenous variation in the type of information that the subjects receive. However, since we are interested in whether and how subjects conform toward the choices of others, we look at information in relative terms, i.e., whether the other group members are more, equally, or less patient. Consequently, to make sure that we do get exogenous variation also in relative terms, we first restrict our analysis to the intermediate choices 2 and 3 in the individual setting. Note that when a subject chooses option 1(4) in the individual setting, she cannot receive the information that another subject chose less (more) patiently.[16]

Table 1.4 shows the number of choice shifts in different directions when participants are informed about others' choices in the following four cases:

1. *More patient other(s).* Both of the other members are more patient, or one other is more patient and the other is equally patient.
2. *One more and one less patient.* One other member is more patient and the other is less patient.
3. *Less patient other(s).* Both of the other members are less patient, or one other is less patient and the other is same patient.
4. *Equally patient others.* Both other members are equally patient.

In the case of the "more patient other(s)," 33.71% of all the decisions that fall under this category shifted to the more patient direction, only 11.54% shifted to the less patient direction, while 54.75% stay the same. In the case of the "less patient other(s)," the percentage of the "less patient" and "more patient" shifts are quite similar (i.e., 17.92% and 17.45%, respectively). Thus, there are more shifts in the direction of information in the case of the "more patient other(s)" than that in the "less patient other(s)." In the "one more and one less other" case, the percentage of the "less patient" shift increases to 21.20%, but there is, with 35.94%, a larger share of "more patient" shifts.

These findings primarily indicate that a more patient other influences the choice shift toward a more patient direction. Secondly, a more patient other has more weight than a less patient other. The choice shifts do not really head toward less patient choices, indicating that information about less patient others do not systematically change behavior.

Table 1.4. Effects of types of others on choice shifts

Direction of Choice Shift / Type of Others	More Patient	Same	Less Patient	Total
(1) More patient other(s)	149	242	51	44
	(33.71%)	(54.75%)	(11.54%)	(100.00%)
(2) Less patient other(s)	37	137	38	212
	(17.45%)	(64.62%)	(17.92%)	(100.00%)
(3) One more and one less patient	78	93	46	217
	(35.94%)	(42.86%)	(21.20%)	(100.00%)
(4) Equally patient others*	8	68	8	84
	(9.52%)	(80.95%)	(9.52%)	(100.00%)
Total	**272**	**540**	**143**	**955**

Note: * Similar result for only participants, whose other members are equally patient as they are in the treatment where the participants do not exchange any messages. The number of choice shifts to a more patient direction is four (8.33%), while that of to a less patient direction is three (6.25%). The number of no shifts is 41 (85.42%).

[16] The analysis of all the choices can be found in Appendix A7.

When all group members are equally patient, choice shifts are only 9.52% toward both directions. This means that when others are equally patient, participants do not seem to change their choices in any direction. These results emphasize the importance of information about others' time preferences on one's own choices for the group. It suggests that people do not try to maximize only the total monetary payoff as Shapiro (2010) models, which would lead to a more patient shift in this "equally patient others" case, but they take into account the preferences of other members. The conformity, however, is asymmetric toward more patient others.

Figure 1.5 summarizes the numbers of choice shifts in percentages, categorized by type of others, and categorized separately for options 2 and 3. The choices on the 45-degree-line exhibit no shift.

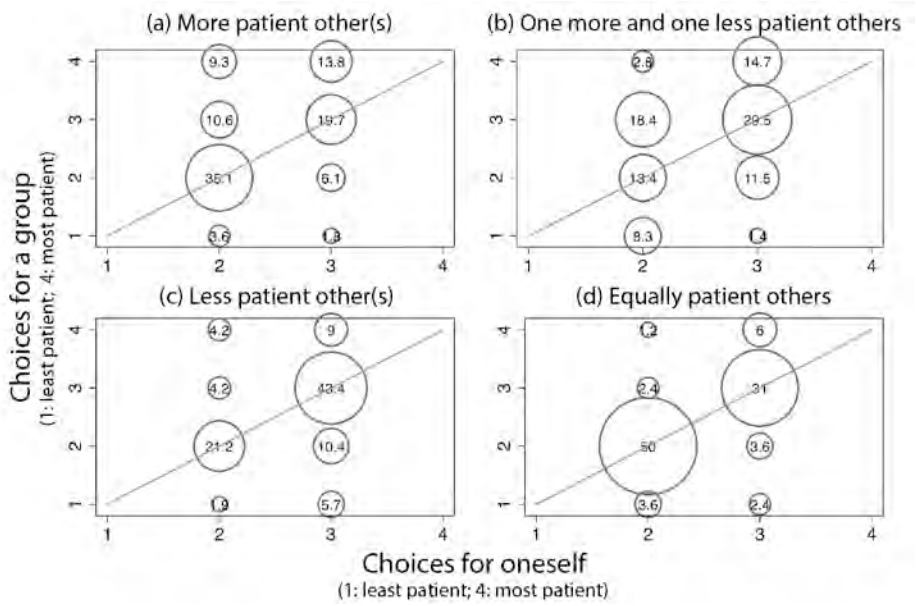


Figure 1.5. Effects of types of others on choice shifts

Table 1.5 shows the effects of others' choices (for themselves) on one's own choice for the group. The explanatory variables are five dummies representing five combinations of types of others. The base category is when all members choose the same option for themselves, i.e., they are all equally patient. The regression results are similar to the results suggested in Table 1.4. Controlling for one's own choice for oneself, interest rate, and also for other sociodemographic characteristics, the participants are significantly more likely to adjust their choices to a more patient option when they receive the information that others are more patient than themselves compared to the base case that others are equally patient. Such a change is even (weakly) significantly more likely compared to the base case when participants receive conflicting information, i.e., when one other is more patient and the other is less patient. By contrast, we find no evidence of conformity toward less patient others. The respective dummies are all insignificantly different from zero. The negative coefficient for 'Choice for oneself' means that participants are less likely to adjust their choices when they already choose a more patient option for themselves.

Taken together, the descriptive statistics and the regression results provide strong evidence for the asymmetric conformity hypothesis while rejecting the null hypothesis of no difference between decisions in the individual and the group setting. Going beyond the asymmetric conformity hypothesis, we find that only information about more patient others significantly influences behavior. This mechanism explains why decisions in the group setting are less present-biased than those in the individual setting.

Result 4. Information about other members' choices has an effect on one's own choices for a group. A more patient other has more influence on one's own choice for a group than a less patient other.

Table 1.5. Ordered logit regression of change in choices on individual choice of oneself and of others

DV: Change in choices	Ordered logit Only Options 2 and 3 (1)	Ordered logit Only Options 2 and 3 (2)
All 'more patient' others (dummy)	0.82**	0.90***
	(0.35)	(0.35)
One 'more patient' and one 'same patient' others (dummy)	0.56**	0.58*
	(0.26)	(0.30)
One 'more patient' and one 'less patient' others (dummy)	0.62*	0.69**
	(0.35)	(0.35)
All 'less patient' others (dummy)	0.13	0.20
	(0.34)	(0.35)
One 'less patient' and one 'same patient' others (dummy)	0.26	0.33
	(0.27)	(0.29)
Choice for oneself	–0.73***	–0.72***
	(0.23)	(0.26)
Interest rate	0.32	0.32
	(0.22)	(0.22)
Age		–0.01
		(0.01)
Female		0.22
		(0.27)
Education level		–0.34
		(0.25)
Membership of the saving group		0.13
		(0.28)
# Group	52	52
# Observation	955	955
Pseudo R^2	0.026	0.0306

Notes: (1) * p < 0.1, ** p < 0.05, *** p < 0.01. (2) Robust standard errors clustered at the group level in parentheses.

5.4 The External Validity of the Measure of Time Preferences

Figure 1.6 shows that, on average, the present bias of the members measured in our experiment is significantly lower than that of the nonmembers (Mann-Whitney rank-sum test, p = 0.074). In addition, membership of the savings group is significantly and negatively correlated with the measure of present bias (Spearman's rho = – 0.15, p = 0.074). These findings prove the external validity of our experimental time preference measure to the field saving behavior in an informal financial organization.

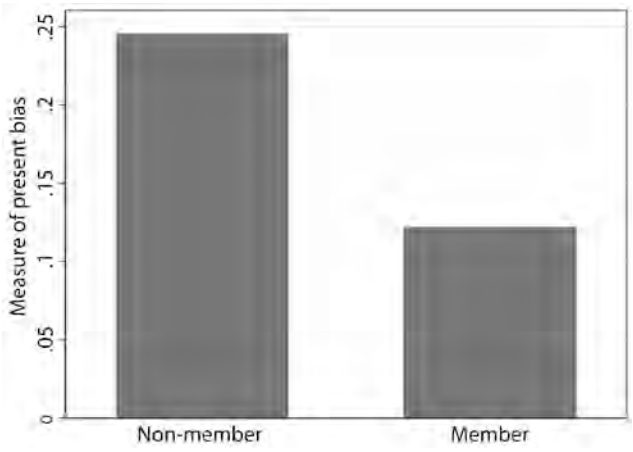


Figure 1.6. Present bias of members and nonmembers of the savings group

Out of the 180 participants, 105 reported in the post-experimental questionnaire that they are members of at least one savings group in the village. However, only 69 participants are members of the Naithung's Rizq Savings Group, for which we have the official record of membership. We do not have this information for the other 36 participants who self-reported their membership in other savings groups. Therefore, we dropped these 36 participants out of the following analysis.

The difference in the present bias between members and nonmembers can be explained by (1) learning, meaning that villagers learn to be less present-biased from the savings group over time or (2) a selection bias, meaning that less present-biased villagers are more likely to enroll in the savings group. Unfortunately, we could not distinguish between these potential explanations since our sample has an unbalanced distribution of membership duration. Most of the savings group members in the sample have been in the savings group for a long time, i.e., 75% have been in the savings group for over 69 months (more than five years) and no one has been in the group for less than 10 months.[17]

Result 5. Members of the savings group are less present-biased than nonmembers.

6.0 DISCUSSION AND CONCLUSION

This study compares intertemporal choices for oneself and for a group of participants from a Thai coastal village, and investigates how information about other members' preferences affects choices for a group. Moreover, we examine the relationship between time preferences measured in our experiment and the field saving behavior in the informal sector, i.e., the membership of an informal savings group.

We find evidence of present-biased preferences in our participants in the lab-in-the-field experiment. This result is in line with previous studies that employ a similar method to elicit subjects' time preferences (CTB method) and pay the sooner payment for the present time frame immediately (Lührmann, Serra-Garcia, and Winter 2014; Balakrishnan, Haushofer, and Jakiela 2016).

We find that when the participants decide for a group and are informed about the other group members' choices, they generally become less present-biased. The descriptive statistics and regression results show that information about the other members' preferences affects the changes in individual behavior. Meanwhile, the participants do not change their choices when the other members choose the same choices as they do. This result suggests that people take into account others' preferences and do not just maximize the total payoff when their choices might affect others—similar to what the model by Shapiro (2010) suggests. More interestingly, people do not simply conform to the choices of others, but they weigh a more patient other more heavily than a less patient other. These results follow the same line as the risk preferences study conducted by Bolton, Ockenfels, and Stauf (2015). The authors find an asymmetric conformity toward more risk aversion when subjects are responsible for the payoff of other passive players. Both risk aversion in Bolton, Ockenfels, and Stauf (2015) and patience in our study can be considered as socially desirable behaviors when people have responsibility for others.

Moreover, we find that members of the savings group are less present-biased than nonmembers. Our result is in line with Lührmann, Serra-Garcia, and Winter (2014), who find that present-biased children in the experiment have smaller (self-reported) savings in real life. Furthermore, Meier and Sprenger (2010) find that present-biased subjects tend to have higher credit card debt. At first glance, our result seems to contradict Ashraf et al. (2006), who find that higher present-biased participants are more likely to open a commitment savings account. The sophisticated present-biased participants in the study of Ashraf, Karlan, and Yin (2006) want to use a commitment savings account to help them overcome their self-control problems with regard to saving. One possible explanation for the contradiction is that the commitment in the savings group in our study, which is to save every month, is much stronger than just opening a commitment savings account and saving however much you want, whenever you want, as in the study of Ashraf, Karlan, and Yin (2006). Members of the savings group are required to have regular self-control regarding their saving behaviors in order to sustain their membership status. Thus, sophisticated

[17] According to the official record of the savings group, February 2015.

present-biased people might see this requirement as being too hard for them to fulfill and may abstain from applying for membership. Another possible explanation is that the benefits of being a member of the savings group, such as access to micro-loans and micro-insurances, can attract villagers who think farsightedly. By contrast, a commitment savings account, as in Ashraf, Karlan, and Yin (2006), cannot offer these benefits, because the commitment savings account gives no benefit other than the protection of savings until a goal date or amount is reached. The saving products in Ashraf, Karlan, and Yin (2006) and in our study are, therefore, different and have different target groups. Also, it might be possible that the regular self-control required to save by members of the savings group can train its members to be less present-biased.

One limitation of this study is that we do not have treatments that could help us distinguish between the effects of information about other group members' preferences and their responsibility toward other group members. For example, we should have had a treatment in which subjects are informed about others' time preferences, but then decide just for themselves, and also a treatment in which subjects do not have any information about other members' preferences. Unfortunately, we cannot conduct these treatments in Naithung village anymore due to a spillover effect.

Lastly, we explain the underlying mechanism of the savings group via the effects of information about others' choices found in our experiment from a behavioral perspective. In the savings group, one's own saving decision benefits the whole group because the fund is used to provide micro-loans and insurance to all members. Every month, members gather together to do all their transactions, especially saving. Members are automatically informed that other members save as well. Consequently, members continue saving regularly in the savings group.

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APPENDICES A

Appendix A1. Naithung's Rizq Saving Group

The Naithung's Fisherfolk Conservation Group also manages their savings fund, which is called the Naithung's Rizq Savings Group. The following information is taken from the official rulebook of the savings group (4th revised edition, 29 June 2012).

The objectives of this savings group are as follows:

1. To encourage members to save money and help its members financially if they need it;
2. To gather its members together so that they volunteer more and be punctual when there is a conservation or community activity;
3. To serve as a venue where members exchange their experiences; and
4. To make profit and spend them on the conservation fund (30%), the community welfare fund (30%), the social development fund (20%) and for the operation of the group (20%).

The savings group offers micro-loan opportunities with lower interest rates than those offered by informal sources such as loan sharks, who charge 20% interest per day. Only members who have been in the group for at least 12 months and who have already saved continuously for six months are eligible to take out a loan. As all the members of the savings group are Muslims,[18] the savings fund is not allowed to collect traditional interest rates for a loan. However, borrowers have to pay an administration fee for every loan taken out. The fee increases discretely with the sum of the loan (see Table A1). The range of interest rate is 0.175%–0.55% per month or 2.1%–6.6% per year. The maximum sum that can be loaned is THB 10,000 (USD 307). Lenders have to pay back at least THB 500 per month, every month until the loan has been repaid.

Table A1. The administrative fee for a loan from the Naithung's Rizq Savings Group

Loan Sum (in THB)	Fee Each Time (in THB)
Up to 3,000	100
3,001–4,000	150
5,001–6,000	250
6,001–7,000	300
7,001–10,000	350

Source: The official rulebook of the Naithung's Rizq Savings Group (4th revised edition, 29 June 2012)

If a borrower does not pay back the loan every month according to the rules, the next time s/he applies for a loan, there will be a reduction of THB 1,000 for every month s/he did not pay back the loan. For example, if A did not pay back for three months, when s/he applies for a loan of THB 7,000, s/he will receive only THB 4,000.

Members have to save THB 50 (around USD 1.53) every month into the fund, and they have to continuously support and participate in the activities of the Fisherfolk Conservation Group and the Rizq Savings Group. There can be more than one member from a household. The loan sum cannot exceed the sum of savings of the lender and two other laypeople.

Furthermore, the savings group also provides micro-health and life insurance to its members. If a member is admitted to hospital, he will get THB 100 (USD 3.06) per night (for up to three nights a year). If a member dies, the family will receive THB 500 (USD 15.32).

There is only one operation day every month, on the last Saturday of the month, from 1 pm to 4 pm. The committee members of between five and eight people operate all transactions together.

[18] About 97% of the villagers of Naithung are Muslim (according to the official and written basic information provided by the village headman).

In order to qualify to be a member of the saving group s/he must (1) be a villager of Naithung, and (2) regularly participate in the activities of the Naithung Fisherfolk Conservation Group and community activities. The second qualification is one of the indicators for participation in conservation activities.

As of February 2015, the total amount in the savings fund was THB 738,050 or USD 22,625, with THB 550,550 (USD 16,878) given in loans to members. Furthermore, THB 10,300 (USD 315) has been spent by Naithung's Rizq Saving Group in pursuit of objective 4 (between March 2014 and February 2015).

Appendix A2. Theoretical Framework

We extend the model described by Andreoni et al. (2015) to capture the situation when decisions also affect others.

Assume that there is an agent *i* who is delegated to decide for the whole group. Agent *i's* decision is binding for all the other group members, and *i* cares about the utility of the other group members (x^G). The other group members could have the same, more patient, or less patient time preferences than *i*.

Agent *i* has parameters δ_i, β_i, and α_i. The group member with the same time preference as *i* has parameters $\delta_j (= \delta_i)$, $\beta_j (= \beta_i)$, and $\alpha_j (= \alpha_i)$. The group member who is more patient than *i* has parameters δ_h, β_h, and α_h. The group member who is less patient than *i* has parameters δ_l, β_l, and α_l. Agent *i* can observe the decisions made by the others before making decisions for the group.

Agent *i* includes the utilities of the others into the calculation with weights for each type of others as follows: ω_i for *i's* own utility, ω_j for the utility of a member with the same time preference, ω_h for the utility of a member who is more patient than *i*, and ω_l for the utility of a member who is less patient than *i*. Hence, agent *i* makes decisions based on a weighted utility function.

There are four main possible cases regarding agent *i*'s time preferences compared to others' preferences.

Case 1

Agent *i* does not care about the utility of the others according to the standard theory. The weights for the others are zero. Agent *i* decides indifferently for a group than for oneself.

Case 2

All types exist in the group, which means that *i*'s time preference lies between the most and the least patient members.

The total utility of *i* is

$$U_i = \omega_i \left(x^{a}_{i,t} + \beta_i^{t_0} \delta_i^k x^{a}_{i,\, t+k} \right) + \sum_{\substack{j=0 \\ j\neq i,\, j\neq h, j\neq l}}^{n} \omega_j \left(x^{a}_{i,t} + \beta_i^{t_0} \delta_i^k x^{a}_{i,\, t+k} \right)$$

$$+ \sum^{m}_{\substack{h=0 \\ h\neq i,\, h\neq j, h\neq l}} \omega_h \left(x^{a}_{h,\, t} + \beta_h^{t_0} \delta_h^k x^{a}_{h,\, t+k} \right) \qquad \text{Equation (A1)}$$

$$+ \sum^{q}_{\substack{l=0 \\ l\neq i,\, l\neq j, l\neq h}} \omega_l \left(x^{a}_{l,t} + \beta_l^{t_0} \delta_l^k x^{a}_{l,\, t+k} \right)$$

with $\beta_h^{t_0}\delta_h^k > \beta_i^{t_0}\delta_i^k$ and $\beta_l^{t_0}\delta_l^k < \beta_i^{t_0}\delta_i^k$.

In our setting, *i*'s decision is binding for all group members (x^G), so the payoffs are the same for all the members:

$$x^G_t = x_{i,\,t} = x_{j,\,t} = x_{h,t} = x_{l,t} \text{ and}$$
$$x^G_{t+k} = x_{i,t+k} = x_{j,t+k} = x_{h,t+k} = x_{l,t+k}. \qquad \text{Equation (A2)}$$

To simplify the model, assume that agent *i* includes each type of other members with a representative. The weighted discounted utility is as follows:

$$U_i = \omega_i \cdot u_i + \omega_j \cdot u_j + \omega_h \cdot u_h + \omega_l \cdot u_l, \qquad \text{Equation (A3)}$$

where $\Sigma\, \omega = 1$ and $\omega_i = \omega_j$.

Maximizing the weighted utility [Equation (A4)] in the case that all types exist, subject to the budget constraint: $Px_t^G + x_{t+k}^G = Y$, gives the following condition:

$$\text{FOC: } \frac{x_t^G}{x_{t+k}^G} = \left(P\left(\left(\omega_i + \omega_j\right)\beta_i^{t_0}\delta_i^k + \omega_h\beta_h^{t_0}\delta_h^k + \omega_l\beta_l^{t_0}\delta_l^k\right)\right)^{\frac{1}{\alpha-1}} \qquad \text{Equation (A4)}$$

Agent *i* decides more patiently for a group than for oneself: $\frac{x_t^G}{x_{t+k}^G} < \frac{x_t}{x_{t+k}}$,

$$\left(P\left(\left(\omega_i+\omega_j\right)\beta_i^{t_0}\delta_i^k + \omega_h\beta_h^{t_0}\delta_h^k + \omega_l\beta_l^{t_0}\delta_l^k\right)\right)^{\frac{1}{\alpha-1}} < \left(P\beta_i^{t_0}\delta_i^k\right)^{\frac{1}{\alpha-1}},\ 0 < \alpha < 1$$

$$\left(\omega_i + \omega_j\right)\beta_i^{t_0}\delta_i^k + \omega_h\beta_h^{t_0}\delta_h^k + \omega_l\beta_l^{t_0}\delta_l^k > \beta_i^{t_0}\delta_i^k$$

$$\omega_h\beta_h^{t_0}\delta_h^k + \omega_l\beta_l^{t_0}\delta_l^k > \left[1 - \left(\omega_i + \omega_j\right)\right]\beta_i^{t_0}\delta_i^k$$

Assume that $\beta_h^{t_0}\delta_h^k = \beta_i^{t_0}\delta_i^k + C$ and $\beta_l^{t_0}\delta_l^k = \beta_i^{t_0}\delta_i^k - C$; C is a constant.

$$\omega_h\left(\beta_i^{t_0}\delta_i^k + C\right) + \omega_l\left(\beta_i^{t_0}\delta_i^k - C\right) > \left[1 - \left(\omega_i + \omega_j\right)\right]\beta_i^{t_0}\delta_i^k$$

$$\left(\omega_h + \omega_l\right)\beta_i^{t_0}\delta_i^k + \left(\omega_h - \omega_l\right)C > \left(\omega_h + \omega_l\right)\beta_i^{t_0}\delta_i^k$$

$$\left(\omega_h - \omega_l\right)C > 0$$

$$\omega_h > \omega_l$$

Agent *i* decides more patiently for a group than for oneself, when *i* weighs the more patient type more heavily than the less patient type, $\omega_h > \omega_l$. And the opposite is true. Hence, agent *i* decides more (less) patiently for groups when *i* weighs the more patient type more (less) heavily than the less patient type.

Case 3

Agent *i* is the most patient member.

Case 3.1. Without any same patient members:

$$U_i = \omega_i \cdot u_i + \omega_l \cdot u_l$$

$$\text{FOC: } \frac{x_t^G}{x_{t+k}^G} = \left(P\left(\omega_i\beta_i^{t_0}\delta_i^k + \omega_l\beta_l^{t_0}\delta_l^k\right)\right)^{\frac{1}{\alpha-1}}$$

Case 3.2. With a same patient member:

$$U_i = \omega_i \cdot u_i + \omega_j \cdot u_j + \omega_l \cdot u_l$$

$$\text{FOC: } \frac{x_t^G}{x_{t+k}^G} = \left(P\left(\left(\omega_i + \omega_j\right)\beta_i^{t_0}\delta_i^k + \omega_l\beta_l^{t_0}\delta_l^k\right)\right)^{\frac{1}{\alpha-1}}$$

Agent *i* decides less patiently for a group than for oneself when *i* is the most patient member in the group when $\omega_l > 0$.

Case 4

Agent *i* is the least patient member.

Case 4.1. Without any same patient members:

$$U_i = \omega_i \cdot u_i + \omega_h \cdot u_h$$

$$\text{FOC: } \frac{X_t^G}{X_{t+k}^G} = \left(P\left(\omega_i \beta_i^{t_0} \delta_i^k + \omega_l \beta_h^{t_0} \delta_h^k\right)\right)^{\frac{1}{\alpha - 1}}$$

Case 4.2. With a same patient member:

$$U_i = \omega_i \cdot u_i + \omega_j \cdot u_j + \omega_h \cdot u_h$$

$$\text{FOC: } \frac{X_t^G}{X_{t+k}^G} = \left(P\left(\left(\omega_i + \omega_j\right) \beta_i^{t_0} \delta_i^k + \omega_l \beta_h^{t_0} \delta_h^k\right)\right)^{\frac{1}{\alpha - 1}}$$

Agent *i* decides more patiently for a group than for oneself when *i* is the least patient member in the group when $\omega_l > 0$.

Appendix A3. Design for Time Preference Elicitation

Table A2. Design for time preference elicitation

t (Sooner Date)	*k* (Delay) Days	*P* (Gross Interest Rate)	Standardized Daily Rate (%)	Annual Rate (%)
0	14	1.05	0.37	217.57
0	14	1.11	0.76	714.41
0	14	1.25	2.58	3,598.47
0	14	1.43	3.71	12,564.12
0	14	2.00	5.08	100,479.55
0	28	1.05	0.18	85.67
0	28	1.11	0.38	226.29
0	28	1.25	0.80	795.98
0	28	1.43	1.28	2,116.61
0	28	2.00	2.51	11574.99
14	14	1.05	0.37	217.57
14	14	1.11	0.76	714.41
14	14	1.25	2.58	3,598.47
14	14	1.43	3.71	12,564.12
14	14	2.00	5.08	100,479.55

Note: The effective annual interest rate is quarterly compounded.

Table A4. Complete decisions

No.	Payment dates	Option 1 (THB)	Option 2 (THB)	Option 3 (THB)	Option 4 (THB)	*t* (Sooner Date)	*k* (Delay) Days	*P* (Gross Interest Rate)
1	TODAY	285	190	95	0	0		
	AND in 2 WEEKS	0	100	200	300		14	1.05
2	TODAY	270	180	90	0	0		
	AND in 2 WEEKS	0	100	200	300		14	1.11
3	TODAY	240	160	80	0	0		
	AND in 2 WEEKS	0	100	200	300		14	1.25
4	TODAY	210	140	70	0	0		
	AND in 2 WEEKS	0	100	200	300		14	1.43
5	TODAY	150	100	50	0	0		
	AND in 2 WEEKS	0	100	200	300		14	2.00
6	TODAY	285	190	95	0	0		
	AND in 4 WEEKS	0	100	200	300		28	1.05
7	TODAY	270	180	90	0	0		
	AND in 4 WEEKS	0	100	200	300		28	1.11
8	TODAY	240	160	80	0	0		
	AND in 4 WEEKS	0	100	200	300		28	1.25
9	TODAY	210	140	70	0	0		
	AND in 4 WEEKS	0	100	200	300		28	1.43
10	TODAY	150	100	50	0	0		
	AND in 4 WEEKS	0	100	200	300		28	2.00
11	in 2 WEEKS	285	190	95	0	14		
	AND in 4 WEEKS	0	100	200	300		14	1.05
12	in 2 WEEKS	270	180	90	0	14		
	AND in 4 WEEKS	0	100	200	300		14	1.11
13	in 2 WEEKS	240	160	80	0	14		
	AND in 4 WEEKS	0	100	200	300		14	1.25
14	in 2 WEEKS	210	140	70	0	14		
	AND in 4 WEEKS	0	100	200	300		14	1.43
15	in 2 WEEKS	150	100	50	0	14		
	AND in 4 WEEKS	0	100	200	300		14	2.00

Appendix A4. Regressions of Choice for Oneself Controlled for Sociodemographic Characteristics

Table A5. Regressions of share of budget allocated to sooner dates of choices for oneself controlled for sociodemographic characteristics

Parameter	(1) OLS	(2) Ordered Logit	(3) OLS Sociodemographic	(4) Ordered Logit Sociodemographic
Today	17.040***	0.850***	17.04000***	0.88000***
	(4.544)	(0.216)	(4.55000)	(0.22000)
Time span = 4 weeks	–6.900	–0.380	–6.90000	–0.30900
	(4.981)	(0.235)	(4.99000)	(0.24000)
Interest rate	–12.880***	–0.590***	–12.88000***	–0.61000***
	(2.024)	(0.102)	(2.03000)	(0.10000)
Interest rate * Today	–7.850***	–0.410***	–7.85000***	–0.43000***
	(2.672)	(0.132)	(2.68000)	(0.13000)
Interest rate * Delay = 4 weeks	4.150	0.240	4.15000	0.26000
	(3.273)	(0.156)	(3.28000)	(0.16000)
Household Income			–0.00020**	–0.00001*
			(0.00009)	(0.00000)
Household Expenditure			0.00050**	0.00002**
			(0.00020)	(0.00001)
Age			0.30000	0.01000
			(0.27000)	(0.01000)
Gender (Male = 1)			–0.53000	–0.01000
			(6.32000)	(0.33000)
Education level			2.59000	0.14000
			(4.58000)	(0.23000)
Number of children			0.73000	0.04000
			(1.33000)	(0.07000)
Fisherman			2.55000	0.10000
			(6.01000)	(0.30000)
Member of NTR saving group			–6.28000	–0.37000
			(5.10000)	(0.27000)
Constant	50.660***		25.67000	
	(4.007)		(17.08000)	
No. of subjects	180	180	180	180
R^2/Pseudo R^2	0.0284	180.0000	0.0645	0.0248

Note: Standard errors are in parentheses.

Appendix A5. Parameter Estimates of the Utility Functions

The decisions made in the experiment are used to estimate the utility parameters, namely, the utility function curvature (α) discounting (δ) and present bias (β). First, we use the ordinary least squares regression based on Equation (4) as a linear model. However, there is a problem at the corner solutions—the allocation ratio $ln\left(\frac{x_t}{x_{t+k}}\right)$ is not well defined. To address this issue, the nonlinear least squares regression, based on Equation (2) as a demand function, is used to estimate the utility parameters.

Nevertheless, for the estimation, those participants who did not alter their choices at all (i.e., always choosing the same options across 15 decisions) are dropped out, since having no variation in choices make it insufficient for the estimation. For decisions in the first round, 55 participants showed no variation in their choices. For decisions in the second round, an additional 25 participants are dropped.

Estimates of parameters for choices in the first round

Aggregate estimates. The aggregate estimates of parameters from decisions for oneself (the first round) by the NLS regression are more evidence of present bias on the aggregate level. The aggregate estimate of β is 0.86, which is smaller than 1, and the difference is significant (Wald test, $p < 0.001$). On the other hand, the aggregate estimate of δ is 1.00, and is not significantly different from 1 (Wald test, $p = 0.11$). This suggests again that the longer time span in this experiment does not have an effect on decisions for oneself.

The aggregate estimate of α, which captures the curvature of the utility function, is 0.66 and significantly differs from 1 (Wald test, $p < 0.001$). This indicates that the utility function is not linear, but concave.

Individual estimates. Figure A1 shows the distribution of the estimates for β from the choices for oneself by the NLS regression. While the peak is at 1, we can see that substantial numbers of participants have β estimates smaller than 1, which indicates present-biased preferences. Also, there are smaller numbers of participants whose β estimates are bigger than 1, indicating future-biased preferences. The individual estimates for β differ significantly from 1 (Wilcoxon signed-rank test, $p = 0.072$).

Figure A2 shows the distribution of estimates for individual δ. The values concentrate well on 1, and they are not significantly different from 1 (Wilcoxon signed-rank test, $p = 0.801$). This suggests that, on average, the estimate for individual δ is 1, which means that if earlier payment is not immediate, subjects value the later payment the same as the earlier payment. The time span has no effect on decisions for oneself.

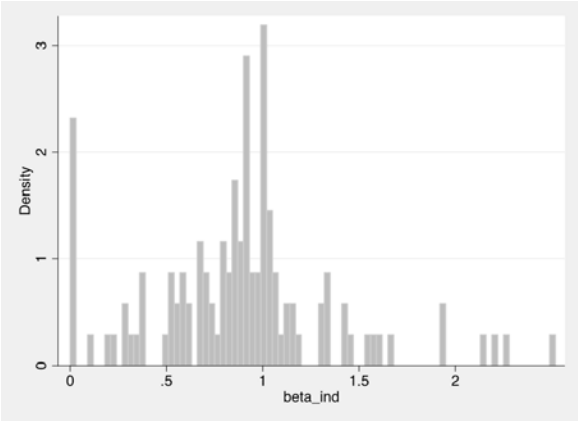

Figure A1. Estimates for β from choices for self

Note: Nine subjects are dropped out in this figure, since they have very high Beta.

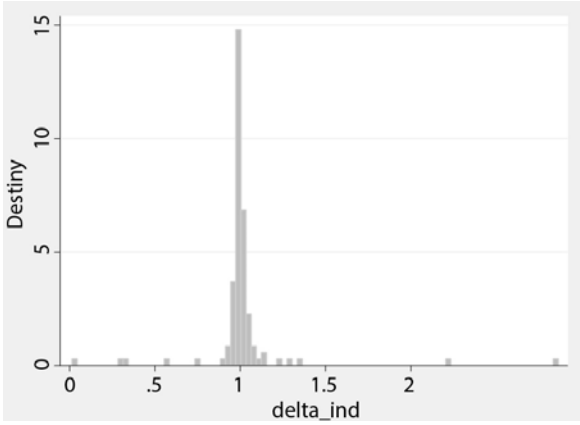

Figure A2. Estimates for δ from choices for self

Note: Seven subjects are dropped out in this figure. Six subjects have very high Delta and a subject has a highly negative Delta.

Estimates of parameters for choices in the second round

Since the participants are informed about the options that their group members chose for themselves, the estimates for the parameters used thereafter are at the group level in order to retain the independency of observations.

Aggregate estimates. Table A6 shows that on the aggregate level, α is significantly smaller than 1, which means the utility function is nonlinear but concave. The estimate for β for oneself is smaller than 1, which means that present bias exists when participants decide for themselves, significantly in the main treatment. The estimate for β for a group is larger than β for oneself, suggesting that present bias decreases. The participants are less present-biased on the average. In the control treatment, the estimated β in the second round increases. However, this increase leads to future bias, which is another type of inconsistency. Aggregate estimates for δ are around 1 in both rounds in both treatments.

Table A6. Aggregate utility parameter estimates by NLS regression

Parameters	Main		Control	
	Oneself (1)	Group (2)	Oneself (3)	Oneself (4)
β	0.849	0.968	0.9719	1.0490
	(0.032)	(0.028)	(0.0772)	(0.0681)
δ	1.002	0.996	1.0125	0.9962
	(0.002)	(0.002)	(0.0043)	(0.0034)
α	0.661	0.700	0.6270	0.8033
	(0.027)	(0.025)	(0.0888)	(0.0520)
No. of Subjects/Groups	113	48	12	11
Observations	1,695	1335	180	165
R-squared	0.6000	0.6173	0.5605	0.6412
H_0: $\beta = 1$	t = 22.65	t = 1.33	t = 0.13	t = 0.30
	p < 0.001	p = 0.254	p = 0.7231	p = 0.6106
H_0: $\delta = 1$	t = 1.28	t = 3.16	t = 8.29	t = 0.67
	p = 0.261	p = 0.082	p = 0.0150	p = 0.4586
H_0: $\alpha = 1$	t = 154.24	t = 140.75	t = 17.66	t = 14.91
	p < 0.001	p < 0.001	p = 0.0015	p = 0.0181

Notes: (1) * p < 0.1, ** p < 0.05, *** p < 0.01 (2) Robust standard errors clustered at the individual level are in parentheses.

Individual estimates. Figure A3 shows the distributions of the estimates for β for oneself and for a group in the main treatment. The distribution of β estimates from decisions for a group seems to converge to 1. However, the β estimates from the decisions for oneself and a group are not significantly different (Wilcoxon signed-rank test, p = 0.625). Furthermore, the estimates for δ for oneself and for a group are not significantly different in the main treatment (Wilcoxon signed-rank test, z = –0.113, p = 0.91).

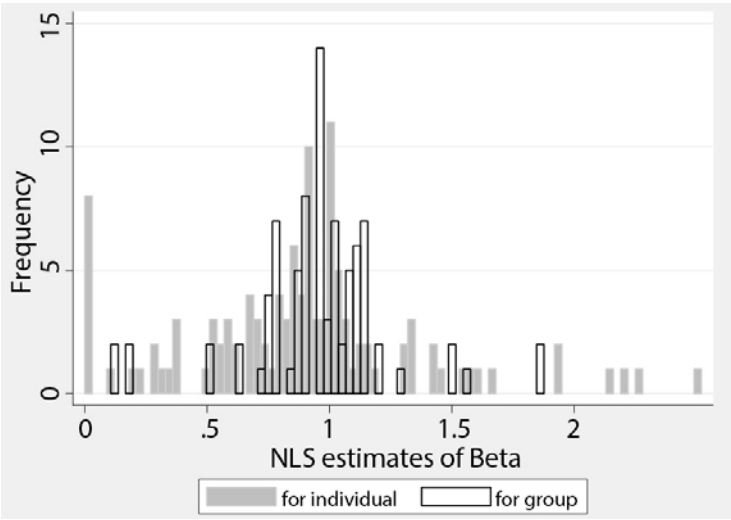

Figure A3. Estimate for β from choices for groups in the main treatment

Appendix A6. Effects of Types of Others on Choice Shifts for All Choices

Table A7. Effects of types of others on choice shifts

Type of Others \ Direction of Choice Shift	More Patient	Same	Less Patient	Total
(1) More patient other(s)	301	493	51	845
	(35.62%)	(58.34%)	(6.04%)	(100%)
(2) Less patient other(s)	37	770	177	984
	(3.76%)	(78.25%)	(17.99%)	(100%)
(3) One more patient and one less patient other	78	93	46	217
	(35.94%)	(42.86%)	(21.20%)	(100%)
(4) Same patient others*	16	379	34	429
	(3.73%)	(88.34%)	(7.93%)	(100%)
Total	432	1,735	308	2,475

Note: (1) *Refers to similar result for participants whose other members are as patient as they are in the treatment, in which the participants do not exchange any messages. (2) The number of choice shifts to a more patient direction is 8 (3.07%), to a less patient direction is 22 (8.43%), and the number of no shifts is 231 (88.51%).

Table A8 shows that including all choices in the analysis changes the results in Section 5.3 in two cases: (1) when both others are less patient and (2) when one other is more patient and one other is less patient. These changes are driven by choices for oneself at the ceiling (option 4), since they can only be adjusted to a less patient direction.

Table A8. Regression of change in choices on individual choice of oneself and of others

Dependent Variable: Changes in Choices	Ordered logit Only Options 2 & 3 (1)	Ordered logit All Options (2)	Ordered logit Only Option 2 & 3 (3)	Ordered logit All Options (4)
All "more patient" others (dummy)	0.82**	1.00***	0.90***	1.08***
	(0.35)	(0.36)	(0.35)	(0.36)
All "less patient" others (dummy)	0.13	–0.50**	0.20	–0.49**
	(0.34)	(0.23)	(0.35)	(0.23)
One "more patient" and one "less patient" others (dummy)	0.62*	0.62	0.69**	0.64
	(0.35)	(0.45)	(0.35)	(0.43)
One "more patient" and one "same patient" others (dummy)	0.56**	0.52*	0.58*	0.53*
	(0.26)	(0.31)	(0.30)	(0.32)
One "less patient" and one "same patient" others (dummy)	0.26	0.02	0.33	0.02
	(0.27)	(0.16)	(0.29)	(0.16)
Choice for oneself	–0.73***	–0.57***	–0.72***	–0.58***
	(0.23)	(0.11)	(0.26)	(0.10)
Interest rate	0.32	0.36**	0.32	0.36**
	(0.22)	(0.15)	(0.22)	(0.15)
Age			–0.01	–0.01
			(0.01)	(0.01)
Female			0.22	0.06
			(0.27)	(0.20)
Education level			–0.34	–0.07
			(0.25)	(0.21)
Membership of the saving group			0.13	0.34*
			(0.28)	(0.20)
# Group	52	55	52	55
# Observation	955	2475	955	2475
Pseudo R^2	0.026	0.0898	0.0306	0.0931

Notes: (1) * p < 0.1, ** p < 0.05, *** p < 0.01 (2) Robust standard errors clustered at the group level are in parentheses.

Appendix A7. Instructions

Notes:

1. *The instructions are read and explained out loud and are not given as written instructions.*
2. *The* **titles in bold** *are not read out loud, but for the understanding of the instructors.*
3. *The italic and underlined letters are what the instructors do or demonstrate.*

Welcome everyone. Thank you very much for your participation. We are from Mahidol University and the University of Cologne, Germany to study human decisions. We are financially supported by EEPSEA (Economy and Environment Program for Southeast Asia), which is a research organization for environmental economics.

Today's activity will take approximately two hours of your time. The first part is the game. When we are done with the game, we would like you to stay for an interview by our facilitators from Walailak University.[19]

In this game, we use real money. The amount you will earn depends on your decision and also on others' decisions.

The decisions

In this game, we have various amounts of money for you to allocate to two days. You have to choose one option that you like the most. You will make several decisions on how you allocate money between today and a day in the future or between two days in the future, for example, in two weeks or in four weeks from now.

You will make several decisions, but we will randomly pick one decision to be the actual payment by drawing lots. Thus, each decision can be the one that determines your actual payoffs! So, it is in your interest to take every decision seriously.

The calendars

In each decision, there are four options *(point at the calendars)*. Each calendar represents each option and shows the amount of money on the two payment days. Your assignment is to choose one option that will pay you your most favorite way. The facilitators will be there to answer your questions any time.

Example

Let's look at the example.

Insert the payment days on the top of the calendars (e.g,. today and in 2 weeks). In this example, you will get the money today after the activity *(point at the date in the calendar)* and in three weeks *(point at the date in the calendar)*. In every option, you will get different amounts of money *(insert the cards with the corresponding amounts at the corresponding dates).*

[19] Walailak University is the university located in the same subdistrict, Thasala, as our study site.

Explanation of the example

If you choose the first option, you choose to get THB 285 today and nothing in three weeks. If you choose the second option, you choose to get THB 190 today and THB 100 in three weeks. If you choose the third option, you choose to get THB 95 today and THB 200 in three weeks. If you choose the fourth option, you choose to get nothing today and THB 300 in three weeks.

Notice that the amount of money you will get today decreases from option to option from THB 285 to 0 *(point at these amounts from calendar to calendar)*. On the other hand, the amount of money you will get in the future, i.e., in three weeks, increases from option to option from 0 to THB 300 *(point at these amounts from calendar to calendar)*. The total amounts of money on both payment days in each option are different, i.e., the total amount increases but you have to wait longer *(explain the total amount in each calendar)*. Thus, you have to trade-off between the money you will get today and in the future. Choose your favorite option. There is no right or wrong answer. It is just about your preference.

Test questions

Do you understand the instructions so far? If not so, please feel free to ask questions.

Then please answer the following questions.

If I choose option 1, how much would I get today? *(The answer is THB 285)*. And how much would I get in three weeks *(The answer is nothing)*.

If my favorite option were to get THB 190 today and THB 100 in three weeks, which option would I have to choose? *(The answer is option 2)*

Practice round

In the game, you will have to answer an answer sheet like this one *(distribute the answer sheet for the practice round)*. There are four options shown in the answer sheet similar to those shown at the front of the room. You have to circle the number in front of your favorite option. If you like the first option, then circle number 1, and so on. Like in the example, I would have to circle the number 2.

Do you have any questions?

Let's choose. Circle the option that you prefer in the test answer sheet. We do not pay for this decision. The facilitators will collect the answer sheets and bring them to the researchers to insert the information.

The number of decisions

There are two rounds in this game *(show the chart to demonstrate the number of decisions)*. In each round, we would like you to make 15 decisions. There are three different time frames. The first time frame is that you will get a payoff today and in two weeks. We play this time frame in the first to the fifth decisions. The second time frame is that you will get the payoff today and in four weeks. We play this time frame in the sixth to the tenth decisions. The third time frame is that you will get the payoff in two weeks and in four weeks. We play this time frame in the eleventh to the fifteenth decisions.

There are two rounds of these decisions. We will explain the rules before you play each round. Thus, you have to make 30 decisions in total. Don't worry if you cannot remember all these numbers, because before you make every decision, we will indicate the payment days and show the options to you. Your job is just to choose one favorite option out of four given options.

How will we pay you?

We will pay one out of the total 30 decisions. We have made 30 lots. Each lot, with a number from 1 to 30, represents each decision *(show the box with 30 lots)*. At the end of the game, we will draw a lot. Assume that we draw the fifteenth decision; you will get the money in two weeks and in four weeks.

On both payment days, you will get additional THB 50 to thank you for your participation and for your travel. For example, if you choose option 1, today you would get THB 285 and an additional THB 50, so THB 335 in total, and in three weeks you would get 0 and an additional THB 50, so THB 50 in total. If you choose option four, today you would get 0 and an additional THB 50, so THB 50 in total, and in three weeks you would get THB 300 and an additional THB 50, so THB 350 in total.

The payoff for today, you will get immediately after this activity. For the payoff in the future, please pick it up at the community shop of the NTFCG by the pier. Does everyone know it?

Caution

During the game, please make sure that the other participants do not know your choices. Do not show your answer sheets to others and you are not allowed to talk to each other. If you break these rules, we have to ask you to leave the activity and you will not get any payment.

The consent form

It seems that everyone would like to start playing the game, doesn't it?

Before we start, please sign this consent form *(distribute the consent forms)*. In the consent form, it is stated that

5. You participate in this activity with your own free will.
6. Your decisions are kept secret in the future and the other participants will not know your decisions.
7. In the data analysis, we will not link your decisions with your identity but only with your ID number in this activity.

Summary of the game

Any questions?

Every decision can be the one that determines your payoff, which depends on your choice. Thus, you have to take every decision seriously. Please keep in mind that you can ask questions any time and you're not allowed to talk to the other participants.

Let's start the game.

Round 1: Individual

In the first round or the following fifteen decisions, only your choice determines your payoff.

(Distribute the answer sheet of the first decision.) This is the answer sheet of the first decision. Please circle your favorite option. Do not forget to write your ID number at the top right of the answer sheet. At the end of the game, if we draw a decision in this round to pay you, you will receive the payoff according to the option you have chosen.

In the first decision, you have to choose the payment option that you would like to get TODAY and IN TWO WEEKS from now *(Stick the cards written "TODAY" and "IN 2 WEEKS" on the top of the calendars in front of the room)*. If you choose option 1, you will get THB 285 today *(Insert the card written "285" in the today's cell)* and get nothing two weeks from now *(Insert the card written "0" in the cell of 2 weeks)*. *Continue explaining options 2 to 4*. You have to choose one favorite option. Let's circle it on the answer sheet.

If you're done with the first round, let's continue with the second decision. (*Assistants collect answer sheets. One assistant helps changing the cards with the amount of payoff and the instructor explains all the options.)*

(After the fifteen decisions have been made). Now we are done with the fifteen decisions, the first round is over. Next, let's play the second round. The rule changes.

Round 2: ***[Variations between the main and control treatments]*** **Group decision** ***[for the main treatment]***

In this round, you are assigned randomly into a group of three members. In each group, there is a "shrimp", a "fish", and a "crab" *(show the chart "group")*. We do the randomization for you and randomly assign who is "shrimp," the "fish," and the "crab" of your group. At no point will you know who your group members are. Still, you are not allowed to talk to others. In this round, you still decide individually and the decisions and options are the same as in the first round.

The difference from the first round or the last fifteen decisions is that one group member— either the "shrimp," "fish," or "crab"—will be the representative of the group due to the random draw. Everyone in the group will receive the same payoff according to the representative's choice. Every group member has an equal chance to be selected as the group representative because we will draw one of the three lots (with the animal symbols) from this box *(show the bag and lots)*. Keep in mind that everyone has an equal chance to be selected the group representative and everyone will get the same payoff according to the representative's choice.

Do you have any questions?

The facilitators come back to the room with answer sheets for the second round, which are already filled out with the decisions of other group members.

This is the answer sheet for the next decision. Please circle your favorite option. However, now you will know the choices of your group members from the previous round. Look at the bottom of the answer sheet. You can see the choices that your other group members made in this decision in the previous round. Please note that we show only your choices from the last fifteen decisions in the first round, and identify you by the symbol of aquatic animals. Thus, your real identities are still kept secret.

At the end of the game, if we draw a decision in this round to pay you, the representative of the group will be randomly selected. All group members will receive the payoff according to the option that the representative has chosen.

Individual decision [for the control treatment].

In this round, we have the same rule as that in the first round. You still decide individually, and the decisions and options are the same as those in the first round. However, you can make the same or different choices as you like.

Let's start the second round.

Explain the same 15 decisions as in the first round.

Now, we are done with the second round. So, the game is over.

The random draw for the payment

We are going to draw a lot now to see which decision will determine your payoff. Are you exited? Who is going to draw the lot?

The lot is drawn. The experimenter shows the lot publicly.

The decision … determines your actual payoff. (Show the decision again on the board.) Can you remember what you have chosen?

[If it is the decision from the first round] The actual payoff is determined by the decision from the first round, so your choice will determine your payoff.

[If it is the decision from the second round] The actual payoff is determined by the decision from the second round, so we have to draw another lot to randomly select the group representative. Who is going to draw this lot? The lot is drawn. The experimenter shows the lot publicly. The group representative is … (fish, crab, or shrimp). Her choice will determine the payoff of all group members.

At this moment, the experimenters outside are preparing the payoffs and also the contract for the future payment for you.

Post-experiment questionnaire

While we are waiting for the contract and payment, let us start the second part of today's activity, which is the questionnaire.

For answering this questionnaire, you will get additional THB 100 today for sure. You will get the payoff today after you have finished the questionnaire.

Thank you very much for your participation!

STUDY 2

TIME PREFERENCES AND FIELD CONSERVATION DECISIONS: EVIDENCE FROM A THAI COASTAL VILLAGE

Suparee Boonmanunt, Thomas Lauer, Bettina Rockenbach, Arne Weiss

EXECUTIVE SUMMARY

We conducted a lab-in-the-field experiment with Thai coastal villagers in which we elicited time preferences, and then organized a mangrove-planting activity to observe the participants' actual contribution to a conservation activity. We used the number of mangrove seeds planted and the participants' membership status in a conservation group as proxies for individuals' conservation decisions. Our results suggest that less present-biased participants contribute more to the planting activity and seem to be more likely to be members of the conservation group. However, conservation decisions are unrelated to the villagers' long-run discounting. Additional results suggest that the conservation group may act as a commitment and learning device.

1.0 INTRODUCTION

Conserving natural resources is obviously an intertemporal decision, as this decision at the moment determines how resources will look like in the future. These resources then influence people's utility in each and every future period, especially for people whose livelihoods depend on the resources. Time preference therefore can be an internal personality trait that affects a decision to engage in resources conservation or not.

A more farsighted person could resist the temptation to exploit resources for her own private benefit better than a myopic person. Hence, she decides to conserve resources as she does not value present consumption as highly as a myopic person. Myopia can be explained by present-biased time preferences (O'Donoghue and Rabin 1999), which are widely represented by the quasi-hyperbolic discounting model in the literature by Laibson (1997). This model distinguishes between long-run discounting or a discount factor, which discounts utilities between two future periods constantly and present bias, which makes utility in the present period relatively high compared to utilities in future periods.

Conservation decisions apparently involve cooperative behavior. Behavioral economics typically focuses on cooperative behavior when studying decisions on conservation. Previous studies on the topic provide useful insights into conservation and its contribution to public goods (e.g., Ostrom 1990; Poteete, Janssen, and Ostrom 2010). However, the relationship between individual farsighted or myopic behavior and conservation has been rarely investigated and, indeed, has been almost overlooked.

Curry, Price, and Price (2008) find a negative correlation between subjects' experimental discount rates and their contribution levels in a one-shot public goods game, suggesting that more patient people are more cooperative. Burks et al. (2009) find that people with less discount rate and less present bias are more cooperative in a sequential prisoner's dilemma. This link has been hardly investigated in the field. Fehr and Leibbrandt (2011) find a relationship between patience and field conservation behaviors in Brazilian fishermen as observed through the mesh size of the fishermen's fishing instruments.[1] As a proxy for patience, the authors asked fishermen to choose between a smaller amount of consumption goods now (at the beginning of their experiment) and a larger amount of the same goods two hours later (after the experiment). The proxy for patience is therefore binary and cannot distinguish between long-run discounting and present bias.

[1] The larger the mesh size, the easier it is for small fish to escape; thus, the larger the mesh size, the higher the concern for conservation.

In our study, we examine time preferences in more detail using the elicitation method that is based on the quasi-hyperbolic discounting model. We can, therefore, look at both the long-run discounting and present bias of an individual and examine how they relate to field conservation decisions. Behaviors resulting from long-run discounting and present bias can be addressed differently. If a low discount factor leads to impatience and then too low contribution to conservation, then we should try to increase people's discount factor, which is not an easy task. On the contrary, if too low a contribution to conservation is due to a present bias, different approaches can be used. Previous work shows that a commitment device is an effective solution (e.g., Ashraf, Karlan, and Yin 2006; Ariely and Wertenbroch 2002).

We conduct a lab-in-the-field experiment to elicit the time preferences of 180 coastal villagers in Southern Thailand. After that, we organize a mangrove-planting activity on the dates that the participants of the experiment pick up their future payoffs. The number of mangrove seeds that each participant chooses to plant is our proxy for a conservation decision. This task is simple and not labor intensive, so it allows us to observe the contribution of both female and male participants within a wide age range. Another proxy for conservation decisions is the membership of the conservation group in the village, since members of this group are required to regularly join conservation activities, which are organized by the group.

Our main results are the following. The participants' time preferences vary regarding both present bias and discounting. Less present-biased participants contribute more to the mangrove-planting activity and are more likely to be members of the conservation group. The conservation group might work as a commitment device. Our data show that members of the conservation group contribute more than nonmembers do to the mangrove-planting activity. Conservation group members also expect more of villagers with regard to their contribution to the mangrove-planting activity than nonmembers, indicating a higher feeling of commitment. Moreover, the longer members have been in the group, the more they contribute to a conservation activity, suggesting the learning effect of the conservation group. All these results support the formation of conservation groups to involve local communities in managing the resources they rely on.

2.0 COASTAL VILLAGERS AS PARTICIPANTS

Our participants are the villagers of Naithung, Nakhon Si Thammarat province, Thailand. The village is located along the coast of the Gulf of Thailand. The major economic activities are related to fisheries, such as fishing with their own boats, selling fish, making fish nets, working on boats, etc. Although there is open access to fishing grounds, fishermen in Naithung still fish in a sustainable way by using sustainable fishing instruments that allow small aquatic animals to escape, then grow and reproduce (Patkaew and Chaiyarak 2010).

In 2002, some fishermen founded the Naithung's Fisherfolk Conservation Group (hereafter called the conservation group) to organize conservation activities regularly, including the annual building of offshore shelters for aquatic animals, supporting the crab bank[2] (Fisherfolk Network Sichon-Thasala 2012). In recent years, the conservation group has been trying to plant mangrove on the newly growing mud at the piers. They hope that the mangroves will be a nursery for aquatic animals, help to prevent/halt soil erosion, and reduce carbon dioxide. Out of the 704 households in Naithung, around 70 households are members of the conservation group.

The conservation group also manages a savings fund[3] to help its members financially and to attract other villagers to join in with conservation activities. Part of the profit is used to finance their conservation activities.

[2] When fishermen catch female crabs who are about to give birth to baby crabs, they put them in baskets so that they can safely hatch their young. The baskets are either onshore or offshore. The baskets are known as the crab bank. The mother crabs can give birth to hundreds of thousands of baby crabs. When the mother crabs have laid their eggs, the fishermen get the mother crabs back.

[3] Members of the savings fund are required to save a constant small amount of money (around USD 1.53) monthly into the fund. After being a member for at least a year, members are eligible to take a micro-loan and to receive micro health insurance and life insurance. Once a month, they meet to do all transactions.

3.0 TIME PREFERENCES INCORPORATED MODEL FOR PUBLIC GOOD

Present-biased preferences can be modeled with a simple functional form of the quasi-hyperbolic discounting or the so-called $\beta-\delta$ model (Laibson 1997). When we plug it into a standard intertemporal utility function from consumption (c_t, c_{t+k}), the total utility function takes the following form:

$$U_t = u(c_t) + \beta \sum_{k=1}^{T} \delta^k \, u(c_{t+k}) \qquad \text{Equation (1)}$$

where:

T = present period,
K = time span,
Δ = long-run discounting (a discount factor), and
β = parameter for present-biased preference with $0 \leq \beta < 1$.

$\beta = 1$ corresponds to the case of standard exponential discounting. The one period discount factor between the present and a future period is $\beta\delta$, while the one period discount factor between two future periods is δ.

Then, we have the standard social dilemma situation adapted from the model in Kocher et al. (2016). Assume that the utility function U of individual i is given by

$$U_i = u(\pi_i). \qquad \text{Equation (2)}$$

π_i is an individual's monetary payoff, which depends on the public good technology, the relative price of the private good, and on contribution costs to the public good: $\pi_i = f(c_i, G(\cdot))$ and $\partial\pi_i / \partial c_i < 0$; where G is the public good technology; $c_i \geq 0$ is i's contribution to the public good from the available endowment E, and the rest is for private consumption.

Kocher et al. (2016) assume further regarding the public good technology that

$$\frac{\partial G(\cdot) / \partial c_i}{n} < \frac{\partial G(\cdot)}{\partial c_i} < 1 < n \cdot \frac{\partial G(\cdot)}{\partial c_i}, \quad \frac{\partial G(\cdot)}{\partial c_i} > 0, \qquad \text{Equation (3)}$$

where n is the group size. Condition (2) constructs the social dilemma situation, in which every contribution is individually irrational ($\partial G(\cdot) / \partial c_i < 1$), but collectively rational ($n \cdot \partial G(\cdot)/\partial c_i > 1$).

In the next step, we incorporate time dimension and time preference parameters of the $\beta-\delta$ model to the utility function. This is the utility from the contribution decision in the present period to the public good from which i can benefit in the future periods.

$$u(\pi_i) = E - c_i + \beta_i \sum_{k=1}^{T} \delta_i^k \, G(\cdot). \qquad \text{Equation (4)}$$

As future benefits from the public goods are discounted, i contributes less to the public good the more i discounts the future.

Proposition 1: Given constant long-run discounting (δ), higher present bias (smaller β) decreases contribution.

Proposition 2: Given constant present bias (β), higher long-run discounting (smaller δ) decreases contribution.

4.0 THE EXPERIMENTS

4.1 Elicitation Method of Time Preferences

We use the Convex Time Budget (thereafter CTB) method to elicit time preferences. This method was developed by Andreoni and Sprenger (2012), and was adapted for a field experiment by Andreoni, Kuhn, and Sprenger (2015); and Lührmann, Serra-Garcia, and Winter (2014). In this method, participants have to allocate a given budget to a sooner and a later date to different gross interest rates. Inner choices are possible and convex utility is, therefore, allowed.

There are three time frames: (I) today and two weeks, (II) today and four weeks, and (III) two weeks and four weeks. The degree of present bias (β) can be identified by comparing (I) and (III), as time frames (I) and (III) have the same time span of two weeks, but the sooner payment in time frame (I) is immediate. The long-run discounting (δ) can be identified by comparing decisions in time frames (I) and (II), as both time frames differ in time spans. Subsequently, types of decisions are pinpointed. The experimental budget is always THB 300 (around USD 9.2),[4] which is a minimum daily wage in Thailand. Thus, the intertemporal budget constraint in each decision is $Px_t + x_{t+k} = 300$, where t is the sooner period, k is the time span, x_t is the budget allocated to the sooner date, x_{t+k} is the budget allocated to the later date, and P is a gross interest rate.[5] The amounts allocated to sooner and later dates in each decision can already reveal information about the patience and present bias of a decision maker. The more patient a subject is, the less she allocates to the sooner date. Furthermore, a subject is present-biased if she allocates more of the budget to the sooner date in the short run (time frame I) than in the long-run time frames (time frame III) for a given gross interest rate. The bigger this difference is, the larger the present bias.

There are five gross interest rates for each time frame, from 1.05 to 2.00, which corresponds to interest rates of 5%–100% for two weeks.[6] These rates are much larger than the market rate at commercial banks (the informal savings group does not pay any interest on savings). Since villagers are predominantly Muslim, informal savings groups in the village follow the Muslim rule of not paying any interest on savings and not collecting any interest from loans. Some villagers do have savings accounts at commercial banks and can expect annual interest rates of around 2%, which was the average deposit interest rate in Thailand in 2014 (World Bank 2016).

4.1.1 Decisions

Table 2.1 summarizes all five decisions (rows in table) for time frame I (Today, +2 weeks). The corresponding parameters are shown in the last three columns. The options stay the same in time frames II (Today, +4 weeks) and III (+2 weeks, +4 weeks); only the timing of payments changes. The subjects have to choose only one favorite budget allocation out of the four allocation options in each decision. Option 4 always gives the highest total payoff (i.e., THB 300), which is the full budget, although the subjects have to wait to get this money at the later date. Option 1 gives the whole payoff on the sooner date, but the amount is the budget discounted by the corresponding gross interest rate. The total amount of payoff on both sooner and later dates in each option increases with the option number, but subjects have to be more patient for a higher total payoff. Hence, option 4 is the most patient option, and option 1 is the least patient option. All subjects have to go through all 15 decisions. Subjects are presented with one decision at a time.

We implement a pen and paper experiment in the field. Each answer sheet is for one decision (a row in Table 2.1). Participants see four calendars. Each calendar represents each of the four options and shows clearly on what dates and how much money will be paid. Every participant chooses one favorite option by circling around its number. Figure 2.1 shows an example of an answer sheet for the first decision.[7]

[4] USD 1 = THB 32.62 at the time of the experiment.

[5] See the full theoretical framework in Appendix B1.

[6] Appendix B2 details the standardized daily rate and annual rate of decisions in our experiment.

[7] The complete time preference experiment also consists of the second situation, in which participants are randomly assigned in groups of three, and each of them then decides for the whole group. Each member has the same chance to be randomly selected as a delegate for the group. In this study, we are interested only in the decisions for oneself.

4.2 Procedure

The lab-in-the-field experiment was conducted on 21–23 February, 2015, in school classrooms in Naithung village. In total, 180 villagers took part in the experiment, of which 63.33% are fisherman and 90% are from fishing families. Some 38.33% of all participants are members of Naithung's Fisherfolk Conservation Group, while the rest are nonmembers. The participants' ages range between 19 and 80 years old with an average age of 44 years.

After all the participants made all their decisions, a randomly selected participant in each session randomly draws one number from a box to determine the decision that is paid out. Participants are informed about this random lottery mechanism. With this mechanism, all decisions are relevant for the payoff, and income effects can be avoided. Further, participants receive THB 100 (around USD 3.07)[8] as a fee for showing up and an additional THB 100 for answering the post-experimental questionnaire. This additional payment for the questionnaire is announced after the experiment. Hence, it does not influence the choices made in the experiment. On average, the whole experiment takes 78 minutes. Additionally, an interview for the post-experimental questionnaire takes around 30 minutes. The total average earning is THB 480.42 (USD 15.73), which is higher than the minimum daily wage of THB 300.

4.3 Implementation of Payments

There are some concerning issues that may make the participants reluctant to choose to receive a payoff in the future. Firstly, participants may harbor uncertainty about receiving the future payments from the experimenters. Secondly, the transaction costs of receiving the payoff across payment dates may differ at different points in time. We try to eliminate these concerns as much as possible by implementing the procedure discussed in this subsection.

Introduction to community leaders. During the first field survey, the NGO officers who had been working in the area for over 10 years introduced us to community leaders. Thus, the community leaders welcomed us.

Residence in the field. The researcher who conducted the experiment lived in the village for around two months before the experiment took place, so she was not a stranger to the participants. During this period, the researcher conducted interviews and focus groups discussions with various villagers. However, to avoid biases regarding participants who knew the researcher, she told them that the money they would get from the experiment was not hers, but came from a foreign granting organization.

Announcement. The community leaders, who are also committee members of the savings group, announced the experiment. The community leaders are trustworthy with regard to money issues, and they guaranteed the participants that the researcher would pay according to what she had promised.

Contract. After the experiment, participants received a contract signed by the researcher, stating how much their payments were and on which dates they would receive their payments. The researcher stressed that participants could sue her if she did not pay them according to the contract.

Transaction costs. The fee of THB 100 given for showing up was divided equally and paid in cash on both payment dates to compensate for transaction costs equally across both dates.

Delivery of payments. The participants received the "today" payment in cash after the experiment to make it really immediate. For "later" payment, participants were asked to pick up the money at the community shop by the pier, which everyone knows, passes by and congregates around every day. The time and money needed by participants to travel between the experiment locations and the community shop are similar.

[8] USD 1 = THB 32.62 at the time of the experiment

Table 2.1. Decisions in time frame I (Today, +2 weeks)*

No.	Payment dates	Option 1 (THB)	Option 2 (THB)	Option 3 (THB)	Option 4 (THB)	*t* (Sooner Date)	*k* (Delay Days)	*P* (Gross Interest Rate)
1	TODAY	285	190	95	0	0		
	AND in 2 WEEKS	0	100	200	300		14	1.05
2	TODAY	270	180	90	0	0		
	AND in 2 WEEKS	0	100	200	300		14	1.11
3	TODAY	240	160	80	0	0		
	AND in 2 WEEKS	0	100	200	300		14	1.25
4	TODAY	210	140	70	0	0		
	AND in 2 WEEKS	0	100	200	300		14	1.43
5	TODAY	150	100	50	0	0		
	AND in 2 WEEKS	0	100	200	300		14	2.00

Note: * See complete decisions for all three time frames in Appendix B2.

Figure 2.1. Example of an answer sheet

4.4 Measures of Time Preferences

First, we look at the actual choices made in the experiment. Then, we use nonparametric measures of time preferences in order to avoid making assumptions on the utility function if we estimate parameters for time preferences in a parametric framework (Sutter et al. [2013] use the nonparametric measures due to this argument).[9] Further, using the nonparametric measures of time preferences allows us to have measures for all participants.

The measure of present bias is calculated as the difference between the average of the five choices made for time frame III (+2 weeks, +4 weeks) and the average of five choices made for time frame I (today, +2 weeks). Both time frames have the same time span of two weeks, but the sooner payment date is immediate in time frame I. If a participant is present-biased, then s/he is more patient for the future time frame (time frame III) and chooses the higher options; thus, the measure is positive. The opposite holds for a future-biased participant. If a participant is non-biased, then s/he chooses the same option in both time frames; thus, the measure is zero.[10]

Measure of present bias = Average choice in time frame III – Average choice in time frame I

The measure of long-run discounting is calculated as the average of the five choices made in time frame III, in which both payment dates are in the future (+2 weeks, +4 weeks), so that only long-run discounting exists but no present bias. Another way to observe whether subjects discount or not is to compare their decisions in time frame I (today, +2 weeks) and time frame II (today, +4 weeks).

Measure of long-run discounting = Average choice in time frame III (scale from 1–4)

4.5 Actual Conservation Decisions

The main objective of this study is to examine the correlation between time preferences elicited in the experiment and actual conservation decisions in the field. We have two proxies for field conservation decisions, as follows.

4.5.1 Contribution to the mangrove-planting activity

In order to observe actual decisions to actively participate in a conservation activity, we organize a mangrove-planting activity. We select this activity for the following reasons: mangrove planting is an easy task that everyone across genders and ages can do; it takes only a short time to plant a mangrove seed; the villagers know about the benefits of mangroves; the villagers know how to plant mangrove seeds because such planning activities have been organized from time to time.

We organize the planting activity on the days that participants of the time preference experiment come to pick up their future payments. So, there are four planting days: 7, 8, 9 March (two weeks after the experimental days) and 23 March, 2015, (four weeks after the experimental days). These dates depend on the random draw of the one paid-out decision (out of all decisions) in the experiment (See pictures of the activity in Appendix B5).

[9] We also estimate parameters β_i and δ_i of the utility function. However, we cannot estimate the individual parameters of the participants who did not alter the choice at all (i.e., who always chose the same option across 15 decisions) since no variation in choices make it insufficient for the estimation. Our sample therefore is reduced by 55 subjects (out of 180). The main results of this method are not different from using the actual choices and non-parametric measures. Thus, we show results from this estimation in Appendix B3.

[10] The problem with this measure of present bias is that participants could be present-biased for some decisions and future-biased for others, leading to a bias of 0 on average. In our sample, there are few cases falling into this situation—10 out of 72 non-biased individuals. Excluding these participants, the results remain qualitatively the same. Thus, we include them in the analysis.

We call the participants one day before the payment days to remind them to pick up their payoffs. We also inform them about the mangrove-planting activity. We tell them that there will be a planting event on the same day near the payment location. This planting event is separate from our experiment; thus, they may or may not participate, and they may want to dress properly if they want to join the planting event.

After the participants pick up their money at the community shop near the pier, they are asked to go to the desk nearby, which is located 15 meters away. We take time to pay them so that only one participant arrives at the mangrove desk at a time. At the desk, research assistants ask them whether they would like to plant mangrove; if yes, how many seeds and for what reason?; if not, why not?[11]
The participants receive the mangrove seeds free of charge. After the participants have decided whether or not they would like to participate in the planting activity and how many mangrove seeds they would plant, we ask them about their expectations of how many other villagers will join the activity.

To avoid reciprocity to the experimental payment, we tell the participants that the mangrove-planting activity and the time preference experiment are separate activities. We add that they can choose not to participate in the mangrove-planting activity if they don't want to. Our data shows that we can rule out such effect on participants' planting decisions. Firstly, in answer to our question regarding reasons for planting, none of the participants states that s/he plants mangrove seeds because she wants to please us. Secondly, the regression results in Table 2.2 show that there is no significant correlation between the number of mangrove seeds planted by each participant and the payoff from the time preference experiment. Every participant, however, has participated in the experiment and received their payments. So, they are all exposed to the influence of the experimental payment. The difference in contributing to the mangrove activity across participants should not be affected by concerns regarding reciprocity.

We can rule out the influence of others' actual contribution to the activity on participants' decisions as well. Trees block the line of sight between the desk where participants make their planting decisions and the mangrove planting area, so participants were not able to see how many mangroves had already been planted by others. Therefore, the motive of conformity can be set aside. Figure 2.2 shows a map of the mangrove-planting activity.

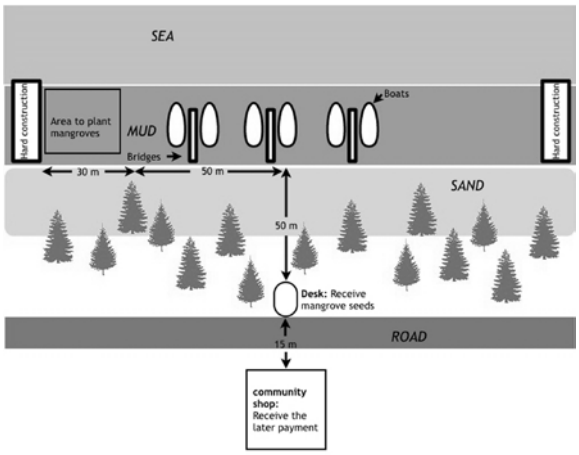

Figure 2.2. Map of mangrove-planting activity

4.5.2 Membership of the conservation group

As the conservation group regularly organizes various conservation activities and asks members to contribute labor, time, or money, its membership status is a decent proxy for a conservation decision. According to the official record[12] of the conservation group, 69 out of 180 participants are members of the group.

[11] Appendix B4 details the participants' reasons for not/participating. Appendix B9 shows the questionnaire used prior to the planting activity.

[12] The official record of the conservation group, February 2015.

5.0 RESULTS

First, we check the rationality of choices according to the law of demand. Choices are rational when participants allocate less to the sooner date, which means opting for a higher option when the interest rate increases. The share of rational choices is 79.77%. There is little evidence of an extremely irrational shift, which is when participants change from option 4 (the most patient) to option 1 (the least patient) as the interest rates increase. Only 5% of all participants make such an extreme shift. We include all decisions in the analysis, since all main results stay the same when we exclude the irrational choices.

5.1 Individual Time Preferences: Comparing Choices between Time Frames

Looking at the distribution of the measure of present bias, Figure 2.3 shows that 20% of participants are future-biased, 40% are consistent, and 40% are present-biased. This indicates that there is a variation in the present bias among participants. The measure is significantly different from 0 (Wilcoxon signed-rank test, p = 0.002), indicating a present bias on average.

Figure 2.4 shows the mean share of budget allocated to sooner dates in time frames I (today, +2 weeks) and III (+2 weeks, +4 weeks); the present and future time frames with the same time span of two weeks. We see that the mean share to sooner dates decreases with higher interest rates, which is according to the law of demand. For every given interest rate, the mean share of budget allocated to the sooner date in time frame I (today, +2 weeks) is higher than that in time frame III (+2 weeks, +4 weeks). This means that participants are less patient when the sooner date is immediate, which indicates present bias on average. The overall difference between choices made in time frames I and III is statistically significant (Wilcoxon signed-rank test, p = 0.002).[13] The regressions of choices on the immediacy of sooner payment, time span, interest rates, and other controlled variables yield similar results.[14]

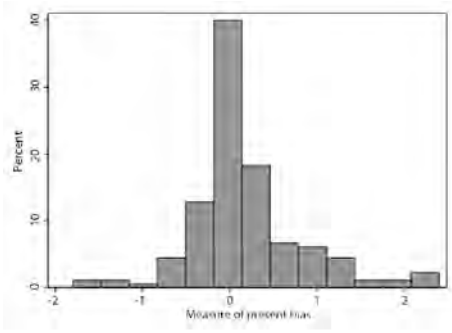

Figure 2.3. Measure of present bias

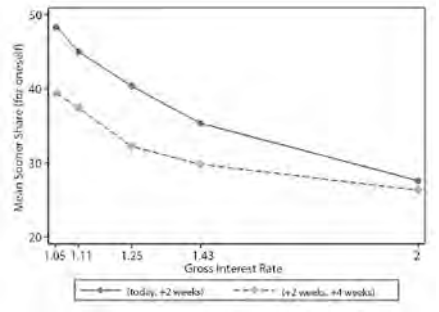

Figure 2.4. Share of budget allocated to sooner dates in time frames I and III

Regarding long-run discounting, Figure 2.5 shows that participants differ in their discounting as well with the highest fraction (33.33%) at 4, which means participants choose option 4 in all five decisions for the future time frame. Another way to look at the discounting is shown in Figure 2.6, which shows the comparison between the mean share of budget allocated to the sooner date in time frames I and II. The differences between the mean share of budget allocated to sooner dates in time frames I and II are small and not significant overall, as well as for every interest rate.[15] The regression results also show that time span does not have any significant effect on choices.[16] In our experiment, the participants do not discount on average.

[13] Regarding the pairwise comparison for each gross interest rate, the differences in choices made for both time frames are statistically significant for the gross interest rates from 1.05 to 1.43, but not significant for the gross interest rate of 2 (Wilcoxon signed-rank test, p-values are 0.009, 0.01, 0.005, 0.008, 0.62). This is what we expected, since the higher the interest rate, the more patient people should be, and the harder we find the difference in choices for both time frames.

[14] See the regression results in Appendix B6.

[15] Wilcoxon signed-rank test, p-values are 0.65 (for the overall difference), and 0.65, 0.58, 0.37, 0.58, 0.28 (for each of the five interest rates).

[16] See the regression results in Appendix B6.

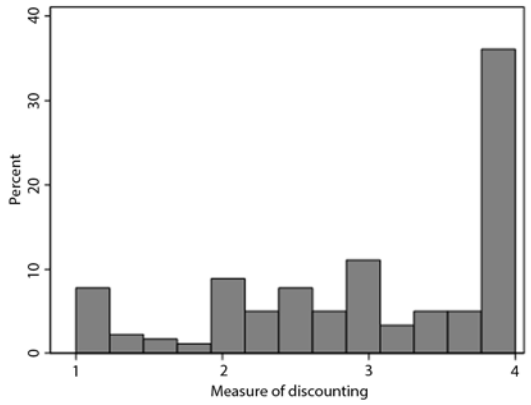

Figure 2.5. Measure of long-run discounting

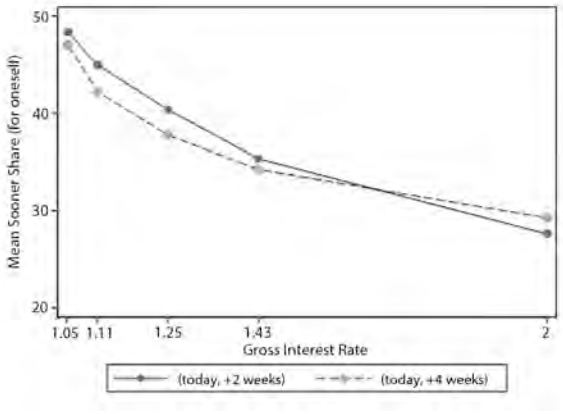

Figure 2.6. Share of budget allocated to a sooner date, time frames I and II

5.2 Time Preferences and Field Conservation Decisions

To answer our main research question, we now examine the relationship between experimentally elicited time preferences and the two proxies for field conservation decisions: (1) the number of individuals who planted mangrove seeds and (2) membership of the conservation group.

5.2.1 Time preferences and contribution to the mangrove-planting activity

Out of the 180 participants who participated in the time-preference experiment, 33 did not pick up their payoffs in person. Twenty-six of these 33 absent participants sent representatives to pick up their payoffs. So we do not have data on the planting decisions of the 33 absent participants. We do the analysis, however, for two samples. First, we use data of all 180 participants, as all the participants actually know about the event but they decide not to come to pick up their payoff and in a way not to plant mangrove seeds. Second, we use data of the 147 participants who come to pick up their payoffs and decide what their contribution to the planting event will be.

Figure 2.7 shows the distribution of the number of mangrove seeds planted by each participant. Out of 180 participants, 61 participants (33.89%) do not plant any seeds. The majority of contributors, 56 participants (31.11%), plant five seeds. There are, however, 33 participants who do not come to pick up their payoff at all, so they are absent from the mangrove-planting activity as well. Out of the 147 participants who come to pick up their payoff, 28 participants (19.05%) do not plant any seeds. The majority of contributors, 56 participants (38.10%), plant five seeds.

Participants who did not come to pick up their payoff do not differ significantly from participants who come to pick up their payoff in terms of present bias, long-run discounting, payoff on the planting day, and the planting day (See the regression results in Appendix B7).

We start with the descriptive results. We categorize the participants into three categories: present-biased, non-biased, and future-biased. A participant is non-biased when his/her measure of present bias is zero, present-biased when his/her measure of present bias is larger than zero, and the opposite holds for future-biased participants.

Figure 2.8 shows that, on average, present-biased participants plant fewer mangrove seeds than do non-biased participants, and future-biased participants plant the largest number of seeds. This trend holds for both the whole sample (n = 180) and for the participants who come to pick up their payoff (n = 147). This indicates that, on average, the more present-biased participants plant fewer mangrove seeds.

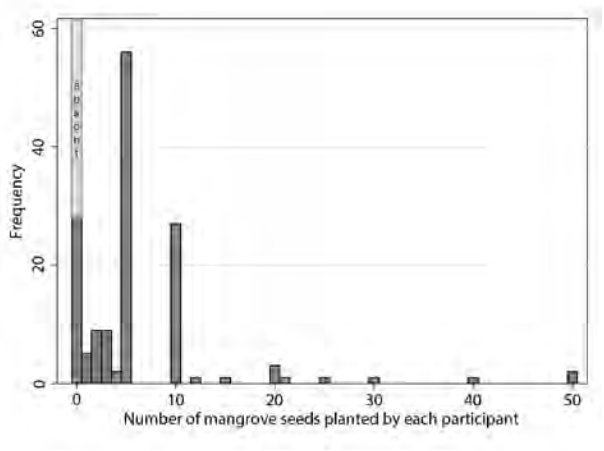

Figure 2.7. Distribution of the number of mangrove seeds planted by each participant

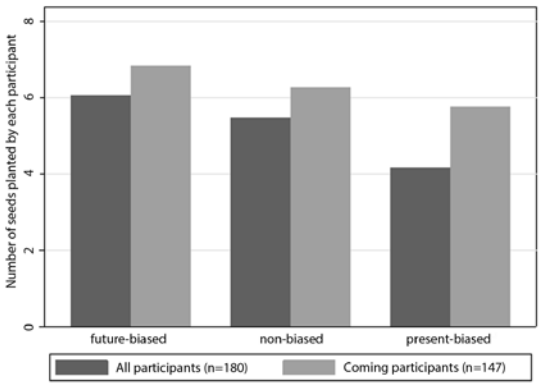

Figure 2.8. Number of mangrove seeds planted by future-, non-, and present-biased participants

We then run a linear regression of the number of mangrove seeds planted by each participant on the measure of present bias and measure of discounting, with clustered standard errors on the experimental session and wild cluster bootstrap resamples.[17] When we include all 180 participants in the analysis, the results in Table 2.2 model (1) suggest that the present bias is significant and negatively correlated with the number of mangrove seeds planted by each participant. This means that less present-biased participants plant more mangrove seeds. Long-run discounting, on the other hand, is not significantly correlated with the number of planted seeds. The positive coefficient, however, suggests that the less that a participant discounts the future, the more seeds she plants. We then control for sociodemographic characteristics, planting day, and payoff from the time-preference experiment[18] as shown in Table 2.2 model (2). The regression results suggest similar results and additionally that female participants plant 3.2 fewer seeds than male participants.

When we include only the 147 participants who come to pick up their payoff and decide about their contribution to the planting activity at the site, the correlation between present bias and the number of planted mangrove seeds is then significant and negatively correlated in model (3) without controlled variables ($p = 0.06$). Model (4) shows that with controlled variables, present bias is still significant and negatively correlated to the number of planted seeds ($p = 0.09$), but also long-run discounting behavior is now significant and positively correlated ($p = 0.07$). Female participants planted significantly less than male participants also in this sample ($p < 0.01$).

The planting day has a significant and negative effect on the number of mangrove seeds planted by each participant in model (2) with the whole sample ($p = 0.05$), but not in model (4) with only participants who pick up their payoff ($p = 0.14$), because the percentage of absent participants increases with the payment days. In other words, on the later payment days (and so the planting days) more participants send a representative to pick up their payoff, probably because they have heard from the others that it was fine not to come by themselves.

Result 1. More present-biased participants contribute less to the mangrove-planting activity.

[17] We use the linear regression with clustered standard errors by the experimental session. Although we randomly assign participants into each session, the experimental days, time of day, and other external factors in the field (e.g., weather) could influence decisions across sessions differently. As we have a small number of sessions (only 12 experimental sessions), we use wild cluster bootstrap resamples (600 resamples), as discussed in Cameron, Gelbach and Miller (2008).

[18] This was done in order to control for reciprocity issue or the effect that participants plant mangrove seeds to reciprocate the payoff from the experiment.

Table 2.2. Linear regression of the number of mangrove seeds planted by each participant

Dependent Variable / Model	Number of Mangrove Seeds Planted by Each Participant							
	(1)		(2)		(3)		(4)	
	Estimate	p-value	Estimate	p-value	Estimate	p-value	Estimate	p-value
Measure of present bias	–1.02**	p = 0.02	–1.13**	p = 0.04	–1.00*	p = 0.06	–1.11*	p = 0.09
Measure of discounting	0.57	p = 0.32	0.69	p = 0.33	0.98	p = 0.18	1.39*	p = 0.07
Female	–	–	–3.20***	p < 0.01	–	–	–3.90***	p < 0.01
Age	–	–	0.05	p = 0.44	–	–	0.07	p = 0.31
Education Level	–	–	2.97	p = 0.14	–	–	3.57	p = 0.15
No. of children	–	–	–0.27	p = 0.56	–	–	–0.31	p = 0.47
Planting day	–	–	–1.01*	p = 0.05	–	–	–0.90	p = 0.14
Payoff from the experiment			0.01	p = 0.52			–0.01	p = 0.17
Constant	3.54	p = 0.2	–8.60***	p < 0.01	3.46	p = 0.56	–1.58	p = 0.23
No. of participants	180		180		147		147	
No. of clusters (sessions)	12		12		12		12	
Adjusted R^2	0.0143		0.1261		0.0224		0.1635	

Notes: (1) * p < 0.1, ** p < 0.05, *** p < 0.01 (2) Robust standard errors are clustered (wild cluster bootstrap) by experimental session.

5.2.2 Time preferences and membership status in the conservation group

Another proxy for conservation decisions is the decision whether to join the conservation group. To be able to join the group, s/he should have had regularly participated in conservation activities organized by the group. Further, once a member of the conservation group, participation in the group's activities is expected. Membership status in the conservation group can therefore reveal a long-term conservation decision. For this proxy, we only use the whole sample in the analysis.

Figure 2.9 shows that the members of the conservation group are on average less present-biased than the nonmembers. On the contrary, Figure 2.10 shows that members and nonmembers are quite similar in discounting behavior.

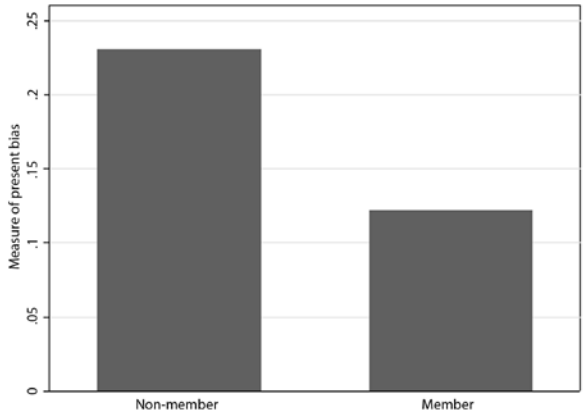

Figure 2.9. Measure of present bias of members and nonmembers

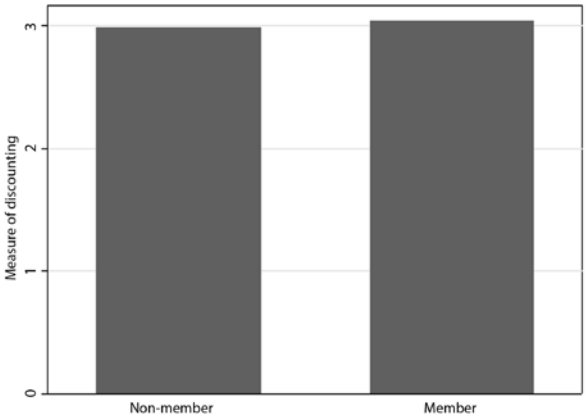

Figure 2.10. Measure of discounting of members and nonmembers

We run a linear regression of membership status in the conservation group on measures of time preferences, again with clustered standard errors by the experimental session (wild cluster bootstrap resamples). In model (1) in Table 2.3, without any control variables, both present bias and discounting are not significantly correlated to the likelihood of being a member of the conservation group. The signs of the coefficients, however, suggest that members of the conservation group tend to be less present-biased and discount the future less. When we control for sociodemographic characteristics, the negative correlation between present bias and the likelihood of being a member of the conservation group becomes weakly significant. The correlation between discounting and the likelihood of membership status stays insignificant. The logit regression of membership status on time preferences with standard error clustered on the individual level yields similar results (see Appendix B8).

Result 2. Members of the conservation group tend to be less present-biased than nonmembers.

Table 2.3. Linear regression of membership status of the conservation group

Dependent Variable / Model	Membership of the Conservation Group			
	(1)		(2)	
	Estimate	p-value	Estimate	p-value
Measure of present bias	–0.08	p = 0.22	–0.10*	p = 0.090
Measure of discounting	0.03	p = 0.42	0.05	p = 0.130
Female	–	–	0.01	p = 0.890
Age	–	–	0.01**	p = 0.020
Education level	–	–	–0.02	p = 0.710
No. of children	–	–	0.01	p = 0.730
Household monthly income	–	–	<0.01	p = 0.810
Constant	–0.30*	p = 0.08	–0.23***	p = 0.003
No. of participants	180		180	
No. of clusters (sessions)	12		12	
Adjusted R^2	0.0158		0.111	

Notes: (1) * p < 0.1, ** p < 0.05, *** p < 0.01 (2) Robust standard errors are clustered (wild bootstrap) by experimental session.

5.3 Role of the Conservation Group

In this section, we try to shed light on one possible approach that could increase contribution to conservation of resources—a conservation group. As our results suggest that present bias can be an individual psychological trait for low contribution, a commitment device for conservation decisions might help people to overcome the temptation not to conserve. In many ways, the conservation group in our study site works like a commitment device for conservation decisions. One of the official rules of the conservation group states that members have to participate regularly in conservation activities. Members of the group may therefore feel committed to participate in such activities. Breaking this commitment might cause them social punishment, for example, shame, gossip or negative financial consequences from being cut off from the savings fund that the conservation group manages.

Our data could provide evidence regarding the commitment function of the conservation group. First, we check whether members and nonmembers of the group contribute to the mangrove-planting activity differently. Figure 2.11 shows that on the average, members plant more mangrove seeds than do nonmembers for both the whole sample (n = 180) and for only those who come to pick up their payoff (n = 147).

We run a linear regression of the number of mangrove seeds that each participant planted on membership status controlled for time preferences and clustered by the experimental session (wild cluster bootstrap). For the whole sample (n = 180), the results of model (1) in Table 2.4 show that members of the conservation group plant significantly 2.63 mangrove seeds more than do nonmembers. Moreover, present bias is still significant and negatively correlated to the number of mangrove seeds planted by each participant (p = 0.08). When we control for sociodemographic characteristics, planting day, and payoff from the experiment, the coefficient of membership status is still significant. Its magnitude suggests that members plant 2.68 seeds more than nonmembers do, as shown in model (2). Present bias is not significantly correlated to the number of planted seeds anymore. Results from models (3) and (4) also suggest that members plant significantly more mangrove seeds than nonmembers do for those who come to pick up their payoff (n = 147).

Result 3. Members of the conservation group plant more mangrove seeds than nonmembers do.

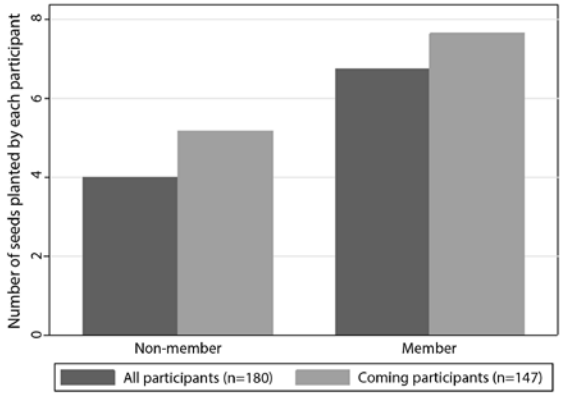

Figure 2.11. Number of mangrove seeds planted by members and nonmembers

Table 2.4. Linear regression of number of planted seeds on membership status

Dependent Variable / Model	Number of Mangrove Seeds Planted by Each Participant							
	(1)		(2)		(3)		(4)	
	Estimate	p-value	Estimate	p-value	Estimate	p-value	Estimate	p-value
Membership of the conservation group (dummy)	2.63***	p = 0.006	2.680**	p = 0.04	2.28**	p = 0.046	2.60*	p = 0.096
Measure of present bias	−0.81*	p = 0.080	−0.840	p = 0.17	−0.73	p = 0.200	−0.77	p = 0.240
Measure of discounting	0.49	p = 0.380	0.520	p = 0.48	0.88	p = 0.200	1.19	p = 0.120
Female	–	–	−3.190***	p < 0.01	–	–	−3.88***	p < 0.010
Age	–	–	0.030	p = 0.65	–	–	0.05	p = 0.480
Education Level	–	–	2.920	p = 0.14	–	–	3.58	p = 0.130
No. of children	–	–	−0.300	p = 0.52	–	–	−0.33	p = 0.450
Planting day	–	–	−0.400	p = 0.50	–	–	−0.33	p = 0.660
Payoff from the experiment	–	–	0.001	p = 0.92	–	–	−0.02**	p = 0.040
Constant	2.74	p = 0.800	−2.820*	p = 0.08	2.77	p = 1.000	4.43	p = 0.730
No. of participants	180		180		147		147	
No. of clusters (sessions)	12		12		12		12	
Adjusted R^2	0.0439		0.1458		0.0431		0.1812	

Notes: (1) * p < 0.1, ** p < 0.05, *** p < 0.01 (2) Robust standard errors clustered (wild cluster bootstrap) by experimental session.

We then try to understand whether members of the conservation group might feel more committed to participate in a conservation activity than nonmembers might. Thus, we look at participants' expectations regarding the contribution of other villagers (called "empirical expectation" by Bicchieri 2006). We ask the participants about this expectation after they have decided whether and how many mangrove seeds they would plant. The question is, "*As you heard about this mangrove-planting activity, do you think that other Naithung's villagers will join the activity?*" They can answer "no one," or "few people," or "some people," or "most people," or "all people" will join the activity.

We find that members expect more people to join the activity than nonmembers do, (see Figure 2.12, Mann-Whitney rank-sum test, $p < 0.01$). Therefore, members might feel more strongly that they should contribute, as the large amount of literature on conditional cooperation and social norms for cooperation suggests (Ostrom 2000; Fischbacher, Gachter, and Fehr 2001; Kocher et al. 2008; Rustagi, Engel, and Kosfeld 2010). Consequently, members could feel more committed to contribute than do nonmembers.

In the following, we further investigate whether members might learn to conserve more over time in the conservation group. If it is the case, the conservation group could also have another function, which is to educate members to conserve. To do this, we examine the relationship between membership duration (in years) and the number of mangrove seeds planted by each participant, by running OLS regressions with standard errors clustered on the individual level.

We start with the whole sample (n = 69). Model (1) in Table 2.5 shows the weakly significant positive correlation between membership duration and the number of mangrove seeds planted without controlled variables. When we control for sociodemographic characteristics, model (2) shows that the positive correlation becomes more significant. When we only include members who come to pick up their payoff (n = 61), models (3) and (4) suggest similar results. These results indicate that the longer a member has been in the conservation group, the more mangrove seeds s/he plants. This may provide evidence for a learning effect of the conservation group.

Result 4. The longer a member has been in the conservation group, the more intensely s/he tends to conserve.

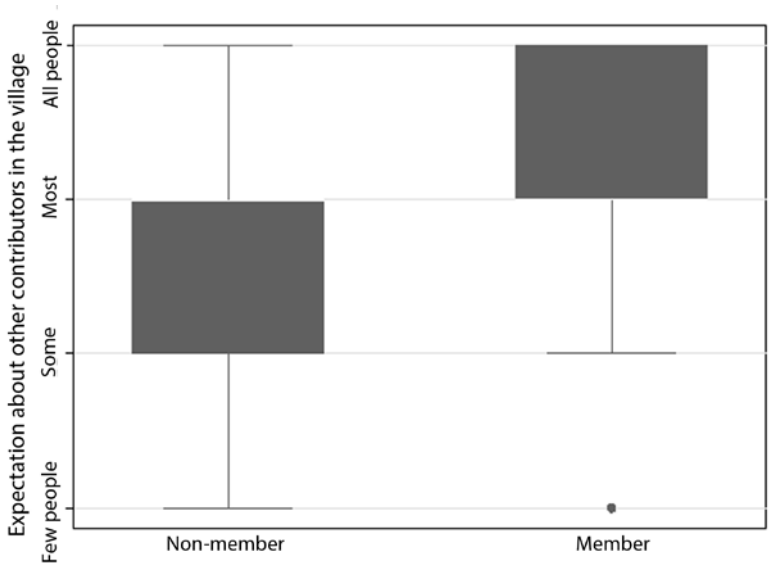

Figure 2.12. Expectation about others' contribution to the conservation activity

Table 2.5. Linear regression of number of mangrove seeds planted on membership duration

Dependent Variable / Model	Number of Mangrove Seeds Planted by Each Participant							
	(1)		(2)		(3)		(4)	
	Estimate	Standard Err	Estimate	Std Err	Estimate	Standard Err	Estimate	Std Err
Membership duration (years)	0.68*	(0.38)	0.99**	(0.45)	0.78*	(0.40)	1.10**	(0.48)
Female	–	–	−3.48	(2.08)	–	–	−4.06*	(2.20)
Age	–	–	0.09	(0.17)	–	–	0.08	(0.18)
Education Level	–	–	5.87	(4.23)	–	–	7.57	(4.65)
No. of children	–	–	−1.16	(0.81)	–	–	−1.12	(0.84)
Planting day	–	–	2.55	(2.16)	–	–	2.53	(2.19)
Payoff from the experiment	–	–	0.07*	(0.04)	–	–	0.07	(0.04)
Constant	1.79	–	−55.20*	(32.72)	1.97	(2.18)	−55.38	(33.04)
No. of participants	69		69		61		61	
R^2	0.0334		0.2385		0.441		0.2804	

Notes: (1) * p < 0.1, ** p < 0.05, *** p < 0.01 (2) Robust standard errors clustered on the individual level are in parentheses.

6.0 CONCLUSION

In order to investigate the relationship between time preferences and actual conservation decisions, we conduct a time preference experiment in a Thai coastal village. We organize a mangrove-planting activity to observe the actual active contributions of participants. Additionally, we have the official record of our participants' membership status in the conservation group.

The significant correlation between the measure of present bias and actual field conservation decisions in our study provide evidence for an important, yet not well-studied, internal psychological trait for contributing to public goods. This result is in line with Fehr and Leibbrandt (2011), who find that patience elicited by a simple binary gratification task is correlated with actual conservation behavior measured by mesh sizes of fishing instruments in Brazil. Beyond that, however, our study finds out that this correlation is driven by present-biased preferences, and not just by simple discounting. This is a very useful insight for an alternative intervention to enhance field conservation decisions. Also, our proxies for conservation allow us to include female participants and participants across a wider age range into our study.

A large body of literature suggests, for example, using commitment devices to overcome self-control problems caused by a present bias (e.g., Ashraf et al. 2006). Our findings suggest that the conservation group might work as a commitment device for conservation decisions according to the rules of the group. Members really do contribute more to the mangrove-planting activity, and they expect more from others' contribution than nonmembers do. These findings can reflect their commitment feeling to such conservation activity. Moreover, the extent of contribution might grow over time during the membership of such a conservation group. Our results emphasize the relevance of conservation groups for field conservation behavior. Such groups could be an institutional solution to conservation problems without the need for heavy-handed state intervention.

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APPENDICES B

Appendix B1. Theoretical Framework of the Time Preference Elicitation Method

Present-biased time preference can be modeled with a simple functional form as quasi-hyperbolic discounting (Laibson 1997)

$$D(k) = \begin{cases} 1 & if\ k = 0 \\ \beta\delta^k & if\ k > 0, \end{cases} \qquad \text{Equation (B1)}$$

where:

$D(k)$	=	discount function,
k	=	time period,
δ	=	discount factor, and
β	=	parameter for present-biased preference with $0 \leq \beta < 1$.

$\beta = 1$ corresponds to the case of standard exponential discounting. The one-period discount factor between the present and a future period is $\beta\delta$, while the one period discount factor between two future periods is δ. By including present-biased preferences into a standard intertemporal utility function, we get the following total utility function:

$$U_t = u(c_t) + \beta \sum_{k=1}^{T} \delta^k u(c_{t+k}). \qquad \text{Equation (B2)}$$

Assume a time-separable CRRA utility function,[19] in which the utility depends on the monetary payoff. In addition, there are only two time periods or dates that an agent has to allocate a given budget to (Andreoni and Sprenger 2012; Andreoni, Kuhn, and Sprenger 2015; Lührmann, Serra-Garcia, and Winter 2014). The utility function has the following form:

$$U(x_t,\ x_{t+k}) = \begin{cases} x_t^a + \beta\,\delta^k x_{t+k}^a & if\ t=0 \\ x_t^a + \delta^k x_{t+k}^a & if\ t>0, \end{cases} \qquad \text{Equation (B3)}$$

where:

x_t	=	amount allocated to the sooner date,
x_{t+k}	=	amount allocated to the later date, and
α	=	parameter that captures the curvature of the utility function.

Agents are assumed to maximize their total utility over time subject to the budget constraint,

$$P\,x_t + x_{t+k} = Y, \qquad \text{Equation (B4)}$$

where:

P	=	gross interest rate and
Y	=	budget.

Maximizing Equation (B3), subject to Equation (B4), gives the following conditions:

$$\frac{x_t}{x_{t+k}} = \left(P\,\beta^{t_0}\,\delta^k\right)^{\frac{1}{\alpha-1}}, \qquad \text{Equation (B5)}$$

where t_0 is an indicator for whether $t = 0$.

[19] The CRRA (constant relative risk aversion) utility function: $U(x) = x^{\alpha}$.

Rewriting the equation by substituting $x_{t+k} = Y - Px_t$ [from Equation (B4)] gives:

$$x_t = \frac{Y\left(P\beta^{t_0}\delta^k\right)^{\frac{1}{\alpha-1}}}{1+P\left(P\beta^{t_0}\delta^k\right)^{\frac{1}{\alpha-1}}}. \qquad \text{Equation (B6)}$$

Equation (B6) tells us that the higher present bias parameter β and/or the higher discount factor δ leads to the higher fraction of the budget which is allocated to the sooner date x_t.

For parameter estimation, take log to Equation (B5):

$$ln\left(\frac{x_t}{x_{t+k}}\right) = \frac{ln(\beta)}{\alpha-1}\,t_0 + \frac{ln(\delta)}{\alpha-1}\,k + \frac{1}{\alpha-1}\,ln(P). \qquad \text{Equation (B7)}$$

Appendix B2. Design for Time Preference Elicitation

Table B1. Design for time preference elicitation

t (Sooner Date)	*k* (Delay) Days	*P* Gross Interest Rate	Standardized Daily Rate (%)	Annual Rate (%)
0	14	1.05	0.37	217.57
0	14	1.11	0.76	714.41
0	14	1.25	2.58	3,598.47
0	14	1.43	3.71	12,564.12
0	14	2.00	5.08	100,479.55
0	28	1.05	0.18	85.67
0	28	1.11	0.38	226.29
0	28	1.25	0.80	795.98
0	28	1.43	1.28	2,116.61
0	28	2.00	2.51	11,574.99
14	14	1.05	0.37	217.57
14	14	1.11	0.76	714.41
14	14	1.25	2.58	3,598.47
14	14	1.43	3.71	12,564.12
14	14	2.00	5.08	100,479.55

Note: The effective annual interest rate is quarterly compounded.

Table B2. Complete decisions

No.	Payment dates	Option 1 (THB)	Option 2 (THB)	Option 3 (THB)	Option 4 (THB)	*t* (Sooner Date)	*k* (Delay) Days	*P* (Gross Interest Rate)
1	TODAY	285	190	95	0	0		
	AND in 2 WEEKS	0	100	200	300		14	1.05
2	TODAY	270	180	90	0	0		
	AND in 2 WEEKS	0	100	200	300		14	1.11
3	TODAY	240	160	80	0	0		
	AND in 2 WEEKS	0	100	200	300		14	1.25
4	TODAY	210	140	70	0	0		
	AND in 2 WEEKS	0	100	200	300		14	1.43
5	TODAY	150	100	50	0	0		
	AND in 2 WEEKS	0	100	200	300		14	2.00
6	TODAY	285	190	95	0	0		
	AND in 4 WEEKS	0	100	200	300		28	1.05
7	TODAY	270	180	90	0	0		
	AND in 4 WEEKS	0	100	200	300		28	1.11
8	TODAY	240	160	80	0	0		
	AND in 4 WEEKS	0	100	200	300		28	1.25
9	TODAY	210	140	70	0	0		
	AND in 4 WEEKS	0	100	200	300		28	1.43
10	TODAY	150	100	50	0	0		
	AND in 4 WEEKS	0	100	200	300		28	2.00
11	in 2 WEEKS	285	190	95	0	14		
	AND in 4 WEEKS	0	100	200	300		14	1.05
12	in 2 WEEKS	270	180	90	0	14		
	AND in 4 WEEKS	0	100	200	300		14	1.11
13	in 2 WEEKS	240	160	80	0	14		
	AND in 4 WEEKS	0	100	200	300		14	1.25
14	in 2 WEEKS	210	140	70	0	14		
	AND in 4 WEEKS	0	100	200	300		14	1.43
15	in 2 WEEKS	150	100	50	0	14		
	AND in 4 WEEKS	0	100	200	300		14	2.00

Appendix B3. Parameter Estimates of the Utility Functions

The decisions made in the experiment are used to estimate the utility parameters, namely the utility function curvature (α), discounting (δ), and present bias (β). First, we use the ordinary least squares regression based on Equation (B7) as a linear model. However, there is a problem at the corner solutions that the allocation ratio ln $(^{x_t}/_{x_{t+k}})$ is not well defined. To address this issue, the nonlinear least squares (NLS) regression, based on Equation (B6) as a demand function, is used to estimate the utility parameters. Nevertheless, for the estimation, subjects who did not alter the choice at all (i.e., those who always chose the same options across 15 decisions) are dropped out, since no variation in choices make it insufficient for the estimation. So, 55 subjects showed no variation in their choices.

Estimates of parameters

Aggregate estimates. The aggregate estimates of the parameters from decisions by the NLS regression are more evidence of present bias on the aggregate level. The aggregate estimate of β is 0.86, which is smaller than 1, and the difference is statistically significant (Wald test, $p < 0.001$). On the other hand, the aggregate estimate of δ is 1.00 and is not significantly different from 1 (Wald test, $p = 0.11$). This suggests again that the longer time span in this experiment does not have an effect on decisions for oneself.

The aggregate estimate of α, which captures the curvature of the utility function, is 0.66 and statistically significantly differs from 1 (Wald test, $p < 0.001$). This indicates that the utility function is not linear, but concave.

Individual estimates. Figure B1 shows the distribution of estimates for β from choices by the NLS regression. While the peak is at 1, we can see that substantial numbers of participants have β estimates smaller than 1, which indicates present-biased preferences. Also, there are smaller numbers of participants whose β estimates are bigger than 1, indicating future-biased preferences. The individual estimates for β differ significantly from 1 (Wilcoxon signed-rank test, $p = 0.072$).

Figure B2 shows the distribution of estimates for individual δ. The values concentrate well on 1 and they are not significantly different from 1 (Wilcoxon signed-rank test, $p = 0.801$). This suggests that on average the estimate for individual δ is 1, which means that if earlier payment is not immediate, subjects value the later payment the same as the earlier payment. The time span has no effect on decisions.

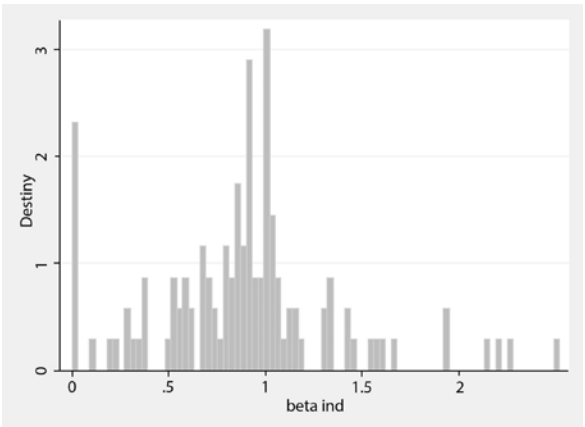

Figure B1. Estimates for *β* from choices

Note: Nine subjects are dropped out in this figure, since they have very high β.

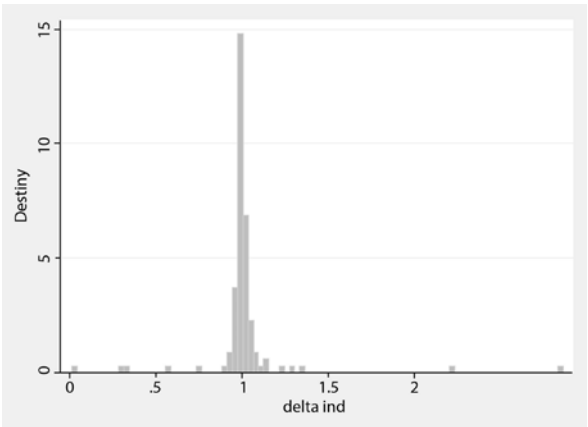

Figure B2. Estimates for *δ* from choices

Note: Seven subjects are dropped out in this figure. Six subjects have very high δ and a subject has a highly negative δ.

Appendix B4. Reasons to Participate and Reasons Not to Participate in Mangrove Planting

Table B3. Reasons to participate in the mangrove-planting activity (n = 147)

Reasons to Participate	No. of Participants	%
Conservation	108	90.76
Protect from waves and make soil solid	108	90.76
Contribution to the community	108	90.76
Conditional cooperation	15	12.61

Table B4. Reasons not to participate in the mangrove-planting activity (n = 147)

Reasons to Not Participate	No. of Participants	%
No time	11	39.29
Mangrove is not effective	0	0.00
Mangrove will not survive	1	3.57
Do not dock at pier 4	1	3.57
Health problem	12	42.86
Special events	0	0.00

Appendix B5. Pictures of the Mangrove-Planting Activity

Figure B3. Mangrove-planting activity

Appendix B6. Regression of Choices Controlled for Sociodemographic Characteristics

We run regressions of choices on the immediacy of sooner payment (Today), the longer time span (time span = 4 weeks), interest rates, and interaction effects. The OLS regression results in model (1) show that, controlling for interest rates and interaction effects, participants allocate an average of 17.04% more share to the sooner date when it is immediate. Time span does not have any significant effect on choices.
The ordered logit regression also gives qualitatively the same results. Results for both models are robust also when we control for sociodemographic characteristics.

Table B5. Regressions of share of budget allocated to sooner dates of choices for oneself controlled for sociodemographic characteristics (standard errors in parentheses)

Dependent Variable / Model	OLS (1)		Ordered logit (2)		OLS Sociodemographic (3)		Ordered logit Sociodemographic (4)	
	Estimate	Std Err	Estimate	Std Err	Estimate	Standard Error	Estimate	Std Err
Today	17.04***	(4.544)	0.85***	(0.216)	17.0400***	(4.55000)	0.880000***	(0.22000)
Time span = 4 weeks	−6.90	(4.981)	−0.38	(0.235)	−6.9000	(4.99000)	−0.39000	(0.24000)
Interest rate	−12.88***	(2.024)	−0.59***	(0.102)	−12.8800***		−0.61000***	(0.10000)
Interest rate * Today	−7.85***	(2.672)	−0.41***	(0.132)	−7.8500***	(2.68000)	−0.43000***	(0.13000)
Interest rate * Delay = 4 weeks	4.15	(3.273)	0.24	(0.156)	4.1500	(3.28000)	0.26000	(0.16000)
Household Income	–	–	–	–	−0.0002**	(0.00009)	−0.00001*	(0.00000)
Household Expenditure	–	–	–	–	0.0005**	(0.00020)	0.00002**	(0.00001)
Age	–	–	–	–	0.3000	(0.27000)	0.01000	(0.01000)
Gender (Male = 1)	–	–	–	–	−0.5300	(6.32000)	−0.01000	(0.33000)
Education level	–	–	–	–	2.5900	(4.58000)	0.14000	(0.23000)
No. of children	–	–	–	–	0.7300	(1.33000)	0.04000	(0.07000)
Fisherman	–	–	–	–	2.5500	(6.01000)	0.10000	(0.30000)
Member of NTR saving group	–	–	–	–	−6.2800	(5.10000)	−0.37000	(0.27000)
Constant	50.66***	(4.007)	–	–	25.6700	(17.0800)	–	–
No. of subjects	180		180		180		180	
R^2/Pseudo R^2	0.0284		180		0.0645		0.0248	

Notes: (1) * p < 0.1, ** p < 0.05, *** p < 0.01 (2) Robust standard errors clustered at the individual level are in parentheses.

Appendix B7. Linear Regression of Absence from Picking Up the Future Payoff on the Planting Day

Model (1) is a linear regression with standard error clustered by experimental session. Model (2) is a logit regression with standard error clustered by participant. Both regressions suggest that none of the independent variables are significantly different between participants who come and do not come to pick up their payoff.

Table B6. Linear regression of absence from picking up the future payoff on the planting day

Dependent Variable / Model	Absence (Binary)		
	(1)	(2)	
	Estimate	Estimate	Std. Err.
Measure of present bias	0.0300	0.180	(0.310)
Measure of discounting	0.0500	0.360	(0.220)
Payoff on the planting day	–0.0002	–0.002	(0.002)
Planting day	0.0400	0.260	(0.180)
Constant	0.0100	–2.890	(0.750)
No. of participants	180	180	
No. of clusters	12	180	
Adjusted R2	0.0415	0.0398	

Notes: (1) * p < 0.1, ** p < 0.05, *** p < 0.01 (2) Robust standard errors clustered by participant are in parentheses.

Appendix B8. Logit Regression of Membership Status of the Conservation Group

Table B7. Logit regression of membership status of the conservation group

Dependent Variable / Model	Membership of the Conservation Group			
	(1)		(2)	
	Estimate	Standard Error	Estimate	Standard Error
Measure of present bias	–0.35	(0.26)	–0.47*	(0.28)
Measure of discounting	0.13	(0.17)	0.24	(0.19)
Female			0.08	(0.36)
Age			0.05**	(0.02)
Education level			–0.13	(0.32)
No. of children			0.03	(0.10)
Household income			<–0.01	(<0.01)
Constant	–0.82	(0.53)	–3.33**	(1.43)
No. of participants	180		180	
Pseudo R^2	0.0079		0.083	

Notes: (1) * p < 0.1, ** p < 0.05, *** p < 0.01 (2) Robust standard errors clustered by participant are in parentheses.

Appendix B9. Questionnaire about Participation in the Mangrove-Planting Activity

Notes:

1. *Research assistants interviewed the interviewees using this short questionnaire and filled it out.*
2. *The number of mangrove seeds indicated in the questionnaire was actually planted.*

The Amount of Mangrove Seeds

Date …… March 2015
Name ……

1. Would you like to plant some mangrove seeds?

☐ 1. Yes, …….. seeds. Because ……. (Select all that apply)

☐ 1. Would like the mangrove forest to be conservation plot and be the kindergarten for aquatic animals

☐ 2. Mangroves prevent waves and reduce mud erosion, so that the boat can be easily docked

☐ 3. Would like to contribute to the community

☐ 4. I do as other people do (If they do not plant any mangrove, I won't either)

☐ 5. Others, specify ……

☐ 2. No, because …… (Select all that apply)

☐ 1. No time

☐ 2. Do not think the mangrove forest is effective

☐ 3. Do not think the mangrove will survive

☐ 4. I do not dock my boat in harbor 4

☐ 5. Others, specify ……..

2. As you heard about this mangrove-planting activity, do you think that other Naithung villagers will join the activity?

1. No one	2. Few people	3. Some people	4. Most people	5. All people
☐	☐	☐	☐	☐

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