Time Preferences, Conservation and the Role of Groups: Experiments in Thailand

Inauguraldissertation
zur Erlangung des Doktorgrades
der Wirtschafts- und Sozialwissenschaftlichen Fakultät
der Universität zu Köln

2017

vorgelegt von
Dipl.-Volksw. Suparee Boonmanunt
aus Ubon Ratchathani (Thailand)

Referent: Professor Dr. Bettina Rockenbach

Korreferent: Professor Dr. Matthias Sutter

Tag der Promotion: 13.07.2017

Acknowledgements

The time that I spent writing this thesis has been a valuable experience and a great pleasure. Along the journey, I have benefitted from guidance and support from many people who deserve my sincere gratitude.

I am deeply grateful to Bettina Rockenbach, my supervisor and co-author, for her devoted supervision and kindness throughout these years. She has taught me not only through her lectures, writings, and valuable comments, but also through being an excellent example of an exceptional researcher and a caring supervisor.

I am also indebted to other members of the thesis committee: Oliver Gürtler and Matthias Sutter.

Many thanks to my co-authors, Thomas Lauer and Arne Weiss. Together, we have learned a lot about patience from our experiments. Working together on these projects teaches us to be patient too. Thank you so much for your patience, invaluable contribution, and a wonderful time working together.

I feel very fortunate to have a group of highly supportive friends at the office. Lea Casser, Agne Kajackaite, Uta Schier and Marcin Waligora, thank you so much for a wonderful time both inside and outside the office. I also thank my colleagues at the department of Economics, Stefania Bortolotti, Mark Pigos, Matthias Praxmarer, Anne Schielke, Sebastian Schneiders, Sebastian Tonke, Anna Untertrifaller, Christopher Zeppenfeld, Jarid Zimmerman, Nina Zimmerman and Claudia Zoller for interesting discussions and a friendly working atmosphere.

Many people have made great contribution toward my field work. My gratutide goes to Kaewsan Atibodhi, Kwansuang Atibodhi and Banjong Nasae for introducing me to people of Natithung village. I want to thank Jinda Jittanang, Charoen To-e-tae and committee members of Naithung's Rizq Savings Group, and Sunisa Pimsen for their generous support. I thank Jintanee Jintranun for the recruitment of research and student assistants. Thank you to the students from the Department of Economics, Walailak University who provided excellent assistance in conducting the lab-in-the-field experiment. I am grateful to the villagers of Naithung for warm welcome and friendship.

For the lab experiments at Kasetsart University, Bangkok, I thank Sombat Ketrat, Suriya Na Nongkai, Isriya Nitithanprapas, Sucheela Polruang and Decharut Sukkumnoed for their vital support. Thank you to Thanakit Porwongsawang, Porawee Chairit, Parinyarat Liangcharoen, Suttinee Ngankan, Arisa Srichom, Poonyawee Srisuntea, Jutimaporn Suwannapoom and Teerawat Thammanut for the assistance in conducting the lab experiment.

My gratitude also goes to Burin Chotechaicharin, Roypimjai Jaimun, Rawadee Jarungrattanapong and Somboon Samakphan for their great assistance in both lab-in-the-field and lab experiments.

Financial support from the Economy and Environment Program for Southeast Asia (EEPSEA) for all experiments is gratefully acknowledged. I am indebted to the German Academic Exchange Service (DAAD) for granting me the full PhD scholarship.

Several friends outside academia have always supported me with their warmth and love. Chanuttha Chitpatanapaibul, Suvaporn Photjananuwat, Prae Pupityastaporn, Atit Sornsongkram, Mary Sysavanh, Patwut Tosen, Kokaew Wongpichet as well as teachers and yogi friends at Ashtanga Yoga Mitte Köln. Thank you so much.

Last but not least, I wholeheartedly thank my mother and father who care more about my happiness than about my career. Love you.

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Chapter 1: Introduction

Intertemporal decisions, which ask us, including people in rural areas in developing countrie, to trade off costs and benefits that incur at different points in time, are omnipresent. Most of our decisions today have consequences in the future, for example, the decisions to save money, to exercise or to study, etc. We often give in the temptation to choose the option that offers the smaller but sooner benefit rather than choosing the option that offers the larger but later benefit. For instance, we end up spending all salary without saving any cents although we planned to save as we got paid. This phenomenon can be theoretically described by present-biased preferences in the quasi-hyperbolic discounting model (Laibson, 1997). This model allows individual discount rates to decrease over time, which contradicts the assumption of constant discount rates in the discounted-utility model (e.g. Samuelson, 1937). The summary article by Frederik, Loewenstein and O'Donoghue (2002) finds that on average individual discount rates decline over time. Individuals, however, have different discount rates across a wide range suggesting heterogeneity of individual time preferences.

In developing countries people in rural areas mostly live nearby natural resources such as fishing grounds, forest, etc. Many of them are classified as poor with regard to their financial situations. Their livelihood therefore depends tremendously on the natural resources. These people are not only the main users but can also be effective guardians of the natural resources. It is therefore important for the success of any conservation program that these local people engage in conservation activities.

A decision to conserve natural resources or not is obviously also an intertemporal decision. For example, planting a tree requires trading-off short-run (opportunity) costs of planting and its long-run benefits. Despite the intertemporal nature of conservation the relationship between individual time preferences and conservation has been just recently investigated. Previous studies still provide contradictory results. Fehr and Leibbrandt (2011) report a negative correlation between present-biasedness and conservation among Brazillian male fishermen: the higher the present-biasedness the smaller the mesh or hole size of fishing instruments (which in turn means the less conservation). Torres-Guevara and Schlüter (2016) find – contrary to Fehr and Leibbrandt – that present-biasedness is unrelated to conservation among Colombian male fishermen, but more patient fishermen with lower discount rates conserve less. Their proxy for conservation behavior is a fisherman-specific fishing impact index, which takes into account fishing instruments, methods and spots.

It is therefore still crucial to study this relationship with a more direct measurement of conservation and a more detailed time-preference elicitation method. This will provide a more complete picture of how time preferences are related to conservation, which might help us to design a more effective conservation program in the field.

Furthermore, it is hard for poor households in developing countries to save regularly because both the market and the state often fail to provide access to credit and adequate protection against income or expenditure shocks (Banerjee and Duflo, 2007). It is also common among poor households that a household head is responsible for making financial decisions for the whole household, such as savings, loan taking or investments in new crops. It will be very useful to know whether the responsibility for other people can lead to different intertemporal decisions, in particular whether it can decrease present bias.

Previous literature shows in other contexts that decisions on behalf of a group differ from decisions for oneself. Charness, Rigotti and Rustichini (2007) show in the Prisoner's Dilemma that participants are more aggressive, i.e. strive for the largest payoff when deciding on behalf of a group than when deciding just for themselves. In addition, Sutter (2009) shows in the investment experiment that participants invest more in a lottery to have a higher probability of winning the lottery when deciding on behalf of a group than when deciding just for themselves. In other words, people try to get a higher payoff when they decide on behalf of a group than for themselves. This difference might also happen in an intertemporal context. Studying this phenomenon can give us another tool that can promote patient decisions when they are desirable.

1.1 The scope of the thesis and its findings

The thesis consists of three studies on intertemporal decisions of Thai coastal villagers and Thai university students. The research methods are lab-in-the-field experiment, field experiment as well as lab experiment.

Chapter 2 (Time preferences and field conservation decisions: Experiment in a Thai coastal village), joint work with Thomas Lauer, Bettina Rockenbach and Arne Weiss,[1] investigates the relationship between time preferences and actual conservation decisions in the field. Planting mangroves is a conservation activity pursuing the long-term goal of sustaining the basis for fishing activities. The decision to engage in mangrove planting requires trading-off the short-run costs of planting with its long-run benefits. We report a lab-in-the-field experiment with Thai coastal villagers in which we elicited short- and long-run time preferences prior to a mangrove-planting activity. We show that less present-biased participants plant more mangroves, but conservation is unrelated to villagers' long-run discounting behavior. Members of savings groups tend to plant more than non-members, suggesting a positive spill-over effect from saving decisions to other intertemporal tasks, like our conservation task.

Chapter 3 (The persuasive power of patience in groups: A lab-in-the-field experiment in rural Thailand), joint work with Thomas Lauer, Bettina Rockenbach and Arne Weiss, compares intertemporal decisions made for oneself and those made on behalf of a group. We conduct a lab-in-the-field experiment with Thai coastal villagers. First, when participants decide for themselves, their choices are on average present-biased. Then participants decide on behalf of a group of three members and prior to this decision they are informed about the choices of their group members in the individual choices. Choices for the group are significantly less present-biased than the individual choices. We show that this result is driven by an asymmetric conformity bias: learning about more patient others has a stronger influence on choices for a group than learning about less patient others.

Chapter 4 (Speaking of patience: The role of others' preferences and communication in groups) examines whether decisions for oneself and decisions on behalf of a group in an intertemporal context are different among Thai university students. Participants decide first for oneself and then decide on behalf of a group of three members. I find that choices made for a group are significantly more patient than those made for oneself. This can be explained by the asymmetric conformity bias toward patience through two mechanisms: other members' time preferences and communication between members. First, only more patient group members are influential for decisions for a group. Second, patient messages are most persuasive among all types of messages.

[1] **Thomas Lauer and Bettina Rockenbach**: University of Cologne, Department of Economics. **Arne Weiss**: University of Oldenburg, Institute of Philosophy.

1.2 Contribution of the thesis

This thesis provides results and new insights that not only contribute to related existing literature but also offer possible policy implications.

Chapter 2 contributes to the recent literature by using a proxy for conservation, number of mangrove seeds planted by each participant, that can measure the concern for conservation by both female and male participants more directly than previous studies. Time preferences are also measured in a more detailed way. The negative relationship between time preferences and conservation that we find suggests that short-term (opportunity) cost can hinder local people's conservation. A conservation program that can help people to overcome present bias might be able to enhance conservation in the field.

Chapter 3 and chapter 4 add to the literature by not just comparing intertemporal decisions made for oneself and those made on behalf of a group. But they also explain less present bias in decisions made on behalf of a group by the asymmetric conformity bias toward patience. Combining all new insights of this thesis, in order to enhance field conservation, one might consider letting representatives make conservation decisions on behalf of a group, e.g. each household head makes decisions for her household or a head of a savings group or a conservation group decides on conservation activities of the whole group.

Chapter 2: Time preferences and field conservation decisions: Experiment in a Thai coastal village

Joint work with Thomas Lauer, Bettina Rockenbach and Arne Weiss

2.1 Introduction

Planting mangroves in tropical and subtropical tidal areas is a conservation activity that benefits the future environment (e.g., by providing nursery for aquatic animals, helping to prevent soil erosion and reducing carbon dioxide) and sustains the basis for fishing activities.[2] The individual decision of the extent of engagement in mangrove planting requires trading-off short-run (opportunity) costs of planting and its long-run benefits. This intertemporal nature of conservation has stimulated research on the role of individual time preferences for conservation decisions.[3] Fehr and Leibbrandt (2011) study the relationship between present-biasedness and conservation behavior of Brazilian male fishermen. Their proxy for present-biasedness is the fishermen's decision 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).[4] The proxy for conservation is the mesh

[2] For the benefits of mangroves, see Kathiresan and Bingham, 2001.

[3] Conservation decisions also share a public goods character, which has been studied by e.g., Ostrom (1990), Curry, Price and Price (2008), Burks, Carpenter, Goette and Rustichini (2009) and Poteete, Janssen and Ostrom (2010).

[4] Fehr and Leibbrandt (2011) speak of patience, as a more general description of time preferences. Because of the short duration between both points in time, long-run discount rates cannot plausibly explain why Fishermen might prefer a smaller amount now to a considerably larger two hours later. Therefore, the consumption decision ultimately measures present-biasedness.

size of the fishing net or the hole size of the bottle that is used to catch shrimp.[5] Fehr and Leibbrandt (2011) report a negative correlation between present-biasedness and conservation: the higher the present-biasedness the smaller the mesh or hole size. Torres-Guevara and Schlüter (2016) investigate conservation decisions of Colombian male fishermen. They measure present-biasedness similar to Fehr and Leibbrandt (2011) and additionally measure discount rates by asking fishermen to choose between a smaller amount in one week and a larger amount in two weeks. Their proxy for conservation behavior is a fisherman-specific fishing impact index, which takes into account fishing instruments, methods and spots. Torres-Guevara and Schlüter find – contrary to Fehr and Leibbrandt – that present-biasedness is unrelated to conservation, but more patient fishermen with lower discount rates conserve less. Torres-Guevara and Schlüter explain the negative influence of patience on conservation with an indirect wealth effect: more patient fishermen have higher savings and therefore more likely invest in more efficient fishing instruments that catch more fish and thus conserve less.

We conduct a lab-in-the-field experiment with Thai fishermen which extends this research in important ways. Firstly, we extend the measurement of time-preferences. While Fehr and Leibbrandt (2011) and Torres-Guevara and Schlüter (2016) measure present-biasedness with one binary decision, we study time preferences in a more continuous way. Like Torres-Guevara and Schlüter (2016) we also measure both present-biasedness and long-run discounting. Secondly, our experimental setup includes an independent conservation task, mangrove planting, that allows us to *directly* study participants' conservation decisions. By counting the number of mangroves planted by each participant we obtain a direct measure of conservation activity, in contrast to e.g. Torres-Guevara and Schlüter's (2016), who indirectly deduced conservation from a constructed fishing impact index. These novel aspects allow investigating how different degrees of time preferences correlate with actual conservation decisions. Moreover, we can address the inconclusive findings on the role of present-biasedness on conservation. Thirdly, in contrast to the previous studies, our subject pool includes both male and female participants.

Our lab-in-the-field experiment took place in the coastal village of Naithung, Nakhon Si Thammarat Province, Thailand. The village is located on the coastline of the Gulf of Thailand. The major economic activities are related to fisheries. We estimate the time preferences of coastal villagers based on the quasi-hyperbolic discounting model (Laibson,

[5] The larger the mesh (hole) size, the easier it is for small fish (shrimp) to escape. Thus, the larger the mesh or hole size, the higher the concern for conservation.

1997) by using the elicitation method by Andreoni and Sprenger (2012). This allows us to elicit both the long-run discounting of an individual, i.e., how an individual discounts income between two future periods, and the present-biasedness (O'Donoghue and Rabin, 1999), i.e., how an individual weights immediate income relative to income in future periods. In order to examine how elicited individual time preferences relate to conservation decisions, we organize a mangrove-planting activity on the dates participants pick up their experimental earnings. The amount of mangrove seeds a participant voluntarily plants is our proxy for her conservation decision. As this task is simple and not physically demanding, it allows us to observe the decisions of both female and male villagers of a wide range of ages.

The village hosts several savings groups that manage savings funds to help its members financially. In general, members are required to save a constant small amount of money (e.g., around USD 1.5) every month into the fund. After having been a member for some time (e.g., a year), members are eligible for micro loans as well as micro health and life insurance.

We find that less present-biased participants contribute more to the mangrove-planting activity and that planting decisions are unrelated to long-run discounting behavior. This result is robust to adding a control variable that captures membership in savings groups. Thus, our results support the findings of Fehr and Leibbrandt (2011), who also use a rather direct measurement of conservation, and stand in contrast to Torres-Guevara and Schlüter (2016), who used the indirect way of the fisherman-specific index to measure conservation.

Interestingly, members of savings groups plant weakly significantly more seeds than non-members, although membership in savings groups has no significant influence on the elicited present-biasedness and long-run discounting behavior. This suggests that membership in savings groups provides an educational effect that also spills over to our experimental conservation task. This spill-over effect underlines the importance of savings groups for sustainable development.

2.2 The experiments

2.2.1. Elicitation method of time preferences

We elicit time preferences through the convex time budget method (as used by Andreoni and Sprenger, 2012; Andreoni, Kuhn and Sprenger, 2015; Lührmann, Serra-Garcia and Winter, 2014). In this method, participants have to allocate a given budget to a sooner and a later date at different interest rates. There are three time frames: (I) today and two weeks later, (II) today and four weeks later, and (III) two weeks and four weeks in the future. The degree of present-biasedness parameter (β) can be identified by comparing (I) and (III), as time frame I and time frame III have the same time span of two weeks, but the sooner payment in time frame I is immediate. The long-run discounting parameter (δ) can be identified by decisions in time frame III since both payments are in the future. The experimental budget is always THB 300 (around USD 9),[6] which is the minimum daily wage in Thailand. The intertemporal budget constraint in each decision is therefore $Px_t + x_{t+k} = 300$, 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.[7] 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.[8] These are much larger than the market interest rate at commercial banks.[9]

Table 2-1 summarizes all five decisions (rows in the table) for time frame I. The corresponding parameters are shown in the last three columns. The options stay the same in time frame II and time frame III, with only the timing of payments changing. For each decision, participants have to choose one favorite budget allocation out of four options. Option 4 gives participants the highest total payoff of THB 300, but participants have to wait to get the entire amount at the later date. Option 1 gives participants the whole budget at the sooner date but discounted by the corresponding interest rate. Option 4 is therefore the most patient option, while option 1 is the least patient option. All participants have to go through all 15 decisions, which are presented one at a time.

Table 2-1: Decisions in time frame I (today,+2weeks)[10]

No.	Payment dates	Option 1	Option 2	Option 3	Option 4	t (sooner date)	k (delay days)	P (gross interest rate)
1	TODAY AND in 2 WEEKS	285 0 Baht	190 Baht 100 Baht	95 Baht 200 Baht	0 Baht 300 Baht	0	14	1.05
2	TODAY AND in 2 WEEKS	270 Baht 0 Baht	180 Baht 100 Baht	90 Baht 200 Baht	0 Baht 300 Baht	0	14	1.11
3	TODAY AND in 2 WEEKS	240 Baht 0 Baht	160 Baht 100 Baht	80 Baht 200 Baht	0 Baht 300 Baht	0	14	1.25
4	TODAY AND in 2 WEEKS	210 Baht 0 Baht	140 Baht 100 Baht	70 Baht 200 Baht	0 Baht 300 Baht	0	14	1.43
5	TODAY AND in 2 WEEKS	150 Baht 0 Baht	100 Baht 100 Baht	50 Baht 200 Baht	0 Baht 300 Baht	0	14	2

Note: The last three columns are not shown to the participants.

We implement a pen and paper experiment in the field. Each answer sheet is for one decision (a row in Table 2-1). Subjects see four calendars. Each calendar represents each of

[6] USD 1 was equal to THB 32.62 when the experiment was conducted. THB stands for Thai Baht.

[7] See the full theoretical framework in Appendix A.

[8] For more details about standardized daily rate and annual rate of decisions in our experiment see Appendix B.

[9] The average deposit interest rate in Thailand in 2014 is around 2.00% (The World Bank, 2016).

[10] See complete decisions for all three time frames in Appendix B.

the four options. The calendars show clearly on what dates and how much money subjects will get. Subjects choose one favorite option by circling the number of their favorite calendar. Figure 2-1 shows an example of an answer sheet for the first decision.

Figure 2-1: Example of an answer sheet

After all decisions are made, one decision is randomly drawn to determine the experimental earnings. With this mechanism, all decisions are relevant for the payoff and income effects can be avoided. The show-up fee is THB 100 (around USD 3). Participants receive an additional THB 100 for answering the post-experimental questionnaire, which is announced after the experiment. It does therefore not influence choices made in the experiment.

The issues that may turn participants reluctant to choose payoffs in the future are (1) a lack of trust that payments will be made in the future and (2) unequal transaction costs across payment dates. We address these concerns, for example, as follows: The researcher who conducted the experiment stayed in the village for two months before the experimental period. We asked the community leaders, who are trustworthy with regard to money issues, to announce the experiments for us. Furthermore, participants received a contract signed by us to guarantee their future payoffs. See Appendix C for more details about the procedure.

2.2.2. Mangrove planting as a conservation decision

The main objective of this study is to examine the correlation between individual time preferences and conservation decisions. In order to observe actual conservation decisions, we organize a mangrove-planting activity.[11] We select this activity for the following reasons: (1) mangrove planting is a simple task that everyone across genders and ages can do; (2) it takes

[11] See Appendix D for pictures of the mangrove-planting activity.

a relatively short amount of time to plant a mangrove seed; (3) another cost of planting is, however, that it is hot and dirty; (4) the villagers know about the benefits of mangroves and how to plant mangrove seeds.

The activity takes place on the days that participants come to pick up their experimental earnings. These dates depend on the random draw in each experimental session, which determines which decision will be paid out. Therefore, there are four planting days. We remind the participants through a phone call one day before their respective payment days to pick up their experimental earnings and inform them about the separate mangrove-planting activity.

After participants pick up the experimental earnings, they are asked to go to the mangrove desk, which is located 15 meters away. Figure 2-2 illustrates the map of mangrove-planting activity. The payments are timed such that only one participant arrives at the mangrove desk at a time. Once there, participants are asked whether they would plant mangrove at all and if so, how many seeds they would like to plant. The participants receive the mangrove seeds free of charge. Willing planters then take the chosen amount of mangrove seeds to the planting area.

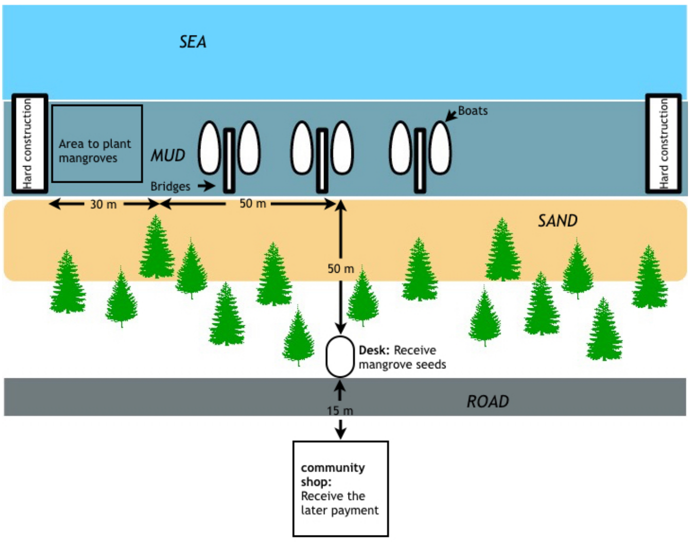


Figure 2-2: Map of mangrove-planting activity

To avoid that participants are influenced by reciprocity toward their experimental earnings, we tell participants during the phone call and again at the payment desk that the mangrove planting is a separate activity and that they should feel free not to participate. Our data soothes any concerns about reciprocity. There is no correlation between planting decisions and the earning from the time-preference experiment (See Table 2-2). We can also rule out spill-overs from participants arriving earlier onto the decisions of subsequent participants. Trees block the line of sight between the mangrove desk, where participants make their planting decisions, and the mangrove-planting area. Participants can therefore not see how many mangroves have already been planted by others while they are making their own decisions.

2.3 Results

The lab-in-the-field experiment was conducted on February 21-23, 2015, in school classrooms in Naithung, Thailand. In total, 180 villagers took part in the experiment. One hundred and five participants (58%) were members of savings groups. Seventy-four participants (41%) were female. Ages ranged from 19 to 80 years old, with an average age of about 44 years. The experiment took around 80 minutes. An interview for the post-experimental questionnaire took around 30 minutes. The total average earning was THB 480.42 (around USD 16), which is about 60% higher than the minimum daily wage in Thailand.

Out of the 180 villagers who participated in the time-preference experiment, 33 (18%) did not pick up their experimental earnings. Those who were absent do not differ from participants who came to pick up their experimental earnings in terms of present-biasedness, long-run discounting and earning on the planting day.[12] To be conservative, we only use the data of the 147 participants who came to pick up their experimental earnings and made a clear choice about their contribution to the planting activity at the site.[13]

2.3.1. Measures of time preferences

We use reduced-form measures of time preferences in order to avoid making assumptions on the utility function, which would be required if we estimated parameters (see Sutter et al., 2013 for an elaboration of this argument).[14] Furthermore, this approach also allows us to have measures for all participants.

The measure of present-biasedness is calculated as the difference between the averages of the five choices made for time frame III (+2weeks,+4weeks) and for time frame I (today,+2weeks). Both time frames have the same time span of two weeks, but the sooner

[12] See the regression results in Appendix E.

[13] The results with all 180 participants are qualitatively similar. See Appendix G for the regression table with all 180 participants.

[14] We also estimate parameters β_i and δ_i of the utility function. However, we cannot estimate individual parameters of 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). We show the parameter estimation in the Appendix F.

payment date is immediate in time frame I. If a participant is non-biased, then she chooses the same option in both time frames and the measure is consequently zero.[15] If a participant is present-biased, she is more patient and chooses a higher option for time frame III than for time frame I and the measure is positive. The opposite holds for a future-biased participant.

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

For the measure of long-run discounting, we use the average of the five choices made in time frame III (scale 1 – 4), in which both payment dates are in the future so that, by definition, present-biasedness does not apply. The interpretation is along the lines of a discount factor, where higher values mean more patience, so 1 represents the least patient and 4 the most patient level.

Measure of long-run discounting = Average choice in time frame III

We observe variation in present-biasedness: 22.77% of participants are future-biased[16], 42.86% are non-biased and 35.37% are present-biased. The participants also differ in their measure of long-run discounting, with the highest fraction (31.97%) at 0, the most patient level.

2.3.2. Time preferences and field conservation decisions

To answer our main research question, we now examine the relationship between experimentally elicited time preferences and our proxy for field conservation decisions, i.e., the number of mangrove seeds planted by each participant. Out of the 147 participants, 28 (19%) do not plant any seeds. The modal choice, taken by 56 participants (38%), is to plant five seeds.

We regress the number of mangrove seeds planted by each participant on the measure of present-biasedness and the measure of long-run discounting. We cluster standard errors on

[15] 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; 9 out of 63 non-biased individuals. Excluding these participants, results remain qualitatively the same. We therefore include them in the analysis.

[16] Future bias is also found in previous studies, e.g. Balakrishnan, Haushofer and Jakiela (2016), Giné, Goldberg, Silverman and Yang (2012), Takeuchi (2011).

the experimental session (see Table 2-2), as proposed by Fréchette (2012).[17] We estimate Tobit models censored at zero, since 19% of participants who appeared at the activity decided not to plant. We find that present-biasedness is significantly negatively correlated with the number of mangrove seeds planted by each participant (p = 0.049 in model I). This means that more present-biased participants plant fewer mangrove seeds, which is in line with Fehr and Leibbrandt (2011). This result is robust to controlling for socio-demographic characteristics, planting day, and earnings from the time-preference experiment,[18] as shown in Table 2-2 model II (p = 0.009).

Table 2-2: Tobit regressions of the number of mangrove seeds planted by each participant

Dependent variable	Number of mangrove seeds planted by each participant		
Model	(I)	(II)	(III)
Measure of present-biasedness	-1.24**	-1.37***	-1.22**
	(0.62)	(0.52)	(0.48)
Measure of long-run discounting	0.72	0.74	0.69
	(0.90)	(1.07)	(1.09)
Membership (dummy)			2.57*
			(1.37)
Female		-4.56***	-4.74***
		(1.23)	(1.25)
Age		0.13	0.11
		(0.10)	(0.10)
Years in school		1.51**	1.45**
		(0.67)	(0.64)
No. of children		-0.40	-0.50
		(0.58)	(0.59)
Second planting day (dummy)		-1.62	-0.87
		(2.70)	(2.67)
Third planting day (dummy)		-0.02	0.94
		(3.30)	(3.17)
Fourth planting day (dummy)		-5.06***	-4.04**
		(1.52)	(1.60)
Earning from the experiment		-0.02	-0.02
		(0.03)	(0.03)
Constant	3.22	0.98	0.52
	(2.49)	(12.19)	(12.12)
/sigma	8.98	7.88	7.80
	(1.62)	(1.20)	(1.20)
Log likelihood	-455.845	-437.889	-436.62
Pseudo R^2	0.0014	0.0407	0.0435
No. of participants	147	147	147
No. of clusters (sessions)	12	12	12

*Notes: * p < 0.1, ** p < 0.05, *** p < 0.01; Robust standard errors clustered on session level in parentheses. There are 28 left-censored observations at 0 and 119 uncensored observations.*

[17] Although we randomly assign participants into each session and try to keep everything constant across sections, but other external factors in the field could influence decisions across sessions differently. As Fréchette (2012) discussed that there might be session-effects, so we run regressions with clustered standard error by experimental session.

[18] In order to control for the concern about reciprocity – that participants plant mangrove seeds to reciprocate the earning from the experiment.

The regression also shows a positive correlation between long-run discounting and the number of planted seeds, which, however, fails to be statistically significant (p = 0.42 in model I and p = 0.49 in model II). The sign of the coefficient suggests that, if there is any relationship at all, the participants who discount the future less (are more patient) tend to plant more seeds (recall that higher values of our measure of long-run discounting mean higher patience). This stands in contrast to Torres-Guevara and Schlüter (2016), who find fishermen with lower discount rates (higher long-run discounting) to harm the environment significantly more.

Result: More present-biased participants plant fewer mangrove seeds. Long-run discounting seems to be unrelated to conservation decisions.

2.3.3. Time preferences, membership status in savings groups and field conservation decisions

The negative correlation between the measure of present-biasedness and conservation decisions are still significant (p = 0.009) when we add membership of local savings groups as a control variable in the Tobit regression censored at zero (members: n = 95; and non-members: n = 52), as shown in Table 2-2 model (III). Controlling for membership is important because members tend to be less present-biased and less future-oriented, though not statistically significantly so (means of measure of present-biasedness is 0.12 for members vs. 0.25 for non-members, Mann-Whitney rank-sum test: p = 0.14; means of measure of long-run discounting is 2.90 for members vs. 3.04 for non-members, Mann-Whitney rank-sum test: p = 0.44). Interestingly, the model also suggests that members of savings groups plant more seeds than non-members, as the coefficient of the membership dummy is positive and weakly significant (p = 0.063).

The regression also exhibits a strong negative gender and a strong positive education effect. The strong and significant negative effect of being female might be due to a cultural effect. Thai women dislike to be exposed to the sun and try to avoid it as much as possible. The strong positive and significant effect of education (years in school) is also remarkable.

2.4 Discussion and conclusion

In order to investigate the relationship between time preferences and field conservation decisions, we elicit the time-preferences of Thai coastal villagers and thereafter observe their conservation decisions in a mangrove-planting activity. Fehr and Leibbrandt (2011) find that a less present-biased fisherman fishes in a more sustainable way, while Torres-Guevara and Schlüter (2016) find no relationship between present-biasedness and conservation, as measured by their fishing impact index, which takes instruments, methods and spots into account. Instead, they find a negative influence of patience on conservation, i.e. the more patient (lower discount rate or higher long-run discounting), the less conservation. To provide further evidence, we measure conservation more directly, i.e., by the number of mangrove seeds planted by each participant. We find a significant negative correlation between present-biasedness and field conservation, which is in line with Fehr and Leibbrandt (2011). By contrast, long-run discounting seems to be unrelated to conservation behavior. Hence, it seems that despite not eliciting long-run discounting behavior, Fehr and Leibbrandt (2011) did not leave out an additional important aspect of time preferences for conservation decisions. The results by Fehr and Leibbrandt (2011) and us suggest that more patient individuals, in terms of their present-biasedness, care more about conserving the environment. However, the results by Torres-Guevara and Schlüter (2016) warn us that this may not necessarily translate into a lower overall environmental impact if being more patient also enables fishermen to be more economically productive.

We also find that members of savings groups conserve weakly significantly more than non-members in our experimental conservation task. This result suggests a spill-over effect of savings groups on a real task that requires trading-off short-run costs and long-run benefits. Our findings suggest that such savings groups could provide double benefits to sustainable development: helping members to save regularly (Rutherford, 2001) and training them to resist smaller short-run benefits in exchange for larger future benefits even in pro-social intertemporal tasks, such as the conservation behavior studied in this chapter.

2.5 Appendix A: 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).

$$D(k) = \begin{cases} 1 & if\ k = 0 \\ \beta\delta^k & if\ k > 0, \end{cases} \quad \text{(A2.1)}$$

where $D(k)$ is the discount function; k is time period; δ is a discount factor; and β is a 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:

$$U_t = u(c_t) + \beta \sum_{k=1}^{T} \delta^k u(c_{t+k}) \quad \text{(A2.2)}$$

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 et al., 2015). The utility function has the following form:

$$U(x_t, x_{t+k}) = \begin{cases} x_t^\alpha + \beta\delta^k x_{t+k}^\alpha & if\ t = 0 \\ x_t^\alpha + \delta^k x_{t+k}^\alpha & if\ t > 0, \end{cases} \quad \text{(A2.3)}$$

where x_t is the amount allocated to the sooner date, while x_{t+k} is the amount allocated to the later date. The parameter α captures the curvature of the utility function.

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

$$Px_t + x_{t+k} = Y, \quad \text{(A2.4)}$$

where P is the gross interest rate, Y is the budget.

Maximizing (3) subject to (4) gives the following conditions:

$$\frac{x_t}{x_{t+k}} = (P\beta^{t_0}\delta^k)^{\frac{1}{\alpha-1}}, \quad \text{(A2.5)}$$

where t_0 is an indicator for whether $t = 0$. Rewriting the equation by substituting $x_{t+k} = Y - Px_t$ (from equation (4)) gives:

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

$$x_t = \frac{Y(P\beta^{t_0}\delta^k)^{\frac{1}{\alpha-1}}}{1 + P(P\beta^{t_0}\delta^k)^{\frac{1}{\alpha-1}}}. \qquad \text{(A2.6)}$$

This Equation (6) 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 (5):

$$\ln\left(\frac{x_t}{x_{t+k}}\right) = \frac{\ln(\beta)}{\alpha-1} t_0 + \frac{\ln(\delta)}{\alpha-1} k + \frac{1}{\alpha-1} \ln(P). \qquad \text{(A2.7)}$$

2.6 Appendix B: Design for time-preference elicitation

Table 2-3: 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	3598.47
0	14	1.43	3.71	12564.12
0	14	2	5.08	100479.55
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	2116.61
0	28	2	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	3598.47
14	14	1.43	3.71	12564.12
14	14	2	5.08	100479.55

Note: The effective annual interest rate is quarterly compounded.

Table 2-4: Complete decisions

No.	Payment dates	Option 1	Option 2	Option 3	Option 4	t (sooner date)	k (delay) days	P (gross interest rate)
1	TODAY	285	190 Baht	95 Baht	0 Baht	0		
	AND in 2 WEEKS	0 Baht	100 Baht	200 Baht	300 Baht		14	1.05
2	TODAY	270 Baht	180 Baht	90 Baht	0 Baht	0		
	AND in 2 WEEKS	0 Baht	100 Baht	200 Baht	300 Baht		14	1.11
3	TODAY	240 Baht	160 Baht	80 Baht	0 Baht	0		
	AND in 2 WEEKS	0 Baht	100 Baht	200 Baht	300 Baht		14	1.25
4	TODAY	210 Baht	140 Baht	70 Baht	0 Baht	0		
	AND in 2 WEEKS	0 Baht	100 Baht	200 Baht	300 Baht		14	1.43
5	TODAY	150 Baht	100 Baht	50 Baht	0 Baht	0		
	AND in 2 WEEKS	0 Baht	100 Baht	200 Baht	300 Baht		14	2
6	TODAY	285 Baht	190 Baht	95 Baht	0 Baht	0		
	AND in 4 WEEKS	0 Baht	100 Baht	200 Baht	300 Baht		28	1.05
7	TODAY	270 Baht	180 Baht	90 Baht	0 Baht	0		
	AND in 4 WEEKS	0 Baht	100 Baht	200 Baht	300 Baht		28	1.11
8	TODAY	240 Baht	160 Baht	80 Baht	0 Baht	0		
	AND in 4 WEEKS	0 Baht	100 Baht	200 Baht	300 Baht		28	1.25
9	TODAY	210 Baht	140 Baht	70 Baht	0 Baht	0		
	AND in 4 WEEKS	0 Baht	100 Baht	200 Baht	300 Baht		28	1.43
10	TODAY	150 Baht	100 Baht	50 Baht	0 Baht	0		
	AND in 4 WEEKS	0 Baht	100 Baht	200 Baht	300 Baht		28	2
11	in 2 WEEKS	285 Baht	190 Baht	95 Baht	0 Baht	14		
	AND in 4 WEEKS	0 Baht	100 Baht	200 Baht	300 Baht		14	1.05
12	in 2 WEEKS	270 Baht	180 Baht	90 Baht	0 Baht	14		
	AND in 4 WEEKS	0 Baht	100 Baht	200 Baht	300 Baht		14	1.11
13	in 2 WEEKS	240 Baht	160 Baht	80 Baht	0 Baht	14		
	AND in 4 WEEKS	0 Baht	100 Baht	200 Baht	300 Baht		14	1.25
14	in 2 WEEKS	210 Baht	140 Baht	70 Baht	0 Baht	14		
	AND in 4 WEEKS	0 Baht	100 Baht	200 Baht	300 Baht		14	1.43
15	in 2 WEEKS	150 Baht	100 Baht	50 Baht	0 Baht	14		
	AND in 4 WEEKS	0 Baht	100 Baht	200 Baht	300 Baht		14	2

2.7 Appendix C: Implementation of payments

Stay in the field: We were introduced to the community leaders by the NGO officers who had been working in the area for over 10 years. Then, the researcher who conducted the experiment stayed in the village for around two months before the experiment period. During this period, the researcher conducted interviews with various villagers, so she was not a stranger to them. To avoid biases regarding that those participants knew the researcher, she told them that the payoff from the experiment came from a foreign granting organization.

Announcement: The community leaders, who are also the committee members of the savings group, announced the experiment. They are trustworthy with regard to money issues, and assured participants that the researcher will pay as promised.

Contract: 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 accordingly to the contract.

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

Delivery of payments: Participants received the “today” payment in cash after the experiment. For the “later” payments, participants were asked to pick up the payoff at the community shop by the pier, a location everyone knows and pass by every day. The travelling expenses and time to the experiment locations and to the community shop should be roughly equal for participants.

2.8 Appendix D: Pictures of the mangrove-planting activity

Figure 2-3: Mangrove-planting activity

2.9 Appendix E: Regressions of absence for picking up the experiment earnings on the planting days

OLS regression with standard error clustered on session level. The "Bootstrapped p-value" column shows the p-values from wild cluster bootstrap resamples. All regressions suggest that time preferences and the amount of payoff on the planting day are not significantly different between participants who come and do not come to pick up their experimental earnings.

Table 2-5: Regressions of absence for the planting activity

Dependent Variable	Absence (binary)	
Model	Coefficient	Bootstrapped p-value
Measure of present bias	0.02 (0.05)	0.62
Measure of long-run discounting	-0.05 (0.03)	0.21
Earning on the planting day	-0.0003 (0.0003)	0.4
Second planting day	0.03 (0.06)	0.67
Third planting day	0.10 (0.07)	0.27
Fourth planting day	0.10 (0.06)	0.18
Constant	0.23* (0.11)	0.05
No. of participants	180	
No. of clusters	12	
R^2	0.0375	

*Notes: * p < 0.1, ** p < 0.05, *** p < 0.01; Robust standard errors clustered at the session level in parentheses. "Bootstrapped p-values" columns report bootstrapped p-values which correct for the small number of clusters following the procedures describe in Cameron, Gelbach, and Miller (2008) and Cameron and Miller (2015)*

2.10 Appendix F: 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 (7) as a linear model. However, there is a problem at the corner solutions that the allocation ratio $\ln\left(\frac{x_t}{x_{t+k}}\right)$ is not well defined. To address this issue, the non-linear least squares regression, based on equation (6) 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. 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 parameters from decisions by the NLS regression are more evidence for 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 statistically 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 2-4 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 2-5 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.

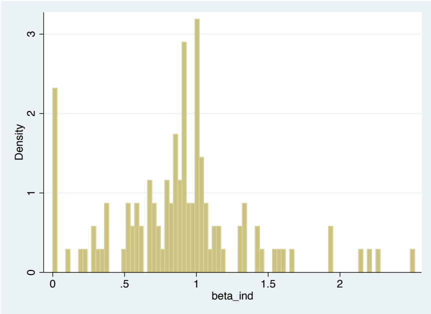


Figure 2-4: Estimates for β from choices

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

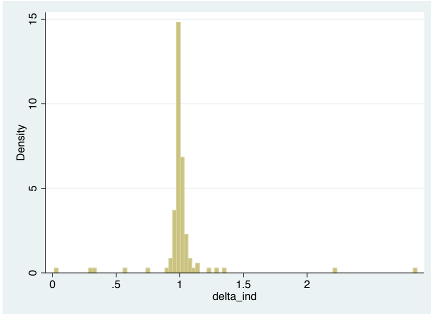


Figure 2-5: Estimates for δ from choices

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

2.11 Appendix G: Tobit regressions for the whole sample of 180 participants

Table 2-6: Tobit regressions of number of mangrove seeds planted by each participant for the whole sample

Dependent variable	Number of mangrove seeds planted by each participant		
Model	(1)	(2)	(3)
Measure of present-biasedness	-1.53**	-1.61**	-1.37**
	(0.77)	(0.69)	(0.60)
Measure of long-run discounting	-0.02	-0.42	-0.41
	(0.85)	(1.10)	(1.11)
Membership of a savings group			5.03***
(dummy)			(1.63)
Female		-4.10***	-4.40***
		(1.37)	(1.49)
Age		0.08	0.04
		(0.11)	(0.10)
Years in school		1.22*	1.09*
		(0.70)	(0.64)
No. of children		-0.51	-0.71
		(0.69)	(0.68)
Second planting day (dummy)		-1.67	-0.04
		(3.14)	(3.04)
Third planting day (dummy)		-1.27	0.87
		(3.31)	(3.17)
Fourth planting day (dummy)		-6.15***	-3.76**
		(1.84)	(1.74)
Earning from the experiment		0.03	0.02
		(0.03)	(0.03)
Constant	3.00**	-15.00	-14.07
	(2.58)	(13.26)	(13.14)
/sigma	10.00	9.08	8.84
	(1.72)	(1.40)	(1.39)
Log likelihood	-491.14	-476.68	-472.38
Pseudo R^2	0.0016	0.0310	0.0397
No. of participants	180	180	180
No. of clusters (sessions)	12	12	12

*Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; Robust standard errors clustered on session level in parentheses*

Obs. summary: 61 left-censored observations at decision<=0
119 uncensored observations
0 right-censored observations

2.12 Appendix H: Time Preferences incorporated in the standard public good model

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 (x_t, x_{t+k}), the total utility function U in period t takes the following form:

$$U_t = u(x_t) + \beta \sum_{k=1}^{T} \delta^k u(x_{t+k}), \tag{A2.8}$$

where $u(\cdot)$ is the utility function from consumption; t is the present period; k is the time span; δ captures long-run discounting (a discount factor); and β is a 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.

We incorporate time dimension and time preference parameters of the $\beta - \delta$ model to the standard social dilemma situation (adapted from the model in Kocher et al., 2016). This is the utility from the contribution decision in the present period t to the public good from which i can benefit in the future periods.

$$u_t(\pi_i) = E - c_i + \beta_i \sum_{k=1}^{T} \delta_i^k G(\cdot). \tag{A2.9}$$

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 $\frac{\partial \pi_i}{\partial c_i} < 0$; 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 the private consumption. Assume that every contribution is individually irrational ($\frac{\partial G(\cdot)}{\partial c_i} < 1$), but collectively rational ($n \cdot \frac{\partial G(\cdot)}{\partial c_i} > 1$).

We investigate the relationship between individual contribution to the public good (c_i) and time preference parameters (β_i, δ_i) by looking at the partial derivative of the individual contribution level in present-biased parameter and in the long-run discounting behavior.

The total utility in period t from the contribution to the public good:

$$u_t(\pi_i) = E - c_i + \beta_i \sum_{k=1}^{T} \delta_i^k G(\cdot).$$

$$\frac{\partial u_t(\pi_i)}{\partial \beta_i} = -\frac{\partial c_i}{\partial \beta_i} + \sum_{k=1}^{T} \delta_i^k G(\cdot) + \beta_i \sum_{k=1}^{T} \delta_i^k \frac{\partial G(\cdot)}{\partial c_i} \times \frac{\partial c_i}{\partial \beta_i} = 0$$

$$\sum_{k=1}^{T} \delta_i^k G(\cdot) + \beta_i \sum_{k=1}^{T} \delta_i^k \frac{\partial G(\cdot)}{\partial c_i} \times \frac{\partial c_i}{\partial \beta_i} = \frac{\partial c_i}{\partial \beta_i}$$

$$\sum_{k=1}^{T} \delta_i^k G(\cdot) = \frac{\partial c_i}{\partial \beta_i}\left(1 - \beta_i \sum_{k=1}^{T} \delta_i^k \frac{\partial G(\cdot)}{\partial c_i}\right)$$

$$\frac{\partial c_i}{\partial \beta_i} = \frac{\sum_{k=1}^{T} \delta_i^k G(\cdot)}{1 - \beta_i \sum_{k=1}^{T} \delta_i^k \frac{\partial G(\cdot)}{\partial c_i}}$$

With sufficient small number of periods (T) and/or sufficient small long-run discounting parameter (δ_i) and/or sufficient small present-biased parameter β_i, $\frac{\partial c_i}{\partial \beta_i}$ is larger than 0, which indicates that higher present bias (smaller β_i) decrease individual contribution to the public good.

$$\frac{\partial u_t(\pi_i)}{\partial \delta_i} = -\frac{\partial c_i}{\partial \delta_i} + \beta_i \sum_{k=1}^{T} \left(k\delta_i^{k-1} G(\cdot) + \delta_i^k \frac{\partial G(\cdot)}{\partial c_i} \times \frac{\partial c_i}{\partial \delta_i}\right) = 0$$

$$\beta_i \sum_{k=1}^{T} k\delta_i^{k-1} G(\cdot) + \beta_i \sum_{k=1}^{T} \delta_i^k \frac{\partial G(\cdot)}{\partial c_i} \times \frac{\partial c_i}{\partial \delta_i} = \frac{\partial c_i}{\partial \delta_i}$$

$$\frac{\partial c_i}{\partial \delta_i}\left(1 - \beta_i \sum_{k=1}^{T} \delta_i^k \frac{\partial G(\cdot)}{\partial c_i}\right) = \beta_i \sum_{k=1}^{T} k\delta_i^{k-1} G(\cdot)$$

$$\frac{\partial c_i}{\partial \delta_i} = \frac{\sum_{k=1}^{T} k\delta_i^{k-1} G(\cdot)}{1 - \beta_i \sum_{k=1}^{T} \delta_i^k \frac{\partial G(\cdot)}{\partial c_i}}$$

With sufficient small number of periods (T) and/or sufficient small long-run discounting parameter (δ_i) and/or sufficient small present-biased parameter β_i, $\frac{\partial c_i}{\partial \delta_i}$ is larger than 0, which indicates that higher long-run discounting (smaller δ_i) decrease individual contribution to the public good.

The model thus suggests that 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_i), higher present bias (smaller β_i) decrease contribution (c_i).

Proposition 2: Given constant present bias (β_i), higher long-run discounting (smaller δ_i) decrease contribution (c_i).

Chapter 3: The persuasive power of patience in groups: A lab-in-the field experiment in rural Thailand

Joint work with Thomas Lauer, Bettina Rockenbach and Arne Weiss

3.1 Introduction

Intertemporal decisions, which ask us to trade off costs and benefits that incur at different points in time, are omnipresent. Often, we give in to a tempting short-term option instead of choosing a long-term option that offers a higher overall utility, evident from the regret we feel afterwards. For example, we plan to save tomorrow, but when tomorrow arrives we go on a shopping spree. 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). Whereas standard economic theory (e.g. Samuelson, 1937) assumes that an individual discounts different time periods at the same rate, the quasi-hyperbolic discounting model allows for discount rates to decline over time. A large body of work indeed finds evidence for declining discount rates (for an overview, see Frederik, Loewenstein and O'Donoghue, 2002).

The failure to save may be particularly detrimental for poor households in developing countries, in which both the market and the state often fail to provide access to credit and adequate protection against income or expenditure shocks (Banerjee and Duflo, 2007). A "natural corrective" to a tempting present-bias may be that individuals in poor households often do not decide just for themselves, but for the entire household on, e.g., savings, loan taking or investments in new crops. There is ample evidence showing that decisions on behalf of a group differ from decisions for oneself. Charness, Rigotti and Rustichini (2007), for example show that in the Prisoner's Dilemma game participants deciding for a group are more aggressive than when deciding just for themselves. Sutter (2009) shows that participants in the investment game invest more in a lottery to have a higher probability of winning the lottery when deciding for a group than deciding for themselves.

In this paper, we ask whether there is also a difference between decisions for oneself and for a group in intertemporal contexts. We study individuals who first take an intertemporal decision for themselves and afterwards for a group of three people. Prior to taking the decision on behalf of the group, participants are informed about the choices that the two other group members made in the individual setting. This setting allows us to investigate whether the information about other members' time preferences is already enough to create choice shifts. Since Sutter (2009) finds that the difference between decisions for oneself and decisions for the group is amplified when group members are given the opportunity to communicate with each other via non-binding messages, we also study the effect of exchanging messages before the group setting starts. We conduct the lab-in-the-field-experiment in the coastal village Naithung in Thailand with 90% of participants living in fishing households. The field setting has the advantage of providing a natural heterogeneity in age, income and time preferences among participants.

We show that the participants deciding for themselves are on average present-biased, yet we also find choices to be significantly more patient and less present-biased when individuals decide on behalf of the group. We explain the choice shifts by an asymmetric conformity bias: more patient others have a stronger influence than less patient others. Yet, we find no additional effect of communication on intertemporal decisions for a group in our experiment.

3.2 Related literature

The literature so far offers little insights into factors that might create the difference between decisions for oneself and for a group in intertemporal contexts. The following models show that the intertemporal decisions of a delegate, who decides on behalf of the group, depend crucially on how other group members enter the delegate's utility function. Jackson and Yariv (2014) model a delegate who fully takes the time preferences of group members into account. Therefore, a delegate of a group with, for instance, present-biased preferences on average will also take present-biased decisions. By contrast, Shapiro (2010) models a delegate as altruistic over payoffs (and not utility) of other group members. Such delegate will take more patient and less present-biased decisions when she decides on behalf of all members than when she decides only for herself.

Previous experiments comparing individual and group decisions in intertemporal context do not provide a clear result. Abdellaoui, L'Haridon and Parashiv (2013) and Shapiro (2010) show that group decisions are more patient and less present-biased. Yang and Carlsson (2016), however, find that spouses' intertemporal decisions lie between decisions of husbands and wives. The closest in spirit to our study is the independent work of Denant-Boemont, Diecidue and L'Haridon (2016). Here each student participant decides both individually and then in groups under majority voting. After four mock-voting rounds, the decisions in the fifth (and last) round determine the payoffs. Group decisions are calculated by the median of all members' choices. Denant-Boemont, Diecidue and L'Haridon (2016) find that members converge their decisions toward higher patience and less present-biasedness. Our study differs in regard to the group decision mechanism and the type of the subject pool. Most importantly, our study complements this literature by explicitly testing possible factors that lead to the differences between decisions for oneself and for a group, namely other members' preferences and communication between members.

3.3 Theoretical framework and expected behaviors

We will first introduce present-biased preferences formally by briefly presenting Andreoni and Sprenger's (2012) model. In order to capture the decisions on behalf of a group, we then extend the basic model by including other-regarding preferences. As we are interested in studying how delegates respond to different types of time-preferences of others, we allow for the possibility that the extent to which the well-being of others is taking into account depends on their time-preferences.

Andreoni and Sprenger (2012) incorporate present-biased preferences into a standard intertemporal utility function. The total utility of a stream of consumption from the present period t to period $t + T$ into the future thereby becomes

$$U_t = u(c_t) + \beta \sum_{k=1}^{T} \delta^k u(c_{t+k}) \tag{3.1}$$

where k is the time span; δ captures long-run discounting (a discount factor) between two future periods; and β is a parameter for present-biased preference with $0 \leq \beta < 1$. $\beta = 1$ corresponds to the case of standard exponential discounting such that the one period discount factor between the present and a future period $\beta\delta$ is equal to the one period discount factor between two future periods δ. By maximizing this utility function subject to a budget constraint Andreoni and Sprenger (2012) show that the higher the present-biased parameter β is and/or the higher the long-run discounting δ is, the higher is the fraction of the budget allocated to the sooner date x_t.

We then extend this model to capture the situation when a delegate's decisions affect other members. Assume that a delegate decides for the whole group. The delegate's decision is binding for all members and the delegate cares about the utility of the other members. The delegate then takes the utility of others into account with weights for each type of others. As the most general model for our set-up, we allow the weight that a delegate attaches to another member's utility to depend on this member's time-preference. For simplicity, we separate three cases: The other member is equally, more or less patient than the delegate.

The weights for the other types could be the same or different across types. The delegate then maximizes the weighted discounted utility. As a result, the delegate might change the decisions when deciding for the group, depending on how the delegate weighs the time preferences of the different types of others.[20]

Behavioral expectations

The starting point is a purely self-oriented delegate who can be modeled by setting all weights of others equal to zero. This yields the **null hypothesis** that decisions for oneself and for a group are not different, neither on an individual level nor on average.

In case that the delegate has the same weights greater than zero for all types of others, then she will behave like a (neutral) conformist. These weights yield the **symmetric conformity hypothesis**. It states that a delegate changes her decisions for a group in the same way toward the decisions of a more patient as toward the decisions of a less patient other. Symmetric conformity, however, does not change the average decision for a group compared to the one for oneself. This is because to the same extent that patient delegates become less patient and impatient delegates become more patient. In case that the delegate puts different weights to different types of preferences, the average decision for a group will differ from the one for oneself. We call this the **asymmetric conformity hypothesis**. To sum up, the symmetric conformity hypothesis predicts changes in decisions in the group setting on individual level but not on the aggregate level, while the asymmetric conformity hypothesis predicts changes in decisions in the group setting on both individual and aggregate levels.

Communication among group members could decrease social distances between the delegate and other members. This could in turn lead to higher weights of others' utilities

[20] See detailed formal calculation and the model in Appendix A.

(Hoffman, McCabe and Smith, 1996) and even stronger conformity toward others' preferences when a delegate decides for a group. We call this the **communication hypothesis**.

3.4 The experimental design

We elicit time preferences through the convex time budget method based on Andreoni and Sprenger (2012), Andreoni, Kuhn and Sprenger (2015), and Lührmann, Serra-Garcia and Winter (2014). In this method, subjects split a given budget between a sooner and a later date at different interest rates. There are three time frames: the time between (I) today and 2 weeks later, (II) between today and 4 weeks later, and (III) between 2 weeks and 4 weeks in the future. The degree of present-biasedness (the parameter β) can be identified by comparing (I) and (III), while the long-run discounting parameter[21] (δ) can be identified by choices in (III).

The amounts allocated to a sooner and a later date in each decision already reveal information about the patience and present-biasedness of a decision maker. The more patient a subject is, the less she allocates to the sooner date. A person is present-biased if she allocates more to the sooner date in the short-run time frame (time frame I) than in the long-run time frame (time frame III) for a given interest rate. The maximum experimental budget (M) is always THB 300 (about USD 9 at the time of the experiment),[22] which is the minimum daily wage in Thailand. There are five interest rates for each time frame, from 5% to 100% for two weeks.[23] These are much larger than the market interest rate at commercial banks.[24]

3.4.1. Decisions

Table 3-1 summarizes all five decisions (rows in the table) for time frame I (today,+2weeks). The corresponding parameters are shown in the last three columns. The options stay the same in time frame II (today,+4weeks) and time frame III (+2weeks,+4weeks), with only the timing of payments changing. For each decision, subjects have to choose one favorite budget allocation out of four options. Option 4 pays the highest total payoff of THB 300, but subjects have to wait to get money at the later date. Option 1 pays the whole budget at the sooner date, but discounted by the corresponding interest rate. The sum payoffs over both dates increases with the option number. Option 4 is therefore the

[21] Following Andreoni, Kuhn and Sprenger (2015), we denote delta as long-run discounting parameter.

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

[23] See more details about the standardized daily rate and the annual rate of decisions in Appendix B.

[24] The average deposit interest rate in Thailand in 2014 is around 2.00% (The World Bank, 2016).

most patient option, while option 1 is the least patient option. All subjects have to go through all 15 decisions, which are presented sequentially one at a time.

Table 3-1: Decisions in time frame I (today,+2weeks)[25]

No.	Payment dates	Option 1	Option 2	Option 3	Option 4	t (sooner date)	k (delay days)	P (gross interest rate)
1	TODAY	285	190 Baht	95 Baht	0 Baht	0		
	AND in 2 WEEKS	0 Baht	100 Baht	200 Baht	300 Baht		14	1.05
2	TODAY	270 Baht	180 Baht	90 Baht	0 Baht	0		
	AND in 2 WEEKS	0 Baht	100 Baht	200 Baht	300 Baht		14	1.11
3	TODAY	240 Baht	160 Baht	80 Baht	0 Baht	0		
	AND in 2 WEEKS	0 Baht	100 Baht	200 Baht	300 Baht		14	1.25
4	TODAY	210 Baht	140 Baht	70 Baht	0 Baht	0		
	AND in 2 WEEKS	0 Baht	100 Baht	200 Baht	300 Baht		14	1.43
5	TODAY	150 Baht	100 Baht	50 Baht	0 Baht	0		
	AND in 2 WEEKS	0 Baht	100 Baht	200 Baht	300 Baht		14	2

Note: The last three columns are not shown to the participants.

3.4.2. Treatments

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

Group treatment (N = 90 subjects)

To see whether subjects change choices when deciding for a group instead of just for themselves, we employ a within-subject design. In the first setting, subjects decide individually just for themselves. Subjects are given an answer sheet for each decision (a row in Table 3-1), which contains four calendars. Each calendar represents each of the four options. The calendars show clearly on what dates subjects would get which amount of money. Subjects choose one favorite option by circling the number of their favorite calendar.

[25] See complete 15 decisions for all 3 time frames in Appendix B.

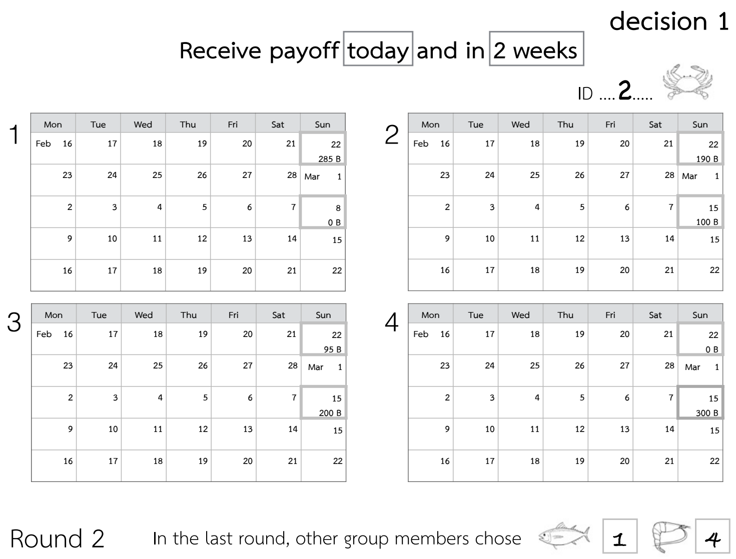


Figure 3-1: Example of an answer sheet in the group setting

In the second setting, subjects decide as a group member for the group. They are randomly matched into groups of three members. One randomly selected group member acts as a delegate, whose choice is binding for all members. The random draw happens after all decisions have been made. To keep the identities of the group members anonymous, we use symbols to represent the members. Each group consists of a “Shrimp”, a “Crab”, and a “Fish”. Subjects make 15 decisions in each setting, which makes 30 decisions in total.

In order to study how other members’ choices affect subjects’ choices for the group, before subjects make a choice for their groups we inform subjects about the options that the two other group members made for themselves in the individual setting. Figure 3-1 shows an example of an answer sheet in the group setting. In the answer sheet, the subject’s symbol is on the top right corner (a “Crab”). On the bottom right corner, subjects see the choices that the two other members made for themselves in the corresponding decision (as an example in Figure 3-1, “Fish” chose option 1 and “Shrimp” chose option 4 in the individual setting).

Message treatment (N = 75 subjects)

In the Message treatment, the experimental design is identical to the Group treatment. The only difference is that we give subjects the opportunity to exchange nonbinding free-form messages once before the group setting starts. We therefore study how communication among group members additionally affects subjects’ decisions for a group on top of knowing other members’ preferences. Each subject sends one message to the two other group members. Hence, each subject receives two separate messages from two other members. Subjects can write down on a sheet of paper any kind of message, except revealing their identity, threatening others or offering an outside option. We tell them to write about decisions in the game, for instance suggestions for other members, their own choices in the individual setting or their intended choices in the group setting. All participants followed these instructions.

Remember that in this treatment subjects can observe other group members' choices in the individual setting before making every (of the 15) decision for the group as in the Group treatment. Additionally, subjects receive two separate messages from the other two members *once* before the group setting kicks of. Therefore each subject is informed about other group members through two channels: other members' choices in the individual setting (revealed preferences) and messages.

Control treatment (N = 15 subjects)

In order to control for possible learning effects between the individual setting and the subsequent group setting, we run a control treatment, in which subjects decide in the individual setting twice.

3.4.3. Payment

In order to determine payments, one out of 30 decisions is randomly drawn. In case a decision from the individual setting is drawn, subjects receive payoffs according to their own choices. In case a decision from the group setting is drawn, a delegate is drawn randomly. The delegate's choice then determines the payoffs for all three group members. Subjects are informed that any of their choices can determine their payoff and that this will be determined by a random draw. With this mechanism, all decisions are relevant for the payoff, and income effects can be avoided.

The show-up fee is THB 100 (around USD 3). In addition, subjects receive THB 100 for answering a post-experimental questionnaire, which is announced after the experiment. We follow the payment procedure described in Appendix C to eliminate the concerns that the subjects could be reluctant to choose future payment due to (1) trust in future payment and (2) unequal transaction cost across payment dates. For example, the trustworthy community leaders announced the experiment for us. We signed a contract for the future payments for the subjects.

3.4.4. Procedure

The participants of our study are villagers of Naithung village, in Nakhon Si Thammarat province, Thailand. The village is located along the coastline of the Gulf of Thailand. The major economic activities in the area are all related to fisheries, such as fishing with their own boats, selling fish, making fish nets, working on boats, etc. In general, fishermen households find it hard to have long-term savings (Chuaychoo, 2002).

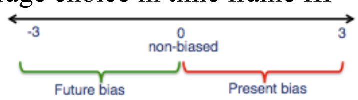
The lab-in-the-field experiment was conducted on 21-23 February 2015 in school classrooms in Naithung. In total, 180 villagers participated in the experiment, of which 63% were fisherman and 90% lived in fishing households. One hundred and five participants (58%) were members of savings groups and 41% were female. Participants' age ranged from 19 to 80 years old, with an average age of 44 years. The experiment took between 60 and 80 minutes, depending on the treatment. An interview for the post-experimental questionnaire took around 30 minutes. The total average earning was THB 480.42 (about USD 16), which was around 60% larger than the minimum daily wage in Thailand.

3.4.5. Measures of (revealed) time preferences

First, we look at the actual choices. We then use reduced-form measures of time preferences in order to avoid having to make assumptions on the utility function. This would be required if we estimated parameters in a structural-model framework (see Sutter et al., 2013 for an elaboration of this argument). This approach also allows us to calculate measures for all participants.[26]

The measure of present-biasedness is calculated as the difference between the average of the five choices made for time frame III (+2weeks,+4weeks) and the average of the five choices made for time frame I (today,+2weeks). 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 non-biased, then she chooses the same option in both time frames, and the measure is zero.[27] If a participant is present-biased, she is more patient for time frame III and chooses the higher options, which turns the measure positive. The opposite holds for a future-biased participant.

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



[26] We also estimate parameters β_i and δ_i of the utility function based upon Equations (A3.6) and (A3.7). However, we cannot estimate individual parameters of those participants who did not alter the choice at all 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 reduced-form measures. Appendix D shows our results for this estimation.

[27] The problem with this measure of present-biasedness is that participants could be present-biased for some decisions and future-biased for others, leading to no bias on average. In our sample, there are few cases falling into this case: 10 out of 72 non-biased participants in the individual setting and 11 out of 92 non-biased participants in the group setting. Excluding these participants, results remain qualitatively the same. Thus, we include them in the analysis.

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. Therefore, only long-run discounting matters but not present bias.

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

3.5 Results

In order to check whether the participants understood the experiment, we first look at the rationality of choices. Choices are rational according to the law of demand if participants allocate less to the sooner date when the interest rate increases, which means choosing a higher option. As it turns out, the vast majority of choices is consistent with the law of demand: Their share 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 qualitatively the same when excluding the irrational choices.

3.5.1. Individual time preferences

Figure 3-2 shows the mean share of budget allocated to sooner dates in time frame I (today,+2weeks) and time frame III (+2weeks,+4weeks), the short-run and long-run time frames with the same time span. The mean share of budget allocated to sooner dates decreases with higher interest rates, which is in line with the law of demand. For every given interest rate the mean share of budget allocated to the sooner date in the short-run time frame is higher than in the long-run time frame. This means that participants choose less patiently when the sooner date is immediate. On average the participants allocate 41% of the budget to sooner date if the sooner date is today (time frame I) but only 34% if the sooner date is in two weeks (time frame III). The average choices for time frame I and time frame III are significantly different (Wilcoxon signed-rank test, $p < 0.01$). On the individual level, 19.39% of participants are future-biased, 40.61% are non-biased and 40% are present-biased. These shares are in line with findings reported in previous studies, e.g. Balakrishnan, Haushofer and Jakiela (2016), Giné, Goldberg, Silverman and Yang (2012) and Takeuchi (2011).

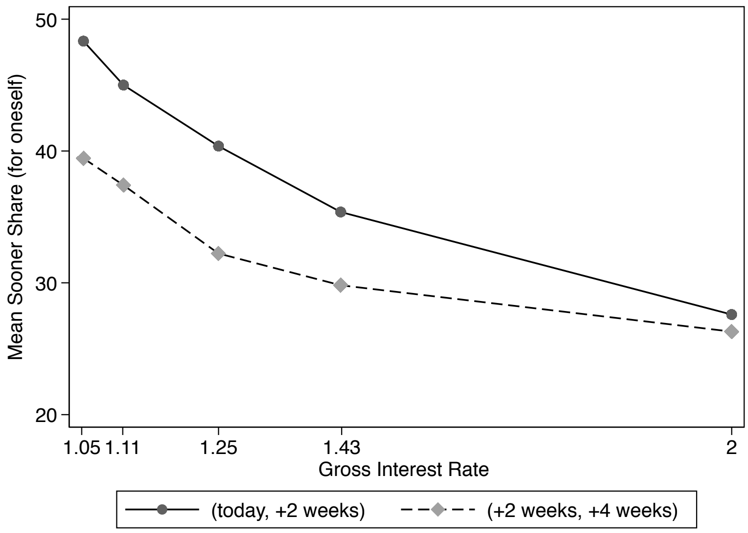


Figure 3-2: Mean share to sooner dates in time frame I and time frame III

Result 1: Participants are present-biased on average when they decide only for themselves in the individual setting.

Regarding long-run discounting behavior, the average share of budget to the sooner date when the sooner date is in two weeks (time frame III) is 34%, which is significantly larger than 0% (Wilcoxon signed rank test, $p < 0.01$). This suggests that the participants are on average discounting long-term payments.

3.5.2. Messages

The exchanged messages have been coded separately by two research assistants. In case of distinct coding they discussed and reached an agreement. The categories used are the following. Message M1 suggests other members to be patient and get the highest sum of money at the later dates. This message is sent by around 39% of participants. Message M2 is neutral, i.e., tells other members to feel free to choose their preferred option for the group. This message is written by about 21% of participants. Message M3 proposes others to be impatient and get money today despite the lowest sum. Message M4 suggests income smoothing, i.e., choosing the intermediate options that give participants payoffs on both payment dates. M3 and M4 are each suggested by 20% of participants. We investigate the effect of received messages on the changes in choices (in the group setting from the individual setting) and do not find any significant effect of any type of messages. Neither do we find an overall difference between the Group and Message treatments. See Appendix E for the regression results.

As each participant receives two separate messages from two other members, there are several combinations of message types participant can get. Therefore, we use simplified categories that capture those combinations. We consider the message types either as neutral or strategic relatively to the choice that participants have made in the individual setting, i.e., more patient, less patient, equally patient. The alternative categories of received messages are as follows. 'All more patient messages' is when participants receive two messages that try to convince them to be more patient for the group than they were for themselves (12% of all decisions in Message treatment). 'All less patient messages' is when both messages suggest receivers to be less patient (4.4% of all decisions in Message treatment). 'One more patient and one less patient messages' is when receivers get one message suggesting a more patient option and the other suggesting a less patient option (4.1%). 'One equally patient and one more patient messages' is when one message mentions the equally patient option and the other suggests a more patient option (13.2%), while 'One equally patient and one less patient messages' is when the other suggests a less patient option (13.8%). 'One neutral and one more patient messages' is when one message does not make any suggestion and the other prefers a more patient option (12.4%), while 'One neutral and one less patient messages' is when the other prefers a less patient option (11.7%). Lastly, 'Neutral and equally patient messages' is when received messages are either neutral or equally patient to the participant's choices (28.4%). We examine the effects of such message types on changes in choices (in the group setting from the individual setting) but do not find any significantly effect of messages and the overall Message treatment. See regression results in Appendix E.

We therefore decided to pool data from the Group and Message treatments (N = 165 participants) to increase statistical power in the later analysis. We will henceforth refer to this pooled dataset as "Main treatment".

3.5.3. Comparison of choices for oneself and for a group

In this section, we compare choices for oneself and for a group. For this analysis, we first look at choices of the participants in the Main treatment, who enter the group setting after the individual setting.

Table 3-2 (column 1) shows that overall participants choose significantly more patient options when deciding on behalf of a group than when deciding for themselves (means are 2.94 and 2.85, respectively; Wilcoxon signed-rank test, $p < 0.01$). Looking separately for each time frame, participants choose more patient options for a group than for themselves in time frame I (today,+2weeks) (means are 2.93 and 2.78 in the group and individual settings;

Wilcoxon signed-rank test, $p < 0.01$). In time frame III (+2weeks,+4weeks), by contrast, there is no difference between the group setting and the individual setting (means are 3.00 and 2.98 in the group and individual settings; Wilcoxon signed-rank test, $p = 0.41$). Consequently, the elicited present-biasedness reduces on average. Choices made for a group in time frame II (+2weeks,+4weeks) are weakly significantly more patient compared to choices for oneself (Wilcoxon signed-rank test, $p = 0.08$).

The measure of present-biasedness in the group setting converges toward 0, reducing the share of both present-biased and future-biased participants compared to the individual setting (Figure 3-3). The distribution of present-biasedness is consequently significantly different between the individual and the group settings (Kolmogorov-Smirnov test, $p = 0.02$). We also find the extent of the bias to be significantly smaller in the group setting for both present-biased and future-biased individuals (Wilcoxon signed-rank test, $p < 0.01$ in both cases).

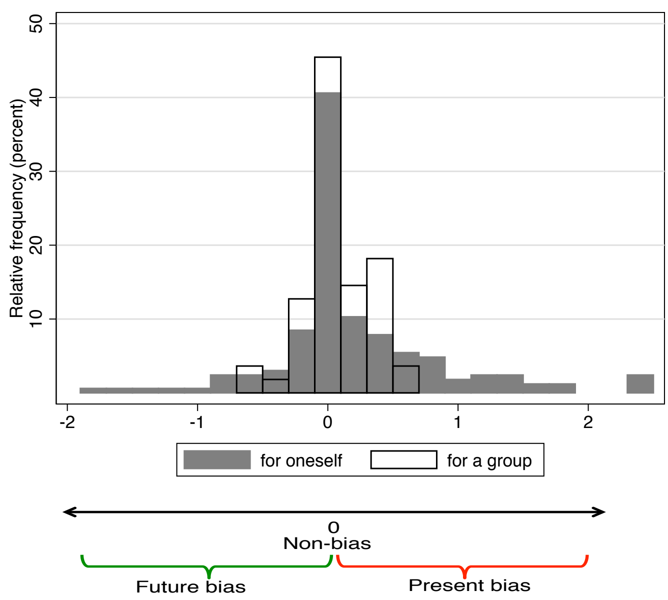


Figure 3-3: Measure of present-biasedness from choices for oneself and on behalf of a group in the main treatment

Given that, on average, participants in the individual setting are present-biased, the convergence in the group setting toward non-biasedness reduces the average present-biasedness in the group setting (means of the measure of present-biasedness are 0.20 in the individual setting and 0.06 in the group setting; Wilcoxon signed-rank test, $p = 0.01$). Regarding long-run discounting, participants do not discount differently in both settings (means of the measure of long-run discounting behavior are 3.00 in the individual setting and 2.98 in the group setting; Wilcoxon signed-rank test, $p = 0.94$).

Table 3-2: Difference of means of options chosen in the second setting and the first setting

	(1) Main	(2) Control
Overall	0.08***	-0.13
Time frame I (today,+2weeks)	0.16***	0.05
Time frame II (today,+4weeks)	0.07*	-0.28
Time frame III (+2weeks,+4weeks)	0.02	-0.53

*Note: * p < 0.1, ** p < 0.05, *** p < 0.01.Wilcoxon signed-rank test between choices in both settings.*

We then analyze changes between choices made in both individual settings in the control treatment in order to test whether or not the difference between choices made in the individual and the group settings in the Main treatment are due to a repetition effect. In the control treatment, participants do not choose different options overall and in any of the time frames (Wilcoxon signed-rank test, p-values are 0.23, 0.85, 0.19, 0.40, respectively). These results show that participants do not "learn" to choose more patient options when they decide just for themselves for the second time. If at all, they tend to make less patient choices (Table 3-2, column 2). Regarding long-run discounting, participants in the control treatment do not discount differently either (Wilcoxon signed-rank test, p = 0.40).

Result 2: Participants choose more patient options and are less present-biased when they decide for a group than when they decide just for themselves.

3.5.4. Effects of other group members' choices

We now try to explain why choices in the group setting are more patient options compared to those in the individual setting. From this point we focus on the actual choices made overall. As discussed earlier, exchange of messages between group members per se (in the message treatment) does not explain the difference between choices in the individual and group settings. We therefore turn to the question of how choices of others influence one's own choice for the group. To do so, we need to compare situations where participants took similar decisions in the individual setting but were exposed to different revealed preferences of other members in the group setting. The random composition of the groups provides exogenous variation in others' types. Since we are interested in whether and how participants take choices of others into account when deciding for a group, we look at types in relative terms, i.e., whether other group members are more, equally or less patient.

We start by focusing on the intermediate options (option 2 and option 3) chosen in the individual setting. Table 3-3 shows the effects of others' choices (in the individual setting) on one's own choice for the group when the intermediate options are chosen in the individual setting. The explanatory variables are five dummies representing five combinations of others' types. The base category is when all members are equally patient, i.e., all choose the same option in the individual setting.

Controlling for one's own choice in the individual setting, interest rate, and for other characteristics, participants are significantly more likely to adjust their choices for a group to a more patient option when other members are more patient compared to the base case and also when one other member is more patient and the other member is less patient. By contrast, we find no evidence of conformity toward less patient others. These findings firstly indicate that in the group setting 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 one on choices for a group. The descriptive statistics in Table 3-10 (Appendix F) suggests the qualitatively similar results.

Table 3-3: OLS regressions of changes in choices in the group setting for situations when options 2 and 3 were chosen in the individual setting

Dependent Variable	Changes in choices	
Model	(I)	(II)
All 'more patient' others (dummy)	0.33**	0.33***
	(0.13)	(0.13)
All 'less patient' others (dummy)	0.06	0.06
	(0.15)	(0.15)
One 'more patient' and one 'less patient' others (dummy)	0.23*	0.24*
	(0.13)	(0.13)
One 'more patient' and one 'equally patient' others (dummy)	0.24**	0.23*
	(0.11)	(0.12)
One 'less patient' and one 'equally patient' others (dummy)	0.12	0.13
	(0.12)	(0.12)
Option 3 chosen (dummy)	-0.37***	-0.38***
	(0.08)	(0.08)
Interest rate	0.70***	0.14
	(0.22)	(0.09)
Age		-0.001
		(0.005)
Female		0.07
		(0.11)
Years in school		-0.003
		(0.02)
Membership of savings groups (dummy)		-0.06
		(0.10)
Constant	0.70***	0.86*
	(0.22)	(0.44)
No. of groups	52	52
No. of observations	955	955
R^2	0.0780	0.0815

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

Next we analyze situations where participants choose either the least patient option (option 1) or the most patient option (option 4) in the individual setting. In the former case, participants cannot choose any less patiently in the group setting, nor could others have chosen less patiently than the participants in the individual setting. In the latter case, the reverse holds true: Participants cannot become more patient in the group setting and other group members cannot have chosen more patiently than the participants. We therefore run two separate regressions for both cases of the changes in choices (from the individual setting to the group setting) on the difference between participants' choice and an average of other members' choices in the individual setting. The regression results in Table 3-4 (I) and (II) show that when the least patient option was chosen (in the individual setting) the magnitude of changes in choices (in the group setting) toward a more patient option increases, the more patient the other members (in the individual setting) are on average. Table 3-4 (III) and (IV) suggest that when the most patient option was chosen (in the individual setting), the choice in the group setting is not changed toward a less patient option when others are on average less patient (in the individual setting). These results suggest that the more patient others tend to have more influence than the less patient others on choices for the group. The descriptive statistics in Table 3-11 and Table 3-12 (Appendix F) support these results.

Table 3-4: OLS regressions of changes in choices in the group setting for situations when the least or the most options were chosen in the individual setting

Dependent variable	Changes in choices: Option 1 (least patient)		Changes in choices: Option 4 (most patient)	
Model	(I)	(II)	(III)	(IV)
Difference between the average of others' choices and one's own choice	0.24** (0.11)	0.25** (0.11)	0.05 (0.05)	0.03 (0.05)
Interest rate	-0.07 (0.22)	-0.13 (0.23)	0.20*** (0.07)	0.23*** (0.06)
Age		0.03 (0.01)		-0.02*** (0.006)
Female		-0.12 (0.18)		-0.03 (0.10)
Years in school		0.11* (0.05)		0.01 (0.01)
Membership of savings groups (dummy)		0.01 (0.22)		0.28*** (0.08)
Constant	0.42 (0.28)	-1.38 (0.77)	-0.57*** (0.14)	-0.17 (0.27)
No. of groups	46	46	52	52
No. of observations	472	472	1048	1048
R^2	0.0393	0.0934	0.0164	0.0691

*Notes: * p < 0.1, ** p < 0.05, *** p < 0.01; Robust standard errors clustered on group level in parentheses.*

Result 3: Other members' preferences affect one's own choices for the group. A more patient other member has more influence on one's own choice for the group than a less patient other.

By analyzing cases in which all members are equally patient, we can further answer the question whether the mere responsibility of deciding for a group already changes decisions. This does not seem to be the case. The descriptive statistics in Table 3-10 (Appendix F) shows that when the intermediate options were chosen in the individual setting, 81% of all choices that fall in this category stay unchanged. The remaining choices are equally shifted to a more or a less patient direction, each with 8% of all choices that fall in this category. In case that the least patient option (option 1) was chosen in the individual setting, 88% of all choices that fall in this category remain unchanged. While the fraction of unchanged choices is 91% in case that the most patient option (option 4) was chosen in the individual setting. This result emphasizes the importance of other members' time-preferences rather than of responsibility for others alone.

Result 4: Having responsibility for others does not by itself change choices for a group.

3.6 Discussion and conclusion

This study compares intertemporal decisions for oneself and for a group. Then the effects of other members' time preferences on choices in the group setting are investigated. We examine also how communication additionally affects choices for a group on top of other members' time preferences. We find that when the participants decide for a group, they are less present-biased on average. The descriptive statistics and regression results show that the others' preferences affect the changes in choices in the group setting, but not the communication between group members. Meanwhile, the participants do not change their choices for a group (from choices for themselves) when the other members choose the same choices as they did for themselves. This result suggests that people take into account the preferences of those for whom they have responsibility rather than maximizing payoffs for the whole group (choosing the most patient option).

The participants show a bias toward patience when deciding for a group, which is consistent with the asymmetric conformity hypothesis. The bias in conformity that we find may be rooted in the social desirability of patience, as patience is a desirable trait in many cultures, considered a virtue by many philosophers, local proverbs, and demanded by religious' prescriptions.[28] This explanation connects to another instance of asymmetric conformity, toward risk aversion, as reported by Bolton, Ockenfels and Stauf (2015) as both risk aversion and patience might be considered socially desirable behaviors. Bolton, Ockenfels and Stauf (2015) find that subjects become more risk-averse when they are responsible for the payoff of a passive player. Decision makers tend to adjust their decisions toward risk aversion when they learn that a passive player is more risk-averse. On the other hand, decision makers do not adjust their decisions when a passive player is less risk-averse. This indicates that decision-makers may conform asymmetrically toward the preferences of others. For more understanding about conformity in intertemporal contexts, the next step could be to study the effect of other members' preferences on decisions for oneself. This can again help disentangle the effects of other members' decisions and responsibility for the group.

Yet the communication has no significant effect on the changes in choices in the group setting from the individual setting on top of learning about the revealed preferences of other group members, which is contradictory to the communication hypothesis. This shows that learning about preferences of other group members gives the participants sufficient information to make decisions for the group. This finding, however, could be driven by the high proportion (28.4%) of participants who receive neutral and equally patient messages, which do not propose any other option than participants' own choices.

Our findings suggest that we might consider encouraging someone to make (intertemporal) decisions on behalf of a group in situations in which patience is desirable. For example, we could ask a household head to decide on the household monthly savings plan instead of asking each household member to make their own savings plan separately.

[28] In the Bible, it is stated, for example, that "Be patient toward all men". Buddha said also, for example, "And invulnerable armor is patience". Proverbs from different parts of the world tell people to be patient. For instance, a German proverb says, "Patience is a bitter plant, but it has sweet fruit". A Chinese proverb says, "Patience and the mulberry leaf becomes a silk gown", and a Kanuri proverb says, "At the bottom of patience is heaven".

3.7 Appendix A: The theoretical framework

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

$$D(k) = \begin{cases} 1 & if\ k = 0 \\ \beta\delta^k & if\ k > 0, \end{cases} \tag{A3.1}$$

where $D(k)$ is the discount function; k is time period; δ is a discount factor; and β is a parameter for present-biased preference with $0 \le \beta < 1$. $\beta = 1$ 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:

$$U_t = u(c_t) + \beta\sum_{k=1}^{T}\delta^k u(c_{t+k}) \tag{A3.2}$$

Assume a time-separable CRRA utility function[29], 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 et al., 2015; Lührmann et al., 2014). The utility function has the following form:

$$U(x_t, x_{t+k}) = \begin{cases} x_t^\alpha + \beta\delta^k x_{t+k}^\alpha & if\ t = 0 \\ x_t^\alpha + \delta^k x_{t+k}^\alpha & if\ t > 0, \end{cases} \tag{A3.3}$$

where x_t is the amount allocated to the sooner date, while x_{t+k} is the amount allocated to the later date. The parameter α captures the curvature of the utility function.

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

$$Px_t + x_{t+k} = Y, \tag{A3.4}$$

where P is the gross interest rate, Y is the budget.

Maximizing (3) subject to (4) gives the following conditions:

$$\frac{x_t}{x_{t+k}} = (P\beta^{t_0}\delta^k)^{\frac{1}{\alpha-1}}, \tag{A3.5}$$

where t_0 is an indicator for whether $t = 0$. Rewriting the equation by substituting $x_{t+k} = Y - Px_t$ (from equation (4)) gives:

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

$$x_t = \frac{Y(P\beta^{t_0}\delta^k)^{\frac{1}{\alpha-1}}}{1+P(P\beta^{t_0}\delta^k)^{\frac{1}{\alpha-1}}}. \tag{A3.6}$$

This Equation (6) 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 (5):

$$\ln\left(\frac{x_t}{x_{t+k}}\right) = \frac{\ln(\beta)}{\alpha-1}t_0 + \frac{\ln(\delta)}{\alpha-1}k + \frac{1}{\alpha-1}\ln(P). \tag{A3.7}$$

We extend the model described in Andreoni, Kuhn and Sprenger (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

$$U_i = \omega_i\left(x_{i,t}^{\alpha} + \beta_i^{t_0}\delta_i^k x_{i,t+k}^{\alpha}\right) + \sum_{\substack{j=0\\ j\neq i, j\neq h, j\neq l}}^{n} \omega_j\left(x_{i,t}^{\alpha} + \beta_i^{t_0}\delta_i^k x_{i,t+k}^{\alpha}\right) \tag{A3.8}$$

$$+ \sum_{\substack{h=0\\ h\neq i, h\neq j, h\neq l}}^{m} \omega_h\left(x_{h,t}^{\alpha} + \beta_h^{t_0}\delta_h^k x_{h,t+k}^{\alpha}\right)$$

$$+ \sum_{\substack{l=0\\ l\neq i, l\neq j, l\neq h}}^{q} \omega_l\left(x_{l,t}^{\alpha} + \beta_l^{t_0}\delta_l^k x_{l,t+k}^{\alpha}\right)$$

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:

$x_t^G = x_{i,t} = x_{j,t} = x_{h,t} = x_{l,t}$ and $x_{t+k}^G = x_{i,t+k} = x_{j,t+k} = x_{h,t+k} = x_{l,t+k}$.

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

$$U_i = \omega_i \cdot u_i + \omega_j \cdot u_j + \omega_h \cdot u_h + \omega_l \cdot u_l, \tag{A3.9}$$

where $\sum \omega = 1$ and $\omega_i = \omega_j$.

Maximizing the weighted utility (9) in the case that all types exist, subject to the budget constraint: $Px_t^G + x_{t+k}^G = Y$, gives the following condition.

$$\text{FOC: } \frac{x_t^G}{x_{t+k}^G} = \left(P\left((\omega_i + \omega_j)\beta_i^{t_0}\delta_i^k + \omega_h\beta_h^{t_0}\delta_h^k + \omega_l\beta_l^{t_0}\delta_l^k\right)\right)^{\frac{1}{\alpha-1}} \tag{A3.10}$$

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

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

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

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

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.

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

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

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

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

$$\omega_h > \omega_l$$

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.

Agent i decides therefore 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 member

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

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

Case 3.2: With a same patient member

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

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

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 member

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

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

Case 4.2: With a same patient member

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

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

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

3.8 Appendix B: Design for time-preference elicitation

Table 3-5: 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	3598.47
0	14	1.43	3.71	12564.12
0	14	2	5.08	100479.55
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	2116.61
0	28	2	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	3598.47
14	14	1.43	3.71	12564.12
14	14	2	5.08	100479.55

Note: The effective annual interest rate is quarterly compounded.

Table 3-6: Complete decisions

No.	Payment dates	Option 1	Option 2	Option 3	Option 4	t (sooner date)	k (delay days)	P (gross interest rate)
1	TODAY AND in 2 WEEKS	285 0 Baht	190 Baht 100 Baht	95 Baht 200 Baht	0 Baht 300 Baht	0	14	1.05
2	TODAY AND in 2 WEEKS	270 Baht 0 Baht	180 Baht 100 Baht	90 Baht 200 Baht	0 Baht 300 Baht	0	14	1.11
3	TODAY AND in 2 WEEKS	240 Baht 0 Baht	160 Baht 100 Baht	80 Baht 200 Baht	0 Baht 300 Baht	0	14	1.25
4	TODAY AND in 2 WEEKS	210 Baht 0 Baht	140 Baht 100 Baht	70 Baht 200 Baht	0 Baht 300 Baht	0	14	1.43
5	TODAY AND in 2 WEEKS	150 Baht 0 Baht	100 Baht 100 Baht	50 Baht 200 Baht	0 Baht 300 Baht	0	14	2
6	TODAY AND in 4 WEEKS	285 Baht 0 Baht	190 Baht 100 Baht	95 Baht 200 Baht	0 Baht 300 Baht	0	28	1.05
7	TODAY AND in 4 WEEKS	270 Baht 0 Baht	180 Baht 100 Baht	90 Baht 200 Baht	0 Baht 300 Baht	0	28	1.11
8	TODAY AND in 4 WEEKS	240 Baht 0 Baht	160 Baht 100 Baht	80 Baht 200 Baht	0 Baht 300 Baht	0	28	1.25
9	TODAY AND in 4 WEEKS	210 Baht 0 Baht	140 Baht 100 Baht	70 Baht 200 Baht	0 Baht 300 Baht	0	28	1.43
10	TODAY AND in 4 WEEKS	150 Baht 0 Baht	100 Baht 100 Baht	50 Baht 200 Baht	0 Baht 300 Baht	0	28	2
11	in 2 WEEKS AND in 4 WEEKS	285 Baht 0 Baht	190 Baht 100 Baht	95 Baht 200 Baht	0 Baht 300 Baht	14	14	1.05
12	in 2 WEEKS AND in 4 WEEKS	270 Baht 0 Baht	180 Baht 100 Baht	90 Baht 200 Baht	0 Baht 300 Baht	14	14	1.11
13	in 2 WEEKS AND in 4 WEEKS	240 Baht 0 Baht	160 Baht 100 Baht	80 Baht 200 Baht	0 Baht 300 Baht	14	14	1.25
14	in 2 WEEKS AND in 4 WEEKS	210 Baht 0 Baht	140 Baht 100 Baht	70 Baht 200 Baht	0 Baht 300 Baht	14	14	1.43
15	in 2 WEEKS AND in 4 WEEKS	150 Baht 0 Baht	100 Baht 100 Baht	50 Baht 200 Baht	0 Baht 300 Baht	14	14	2

3.9 Appendix C: Implementation of payments

The issues that may make participants of any intertemporal choice experiment reluctant to choose payoff in the future are (1) the trust of participants that payments will be made in the future and (2) the unequal transaction costs across payment dates. We try to address these concerns by implementing the procedure discussed in this section. Furthermore note that these concern would not confound our results in any case as our research interest is to compare the individual and the group setting, across which all conditions related to payments are held constant.

Stay in the field: We were introduced to the community leaders by the NGO officers who had been working in the area for over 10 years. Then, the researcher who conducted the experiment, a native of Thailand, stayed in the village for around two months before the experiment started. During this period, the researcher conducted interviews both with individuals and with focus groups such that she was not a stranger anymore once the experiment started. To avoid any reciprocity concerns from the participants toward the researcher, participants were truthfully told them that the payoff from the experiment was not taken from the researcher's personal money but instead came from a foreign granting organization.

Announcement: The community leaders, who are also the committee members of the savings group, announced the experiment. They are trustworthy with regard to money issues, and assured participants that the researcher will pay as promised.

Contract: 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 show-up fee of THB 100 was divided equally and paid in cash on both payment dates to compensate for transaction costs equally across both dates.

Delivery of payments: Participants received the "today" payment in cash after the experiment. For the "later" payments, participants were asked to pick up the payoff at the community shop by the pier, a location everyone knows and passes by every day. The travelling expenses and time to the experiment locations and to the community shop should be roughly equal for participants.

3.10 Appendix D: 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 (A7) as a linear model. However, there is a problem at the corner solutions that the allocation ratio $\ln\left(\frac{x_t}{x_{t+k}}\right)$ is not well defined. To address this issue, the non-linear least squares regression, based on Equation (A6) 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 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, additional 25 participants are dropped.

Estimates of parameters for choices in the individual setting

Aggregate estimates

The aggregate estimates of parameters from decisions for oneself (in the individual setting) by the NLS regression are more evidence for present bias on the aggregate level. The aggregate estimate of β is 0.86, which is smaller than 1.00, 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 significantly differs from 1 (Wald test, $p < 0.001$). This indicates that the utility function is not linear, but concave.

Individual estimates

Figure 3-4 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 3-5 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.

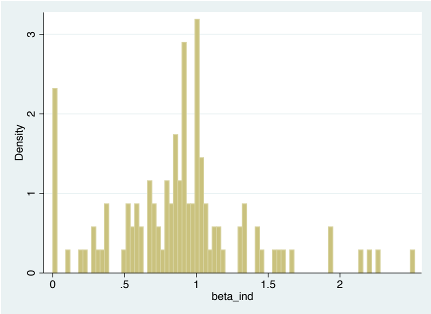


Figure 3-4: Estimates for β from choices for oneself

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

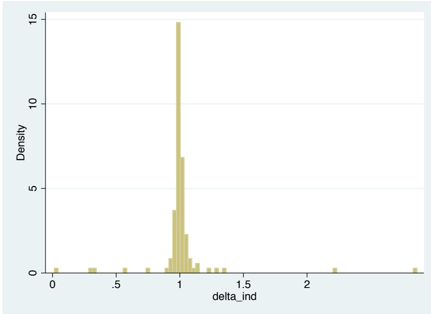


Figure 3-5: Estimates for δ from choices for oneself

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 group setting

Since 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 3-7 shows that on aggregate, α is significantly smaller than 1, which means the utility function is non-linear 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. Participants are less present-biased on average. But also, 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 3-7: Aggregate utility parameter estimates by NLS regressions

	Main		Control	
	Oneself (1)	Group (2)	Oneself (3)	Oneself (4)
β	0.849 (0.032)	0.968 (0.028)	0.9719 (0.0772)	1.0490 (0.0681)
δ	1.002 (0.002)	0.996 (0.002)	1.0125 (0.0043)	0.9962 (0.0034)
α	0.661 (0.027)	0.70 (0.025)	0.6270 (0.0888)	0.8033 (0.0520)
No. of subjects/groups	113	48	12	11
Observations	1695	1335	180	165
R-squared	0.6	0.6173	0.5605	0.6412
H0: β = 1	t = 22.65 p < 0.001	t = 1.33 p = 0.254	t = 0.13 p = 0.7231	t = 0.30 p = 0.6106
H0: δ = 1	t = 1.28 p = 0.261	t = 3.16 p = 0.082	t = 8.29 p = 0.0150	t = 0.67 p = 0.4586
H0: α = 1	t = 154.24 p < 0.001	t = 140.75 p < 0.001	t = 17.66 p = 0.0015	t = 14.91 p = 0.0181

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

Individual estimates

Figure 3-6 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, β estimates from decisions for oneself and a group are not significantly different (Wilcoxon signed-rank test, p = 0.625).

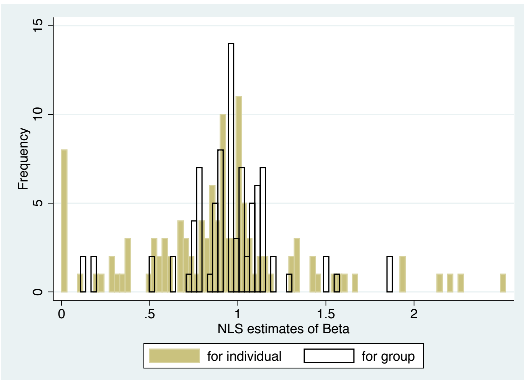


Figure 3-6: Estimate for β from choices for groups in the main treatment

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).

3.11 Appendix E: The effect of others' choices and communication on choice shifts

Table 3-8: OLS regressions of changes in choices on others' decisions and communication (I)

Dependent variable	Changes in choices	
Model	(1)	(2)
All 'more patient' others (dummy)	0.30**	0.30**
	(0.15)	(0.14)
All 'less patient' others (dummy)	0.01	0.01
	(0.14)	(0.15)
One 'more patient' and one 'less patient' others (dummy)	0.19	0.19
	(0.14)	(0.14)
One 'more patient' and one 'equally patient' others (dummy)	0.22*	0.20
	(0.12)	(0.12)
One 'less patient' and one 'equally patient' others (dummy)	0.09	0.09
	(0.13)	(0.13)
Message Treatment (dummy)	0.10	0.11
	(0.20)	(0.23)
M1: patient (dummy)	0.02	0.10
	(0.18)	(0.19)
M2: neutral (dummy)	-0.06	-0.07
	(0.14)	(0.15)
M3: impatient (dummy)	0.06	-0.10
	(0.17)	(0.15)
M4: income smoothing (dummy)	-0.10	0.02
	(0.13)	(0.19)
Option 3 chosen (dummy)	-0.37***	-0.38***
	(0.08)	(0.08)
Interest rate	0.14	0.14
	(0.09)	(0.09)
Age		-0.002
		(0.005)
Female		0.10
		(0.11)
Years in school		-0.003
		(0.02)
Membership of savings groups (dummy)		-0.04
		(0.11)
Constant	0.60*	0.78
	(0.31)	(0.50)
No. of groups	52	52
No. of observations	955	955
R^2	0.0822	0.0875

*Notes: * p < 0.1, ** p < 0.05, *** p < 0.01; Robust standard errors clustered on group level in parentheses.*

Table 3-8 shows that the overall treatment effect as well as effect of each type of received message is small and insignificant. The effect of more patient others is still significant. Also, when one other is more patient while the other is equally patient, choices are shifted (weakly) significantly toward more patient direction. This points also toward an asymmetric conformity in favor of patience as in Table 3-3.

Table 3-9: OLS regressions of changes in choices on others' decisions and communication (II)

Dependent variable	Changes in choices	
Model	(I)	(II)
All 'more patient' others (dummy)	0.32**	0.32**
	(0.14)	(0.14)
All 'less patient' others (dummy)	0.09	0.08
	(0.12)	(0.13)
One 'more patient' and one 'less patient' others (dummy)	0.21	0.21
	(0.13)	(0.13)
One 'more patient' and one 'equally patient' others (dummy)	0.23**	0.21*
	(0.11)	(0.12)
One 'less patient' and one 'equally patient' others (dummy)	0.12	0.11
	(0.13)	(0.13)
Message Treatment (dummy)	0.04	0.04
	(0.11)	(0.13)
All 'more patient' messages (dummy)	0.03	0.06
	(0.13)	(0.15)
All 'less patient' messages (dummy)	-0.58	-0.51
	(0.35)	(0.35)
One 'more patient' and one 'less patient' messages (dummy)	0.25	0.30
	(0.30)	(0.30)
One 'more patient' and one 'equally patient' messages (dummy)	-0.03	-0.02
	(0.13)	(0.15)
One 'less patient' and one 'equally patient' messages (dummy)	-0.003	0.08
	(0.22)	(0.25)
One 'more patient' and one 'neutral' messages (dummy)	0.02	0.03
	(0.23)	(0.24)
One 'less patient' and one 'neutral' messages (dummy)	0.05	0.06
	(0.32)	(0.31)
Option 3 chosen (dummy)	-0.38***	-0.39***
	(0.09)	(0.09)
Interest rate	0.16*	0.16*
	(0.09)	(0.09)
Age		-0.001
		(0.005)
Female		0.11
		(0.11)
Years in school		-0.002
		(0.02)
Membership of savings groups (dummy)		-0.04
		(0.11)
Constant	0.64**	0.82*
	(0.24)	(0.47)
No. of groups	52	52
No. of observations	955	955
R^2	0.0869	0.0917

*Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; Robust standard errors clustered on group level in parentheses. The base category for message combination is the 'neutral and equal patient'.*

Table 3-9 also shows small and insignificant effect of messages overall as well as for each combination of received messages. Again in this regression, 'all patient others' and one more patient and one equally patient others are significantly correlated to changes in choices, suggesting the asymmetric conformation toward a more patient choice shift.

3.12 Appendix F: Descriptive statistics of direction of choice shifts corresponding to others' types

Table 3-10: Effects of types of others on choice shifts for options 2 and 3 in the individual setting

Direction of choice shift / Type of others	More patient	Same	Less patient	Total
(1) More patient other(s)	149 (33.71%)	242 (54.75%)	51 (11.54%)	442 (100%)
(2) Less patient other(s)	37 (17.45%)	137 (64.62%)	38 (17.92%)	212 (100%)
(3) One more and one less patient	78 (35.94%)	93 (42.86%)	46 (21.20%)	217 (100%)
(4) Equally patient others	8 (9.52%)	68 (80.95%)	8 (9.52%)	84 (100%)
Total	272	540	143	955

Table 3-10 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 equally patient; (4) *Equally patient others*: Both other members are equally patient.

In the case of the 'more patient other(s)', a lot more decisions are shifted to the more patient direction than to the less patient direction (i.e., 33.71% vs. 11.54%). In the case of the 'less patient other(s)', the number of the 'less patient' and the 'more patient' shifts are quite similar (i.e., 17.92% vs. 17.45%). In the case of 'one more and one less other', 'more patient' shifts are more than the 'less patient' shifts as well (i.e., 35.94% vs. 21.20%).

When all members are equally patient, participants do not seem to change their choices in any direction. This result emphasizes the importance of information about others' time preferences. 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.

Table 3-11: Effects of others on choice shifts for the least patient option (option 1) in the individual setting

Direction of choice shift / Type of others	More patient	Same	Total
(1) More patient other(s)	152 (37.72%)	251 (62.28%)	403 (100%)
(2) Equally patient others	8 (11.59%)	61 (88.41%)	69 (100%)
Total	160	312	472

Table 3-12: Effects of others on choice shifts for the most patient option (option 4) in the individual setting

Direction of choice shift / Type of others	Less patient	Same	Total
(1) Less patient other(s)	139 (19.25%)	633 (81.99%)	772 (100%)
(2) Equally patient others	26 (9.42%)	250 (90.58%)	276 (100%)
Total	165	833	1048

Table 3-11 and Table 3-12 show the number of choice shifts when participants choose the least patient option and the most patient option in the individual setting, respectively. The first case in Table 3-11 is that when at least one other member is more patient than the participants. The second case is that when all members are equally patient. We can see that the percentage of the ‘more patient’ choice shift in the first case is much larger than in the second case, 37.72% vs. 11.59%. In Table 3-12 the percentage of the ‘less patient’ choice shift in the first case is larger than in the second case, 19.25% vs. 9.42%. Comparing the percentage of the first case in Table 3-11 and Table 3-12, however, show that choice shift in the direction of others’ preferences occurs more when others are more patient.

3.13 Appendix G: Instructions

Note:

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 2 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[30].

In this game, we use real money. The amount you will earn depends on your decisions 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 4 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 anytime.

Example

Let's look at the example.

[30] Walailak University is the university located in the same sub-district, Thasala, as our study site.

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 3 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).*

Explanation of the example

If you choose the first option, you choose to get THB 285 today and nothing in 3 weeks. If you choose the second option, you choose to get THB 190 today and THB 100 in 3 weeks. If you choose the third option, you choose to get THB 95 today and THB 200 in 3 weeks. If you choose the fourth option, you choose to get nothing today and THB 300 in 3 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 3 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 3 weeks *(The answer is nothing)*.

If my favorite option were to get THB 190 today and THB 100 in 3 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 4 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 his 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 1 favorite option out of 4 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 4, 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 …

You participate in this activity with your own free will.

Your decisions are kept secret in the future and the other participants will not know your decisions.

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 15 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 down 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 2 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 in 2 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 15 decisions have been made). Now we are done with the 15 decisions, the first round is over. Next, let's play the second round. The rule changes.

Round 2: ***[Variations between the group and control treatments]***

Group decision ***[for the group treatment]***

In this round, you are assigned randomly into a group of three members. In each group, there are a "shrimp", a "fish", and a "crab" *(show the chart "group")*. We do the randomization for you and randomly assign who are the "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 15 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 15 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!

Chapter 4: Speaking of patience: The role of others' preferences and communication in groups

4.1 Introduction

Intertemporal decisions are common in everyday life. Most of our decisions today have consequences in the future, for example, the decisions to save money, to exercise or to study, etc. We often give in the temptation to choose the option that offers the smaller but sooner benefit rather than choosing the option that offers the larger but later benefit. For instance, we end up spending all monthly salary without saving any cents although we planned to save as we got paid. This phenomenon can be theoretically described by present-biased preferences in the quasi-hyperbolic discounting model (Laibson, 1997). The summary article by Frederik, Loewenstein and O'Donoghue (2002) finds that on average individual discount rates decline over time, which contradicts the assumption of constant discount rates in the discounted-utility model (e.g. Samuelson, 1937). Frederik, Loewenstein and O'Donoghue (2002) show therefore that present-biased preferences indeed exist. Individuals, however, have different discount rates across a wide range suggesting heterogeneity of individual time preferences.

In many situations a single person is responsible for making intertemporal decisions that affect a group of people. For example, a president of a company decides on investment strategy that is decisive for company's long-term profit and in turn affects all stakeholders' benefit. In many cultures and areas, a household head decides on a household's financial plan that affects the livelihood of the whole family. It is crucial to ask whether making decisions on behalf of a group leads to different decisions than making decisions just for oneself.

Boonmanunt, Lauer, Rockenbach and Weiss (2017) (Chapter 3) ask this question and find in a Thai coastal village that decisions made for a group are more patient and less present-biased compared to decisions made for oneself. The explanation is that when villagers decide on behalf of a group, they conform more to a more patient member than to a less patient member. Boonmanunt, Lauer, Rockenbach and Weiss (2017) argue that patience could be considered as a socially desirable behavior. Yet, they find that communication among group members does not have an additional effect on decisions for a group. However, Sutter (2009) finds that participants invest more in a lottery to have a higher probability of winning the lottery when deciding for a group than deciding just for oneself and that communication via nonbinding messages makes participants invest even more in the lottery when deciding for a group.

Based on Boonmanunt, Lauer, Rockenbach and Weiss (2017) this chapter also studies the difference between decisions for oneself and for a group. Then I investigate the effects of two features on intertemporal decisions for a group: time preferences of other members and communication between group members. One novel feature of Boonmanunt, Lauer, Rockenbach and Weiss (2017) is to have coastal villagers, who are familiar with deciding in groups or for groups as participants, in the experiment. This fact, however, could influence their findings on the difference between decisions for oneself and for a group. In this study I therefore use a more standard subject pool, university students, to investigate whether the findings in Boonmanunt, Lauer, Rockenbach and Weiss (2017) can be generalized to a broader population without much experiences of being in groups. The students might also feel more comfortable in communication via written messages than villagers. This might allow me to study the additional effect of communication on decisions for a group more deeply.

In the experiment participants first decide just for themselves and then decide on behalf of a group with three members who are randomly matched. Prior to making decisions on behalf of the group, participants can observe other members' preferences, i.e., the choices that the other group members made for themselves in the individual setting. In order to study the additional effect of communication between members on decisions for a group on top of influence of other members' (reveal) preferences, I allow a subset of participants to communicate with each other using nonbinding free-form messages before the experiment in the group setting starts.

I find that participants choose more patiently for a group than for themselves. This is driven by both other group members' preferences as well as communication. Only when other members are more patient than the decision maker, others' preferences influence decisions for a group, while less patient preferences of others do not. This asymmetric conformity bias toward patience is along the same lines as in Boonmanunt, Lauer, Rockenbach and Weiss (2017). In contrast, however, communication plays a significant role on decisions for a group in this study. Patient messages are most persuasive. These findings suggest that there is an asymmetric conformity bias toward patience when decisions are made on behalf of a group.

4.2 Related literature

This study closely resembles the experimental design of Boonmanunt, Lauer, Rockenbach, and Weiss (2017) (Chapter 3) to disentangle mechanisms driving decisions for a group in an intertemporal context with different treatment variations. Another difference is also the subject pool: university students in this study compared to coastal villagers in Boonmanunt, Lauer, Rockenbach, and Weiss (2017).

Previous studies show that group decisions are different from individual decisions. Starting from literature on social and group identity, the main insight is that people identifying with a group behave differently from individuals, i.e., more favorably to in-group members at the expenses of out-group people (e.g. Tajfel and Turner, 1979; Chen and Li, 2009). Charness, Rigotti and Rustichini (2007), however, show that even without an out-group the salient group membership alone already affects individual behavior in coordination and prisoner's dilemma games: Individuals become more aggressive when deciding on behalf of a group. While Sutter (2009) also finds individuals invest more in a lottery to increase the chance of winning when deciding on behalf on a group than when deciding for oneself. Furthermore, Sutter (2009) argues that one important feature of group decisions is the communication between group members. Sutter (2009) finds that individuals invest even more in a lottery when deciding on behalf of a group after receiving messages from other group members.

There are two contradictory models with regard to comparison between decisions for oneself and for a group. Shapiro (2010) models a delegate as being altruistic over payoffs (and not utility) of other group members. Such delegate will make more patient and more time-consistent decisions when she decides on behalf of all members than when she decides only for herself. By contrast, Jackson and Yariv (2014) model a delegate who fully takes the time preferences of group members into account. Therefore, a delegate of a group with, for instance, present-biased preferences on average will also make present-biased decisions.

These two models show that the intertemporal decisions of a delegate depend on how much weight the delegate puts on other group members' preferences.

Previous experiments that only compare intertemporal decisions for oneself and for a group do not provide a clear picture. Abdellaoui, L'Haridon, and Parashiv (2013) invite couples in Paris to an experiment. Participants first make individual decisions separately and then they decide together. Yang and Carlsson (2016) conduct a similar experiment with spouses in rural China. Shapiro (2010) let each participant decide for oneself, for another subject. Then, both partners decide together, and lastly the participants jointly decide in a group of four members. Abdellaoui, L'Haridon, and Parashiv (2013) and Shapiro (2010) find that group decisions are more patient and less present-biased. Yang and Carlsson (2016), however, find that spouses' joint decisions lie between husbands and wives' decisions (made individually).

The independent work of Denant-Boemont, Diecidue and L'Haridon (2016) is close to this study and Boonmanunt, Lauer, Rockenbach and Weiss (2017). In their study, each participant decides both individually and then in groups under majority voting. After four mock-voting rounds, the decisions in the fifth (and last) round determine the payoffs. Group decisions are calculated by the median of all members' choices. Denant-Boemont, Diecidue and L'Haridon find that members converge their decisions toward higher patience and less present bias. This study differs in regard to the group decision mechanism. Most importantly, I explicitly study how time preferences of others and communication affect decisions on behalf of a group in a standard subject pool: university students.

4.3 Theoretical framework and hypotheses

I adopt the theoretical framework of Andreoni and Sprenger (2012), which incorporates present-biased preferences into a standard intertemporal utility function. The total utility of a stream of consumption from a present period *t* to period *T* into the future thereby becomes

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

where k is the time span; δ captures long-run discounting (a discount factor) between two future periods; and β is a parameter for present-biased preference with $0 \leq \beta < 1$. $\beta = 1$ corresponds to the case of standard exponential discounting such that the one period discount factor between a present and a future period $\beta\delta$ and the one period discount factor between two future periods δ are equal. By maximizing this utility function subject to a budget constraint Andreoni and Sprenger (2012) show that the higher the present-biased parameter β

is and/or the higher the long-run discounting δ is, the higher is the fraction of the budget allocated to the sooner date x_t.

I then extend this model to capture the situation when a delegate's decision affects other people. Assume that an agent is delegated to decide for the whole group. The agent's decision is binding for all other members and the agent cares about the utility of the other members, who could have the same, more or less patient time preference than the agent. The agent therefore takes the utility of others into account with weights for each type of preferences in the agent's utility function. The weights for the other types could be the same or different across types. The agent then maximizes the weighted discounted utility. As a result, the agent might make different decisions when deciding for the group, depending on how the agent weighs each type of preferences.[1]

Behavioral expectations

In case that the weights are zero because the delegate cares only about her own utility, thus the **null hypothesis** is that decisions for oneself and for a group are not different.

In case that the delegate has the same weights greater than zero for all types of others, then she will behave like a (neutral) conformist. This identical weight yields the **symmetric conformity hypothesis**. It states that subjects react in the same way toward the decisions of a more patient and a less patient player when deciding for a group. Symmetric conformity, however, does not change the average decision in the group setting compared to the individual setting. This is because to the same extent that patient delegates become less patient and impatient delegates become more patient. In case that the delegate puts different weights to different type of preferences when deciding for a group, the average decision in the group setting will differ from the one in the individual setting. I call this the **asymmetric conformity hypothesis**.

Communication could decrease social distances between the delegate and other members. This could in turn lead to higher weights on others' utilities (Hoffman, McCabe and Smith, 1996) and stronger conformity toward others' preferences when decisions are made for a group. This yields the **communication hypothesis**.

4.4 The experimental design

The experimental design in this study is based on the experimental design used in Boonmanunt, Lauer, Rockenbach, and Weiss (2017)(Chapter 3). To elicit subjects' time preferences, subjects have to make a battery of decisions. For this, the convex time budget

[1] See detailed formal calculation and the model in Appendix A.

method is implemented based on Andreoni and Sprenger (2012), Andreoni, Kuhn and Sprenger (2015), and Lührmann, Serra-Garcia and Winter (2014). I use three time frames: (I) today and 2 weeks, (II) today and 4 weeks, and (III) 2 weeks and 4 weeks. The degree of present-biasedness (β) can be identified by comparing choices made in (I) and (III), as both time frames have the same time span of two weeks, but the sooner date in (I) is immediate while it is in 2 weeks in (III). The long-run[2] discounting parameter (δ) can be identified by choices made in time frame (III) since both payment days are in the future.

The maximum experimental budget (M) is always THB 300 (about USD 9),[3] which is the minimum daily wage in Thailand. I use five interest rates for each time frame, from 5% to 100% for two weeks.[4] These are much larger than the market interest rate at commercial banks.[5]

4.4.1. Decisions

Table 4-1: Decisions in time frame I (today,+2weeks)[6]

No.	Payment dates	Option 1	Option 2	Option 3	Option 4	t (sooner date)	k (delay days)	P (gross interest rate)
1	TODAY AND in 2 WEEKS	285 0 Baht	190 Baht 100 Baht	95 Baht 200 Baht	0 Baht 300 Baht	0	14	1.05
2	TODAY AND in 2 WEEKS	270 Baht 0 Baht	180 Baht 100 Baht	90 Baht 200 Baht	0 Baht 300 Baht	0	14	1.11
3	TODAY AND in 2 WEEKS	240 Baht 0 Baht	160 Baht 100 Baht	80 Baht 200 Baht	0 Baht 300 Baht	0	14	1.25
4	TODAY AND in 2 WEEKS	210 Baht 0 Baht	140 Baht 100 Baht	70 Baht 200 Baht	0 Baht 300 Baht	0	14	1.43
5	TODAY AND in 2 WEEKS	150 Baht 0 Baht	100 Baht 100 Baht	50 Baht 200 Baht	0 Baht 300 Baht	0	14	2

Note: The last three columns are not shown to participants.

Table 4-1 summarizes all five decisions (rows in the table) for time frame I (today,+2weeks). The corresponding parameters are shown in the last three columns. The options stay the same in time frame II (today,+4weeks) and time frame III (+2weeks,+4weeks). For each decision, subjects have to choose one favorite budget allocation out of four options. Option 4 offers the highest total payoff of THB 300, but subjects have to wait to get money at the later date. Option 1 offers the whole budget on the sooner date but discounted by the corresponding interest rate. The sum payoffs over both dates increases with the option number. Option 4 is therefore the most patient option, while

[2] Following Andreoni, Kuhn and Sprenger (2015), we denote delta as long-run discounting parameter.

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

[4] See more details about the standardized daily rate and the annual rate of decisions in Appendix B.

[5] The average annual deposit interest rate in Thailand in 2014 is around 2.00% (The World Bank, 2016).

[6] See complete 15 decisions for all three time frames in Appendix B.

option 1 is the least patient option. All subjects have to go through all 15 decisions, i.e., five decisions for each time frame, which are presented one at a time.

4.4.2. Treatments

Subjects are informed at the beginning of the experiment that there are two decision settings and that the rules of the second setting will be explained after all subjects have finished the first setting. The within-subject design is employed in order to see whether subjects change choices when deciding for a group instead of deciding just for themselves. There are three treatments as follows.

Group treatment (N = 57)

For the Group treatment, subjects decide individually just for themselves in the first setting. In the second setting, subjects decide as a group member, whose decision could represent the group decision. They are randomly matched into groups of three members. To keep the identities of the group members anonymous, I use the symbols “Shrimp”, “Crab”, and “Fish”, to represent each member. Subjects make 15 decisions in each setting, which makes 30 decisions in total. Most importantly, in order to study how other members’ choices affect subjects’ choices for the group, subjects can observe the options that the other two group members made for themselves in the individual setting before subjects make a choice for their groups. For the payoffs, one randomly selected group member acts as a delegate (after all decisions are made), whose choice is binding for all three members.

Message treatment (N = 48)

In order to study a stronger form of group decision as discussed in Sutter (2009), communication between group members is added in this treatment. Communication is implemented by the opportunity to exchange nonbinding free-form messages among group members before the group setting starts. In each round of message exchange, each subject has to send one message to each group members, so each subject receives two separate messages from the two other members. Subjects can write on sheets of paper any kind of message, except revealing their identity, threaten or negotiate outside options. They are asked to write about decisions in the game, for instance suggestions for other members, their own choices in the individual setting or their intended choices in the group setting. All participants followed these instructions.

There are two variations of this treatment: (a) 21 subjects exchange messages only once (M1) and (b) 27 subjects exchange messages for three rounds (M3). Three rounds of exchanging messages are intended to mimic more intense communication between group members. I find, however, no difference between choices and time preferences between the M1 and M3, neither in choices made for oneself nor in choices made for a group (see test results in Appendix C). As such, to increase statistical power in the analysis of the effect of communication, both variations are pooled together into the “Message” treatment.

In addition, participants can observe other group members’ choices in the individual setting before making every (of the 15) decision for groups, as in the Group treatment. In this way, I can disentangle the additional effect that messages have on choices for a group on top of other members’ preferences. Therefore, each participant is informed about other group members through two channels: other members’ choices made just for themselves in the individual setting (revealed preferences) and the messages.

Control treatment (N = 27)

In order to control for possible learning effects between the individual setting and the group setting, I run a control treatment, in which subjects decide just for themselves in the individual setting twice.

4.4.3. Payment

One out of all 30 decisions is randomly drawn to determine the actual payment. In case a decision from the individual setting is drawn, participants receive the payment according to their own choices made for themselves. In case a decision from the group setting is drawn, a delegate (one out of the three symbols) is drawn randomly. The delegate’s choice for the group then determines the payments for all three members. With this mechanism, all decisions are payoff-relevant and income effects can be avoided. The show-up fee is THB 100 (around USD 3).

In order to keep participants’ trust level in receiving payments constant across payment dates, all payments are made via bank transfer, including payments that were supposed to be due on the experimental days.

4.4.4. Experimental procedure

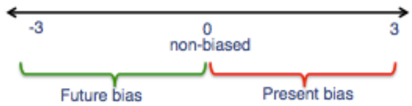
The experiment was conducted on 25-27 April 2015 at the Kasertsart University in Bangkok, Thailand. The participants were university students from different disciplines. In total, 132 students (68% female) participated across all treatments. The experiment took around 80 minutes in the Group treatment, 90 minutes in the Message treatment and 60 minutes in the control treatment. The total average earning was THB 387.65 (about USD 12).

4.4.5. Measures of (revealed) time preferences

The reduced-form measures of time preferences are used so that I can avoid making assumptions on the utility function that would be required if I estimated parameters in a structural-model framework (Sutter et al., 2013 use the non-parametric measures due to this argument).[7]

The reduced-form measure of present-biasedness is calculated as the difference between the average of the five choices made for time frame III (+2weeks,+4weeks) and for time frame I (today,+2weeks). If a participant is non-biased, then she chooses the same option in both time frames, and the measure is zero.[8] If a participant is present-biased, she chooses the higher options (more patient), and then the measure is positive. The opposite holds for a future-biased participant.

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



The reduced-form measure of long-run discounting is calculated as the average of the five choices made in time frame III (+2weeks, +4weeks), in which both payment dates are in the future. Present-biasedness, therefore, does not play a role.

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

4.5 Results

First, I check the rationality of choices according to the law of demand.[9] I find that only 2.27% of all participants made an extremely irrational shift, which is when participants change from the most patient option (option 4) to the least patient option (option 1) as the interest rates increase. There are, however, small and non-extreme shifts. Nevertheless, the share of rational choices is very high: 89.72% of all choices made for oneself and 93.38% of

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[7] I also estimate parameters β_i and δ_i of the utility function based upon Equations (A4.6) and (A4.7) in Appendix A. However, I cannot estimate individual parameters of those participants who did not alter the choice at all across 15 decisions, since no variation in choices make it insufficient for the estimation. For decisions in the individual setting, our sample is reduced by 19 subjects (out of 132). For decisions in the group setting, the sample is additionally reduced by 15 subjects. The main results of this method are not different from using the actual choices and reduced-form measures. Appendix D shows our results for this estimation.

[8] The problem with this measure of present-biasedness 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 some cases falling into this situation; 9 out of 42 non-biased participants in the individual setting and 5 out of 57 non-biased participants in the group setting. Excluding these participants, results remain similar. We therefore include them in the analysis.

[9] Choices are rational when participants allocate less to the sooner date, which means opting for a higher option when the interest rate increases.

choices made for a group. All decisions are then included in the analysis, since the main results stay the same when irrational choices are excluded.

4.5.1. Choices for oneself versus for a group

The first question to be answered in this study is whether participants decide differently when deciding for oneself and for a group. Table 4-2 summarizes the means of choices (chosen options) and measures of time preferences in individual and group settings in all treatments.

Table 4-2: Means of choices (chosen options) and measures of time preferences in both settings in each time frame and treatment

	(1) Group			**(2) Message**			**(3) Control**		
	For oneself	For a group	**Diff-erence**	For oneself	For a group	**Diff-erence**	For oneself	For oneself	**Diff-erence**
Overall	3.20	3.35	**0.15*** **	3.41	3.56	**0.15*** **	3.13	3.21	**0.08**
Time frame I (today,+2wks)	3.17	3.34	**0.17** **	3.43	3.61	**0.18*** **	3.2	3.33	**0.13**
Time frame II (today,+4wks)	3.11	3.23	**0.12** **	3.25	3.45	**0.20*** **	2.98	3.07	**0.09**
Time frame III (+2wks,+4wks)	3.32	3.49	**0.17** **	3.55	3.63	**0.08** **	3.21	3.26	**0.05**
Measure of present-biasedness	0.15	0.15	**0**	0.12	0.02	**-0.10***	0.01	-0.07	**-0.08**
Measure of long-run discounting	3.32	3.49	**0.17** **	3.55	3.63	**0.08** **	3.21	3.26	**0.05**

*Note: * p < 0.1, ** p < 0.05, *** p < 0.01. Wilcoxon signed-rank test between options chosen in both settings, as well as measures of time preferences.*

Control treatment

In the control treatment, in which the participants decide for oneself twice, I find no difference between choices as well as measures of time preferences across both rounds (Wilcoxon signed-rank tests: p-values are 0.62, 0.40, 0.22, 0.44 for overall choices and choices in time frames I, II and III, respectively; p-values are 0.76 and 0.44 for measures of present-biasedness and long-run discounting, respectively).

Result 1: Participants do not “learn” over time when deciding just for oneself. Rather they tend to stick to their choices.

Group treatment

In the Group treatment, group members in the group setting can observe preferences of other group members (choices made in the individual setting). Participants in this treatment choose on average significantly more patient options when deciding for a group than when deciding just for oneself overall and in all time frames (Wilcoxon signed-rank test, p-values are 0.009 for choices overall and 0.03 in each time frames). While the measure of long-run discounting is significantly higher, which corresponds to the changes in choices in time frame III, the measure of present-biasedness, however, has not changed (Wilcoxon signed-rank test, p = 0.86). This is because choices change to a similar extent in time frame I (the short-run time frame) and in time frame III (the long-run time frame). See column “Difference” of Group treatment in Table 4-2.

The results in control and Group treatments indicate that participants decide more patiently for a group than for oneself due to the group effect and not from experience gained during the experiment.

Result 2: Participants choose more patient options when they decide for a group, whose members’ time preferences can be observed. However, their measures of present-biasedness remain unchanged.

4.5.2. Communication

In the Message treatment, I add the opportunity to exchange messages to the Group treatment. The difference between decisions in the Group and Message treatments can reveal the additional effect of exchanging messages among members, which is a simple form of communication, on decisions made for a group.

Before the experiment in the group setting starts, each participant receives separate messages from two other group members. Therefore, there are different combinations of messages that participants can get. The combinations of message types are categorized as follows: The most frequently received message type is ‘Patient messages’, which is when participants receive messages that try to convince them to be patient[10] or the combination of patient and neutral[11] messages. The second most received message type is ‘Twisted messages’ that suggest receivers to choose a less patient option in decisions with lower interest rate and to choose a more patient option in decisions with higher interest rate.[12] The next type is ‘Patient and twisted messages’ when receivers get patient and twisted messages. ‘Patient and impatient messages’ is when receivers get a message suggesting patient decision and the other suggesting an impatient[13] decision. Then, there are ‘Twisted and impatient

[10] Example for a patient message: “Choose option 4 because it offers the highest total payoff although we have to wait to have it all.”

[11] Example for a neutral message: “Choose whatever choice you want.”

[12] Example for a twisted message: “If we get the payoff of 290 or 285 Baht today, which is not much different from 300 Baht, then please choose option 1. But if we will get only 260 Baht today, please choose option 4. I can wait.”

[13] An impatient message: “Do not choose option 4. We have to wait for so long. I have to use money at this moment. Actually, choose want you want :).”

messages' and lastly 'neutral messages'. The numbers of participants who received each type of messages are listed in Table 4-3.

Table 4-3: Number of participants who receive each type of messages

Types of messages	**No. of participants**
Patient messages	23
Twisted messages	14
Patient and twisted messages	8
Patient and impatient messages	1
Twisted and impatient messages	1
Neutral messages	1

Overall participants with the opportunity to exchange messages choose significantly more patient options for a group than for oneself and also in all three time frames (Wilcoxon signed-rank test, p-values are 0.003, 0.007, 0.003 and 0.03 for choices overall and in time frames I, II and III, respectively). Consequently, the measure of long-run discounting increases significantly as the choices in the long-run time frame (time frame III). The reduction of the measure of present-biasedness is weakly significant (Wilcoxon signed-rank test, $p = 0.07$) as participants choose more patient options in time frame I, the short-run time frame, to the higher extent than in time frame 3, the long-run time frame (Wilcoxon signed-rank test of the difference between time frames I and III in difference between choices in the individual and group settings, $p = 0.07$). This result can be driven by the fact that the patient messages could be able to convince participants to choose more patient options even in the short-run time frame.

Result 3: With communication, participants choose more patient options and tend to become less present-biased when deciding for a group.

4.5.3. Effects of others' preferences and communication

Beyond showing the difference between intertemporal choices made for oneself and for a group, this study also tries to figure out the possible underlying explanations for these differences: influences of others' preferences and communication among members. In this section, I examine therefore the effects of other group members' choices (i.e., revealed preferences) and messages on decisions for a group. Hence, I focus on changes in choices overall.

Let us start with situations in which participants chose the intermediate options (option 2 and option 3) in the individual setting, as from there participants could change their choices for a group in both directions, more or less patiently. Table 4-4 shows linear regressions of the extent of choice changes in the group setting from the individual setting. The explanatory variables are the five dummies that correspond to each combination of others' choices in the individual setting. As participants can only observe other members' choices and consider whether or not to conform to those choices, others' preferences are likely to be considered in relative terms, i.e., whether other members are more, equally or less patient. The base category is all three members being equally patient. The explanatory variables also include the dummies that represent each type of messages as described in the previous section. The cases with impatient messages are dropped from the analysis, because only one participant sent the impatient message. Thus, there is only one participant each in the case of 'patient and impatient messages' and 'twisted and impatient messages'.

Since quite an amount of participants receive 'Twisted messages', which suggest receivers to be impatient when the interest rate is low and then to switch to be patient when the interest rate is high, it is important to have interactions between each message type and interest rates in the regressions.

With regards to others' preferences, Table 4-4 (model I) shows that only more patient others (in the first case) have a significant positive relationship to the changes in choices in the group setting. On the other hand, the negative correlation of less patient others and choice shifts is not significant (the second case). In all remaining cases, others' preferences do not have any significant correlation with choice shifts.

Now let us turn to the effects of messages on choice shifts from choices for oneself to choices for a group in model (I). The complete relationship between each type of messages and the choice shifts is the sum of the coefficients of each message type dummy and its corresponding interaction term with interest rate. I begin with 'patient message' when (1) participants receive only messages suggesting to choose the patient option or (2) they receive patient and neutral messages. The positive coefficients of the dummy and the interaction term would mean that 'patient message' always leads to a more patient option when decisions are made for a group than when decisions are made for oneself. This effect is, however, not significant.

Table 4-4: OLS regressions of changes in choices in the group setting for situations when options 2 and 3 were chosen in the individual setting

Dependent Variable	Changes in choices	
Model	(1)	(2)
All 'more patient' others (dummy)	0.37***	0.37***
	(0.13)	(0.12)
All 'less patient' others (dummy)	-0.33	-0.30
	(0.27)	(0.28)
One 'more patient' and one 'less patient' others (dummy)	0.03	0.02
	(0.16)	(0.16)
One 'more patient' and one 'equally patient' others (dummy)	0.05	0.05
	(0.11)	(0.11)
One 'less patient' and one 'equally patient' others (dummy)	-0.12	-0.10
	(0.16)	(0.16)
Interest rate	0.22	0.21
	(0.21)	(0.20)
Patient message (dummy)	0.10	0.13
	(0.41)	(0.41)
Twisted message (dummy)	-2.20***	-2.10***
	(0.58)	(0.56)
Patient and twisted message (dummy)	-0.73	-0.77
	(0.49)	(0.46)
Patient message * Interest rate	0.33	0.31
	(0.29)	(0.30)
Twisted message * Interest rate	1.38***	1.35***
	(0.43)	(0.42)
Patient and twisted message * Interest rate	0.85***	0.90***
	(0.30)	(0.30)
Option 3 chosen (dummy)	-0.44***	-0.44***
	(0.10)	(0.09)
Female		0.14*
		(0.08)
Age		0.01
		(0.04)
Monthly expenditure		<0.001
		(<0.001)
Constant	1.17***	0.91
	(0.31)	(0.83)
No. of groups	35	35
No. of observations	569	569
R^2	0.2811	0.2876

*Note: * p < 0.1, ** p < 0.05, *** p < 0.01; Robust standard errors clustered on the group level in parentheses.*

Next I look at the case of ‘twisted messages’, in which (1) participants receive only messages saying that they should be impatient when the interest rate is low and be patient when the interest rate is high or (2) they receive the twisted and neutral messages. The sum of the coefficients of the dummy (-2.20 in model I) and the interaction (1.38 in model I) suggest that when the interest rate is lower than 59%[14], which is the first four interest rates, choices for a group are significantly shifted toward a less patient option. On the contrary, when the interest rate is larger than 59%, which is the last interest rate, choices for a group are shifted

[14] This interest rate is the threshold for the interest rate that will make no shift. This interest rate is calculated by the ratio of the coefficient of the dummy to the coefficient of the interaction term and then minus 1.

toward the more patient direction. These findings indicate that the 'twisted messages' are also persuasive.

In the combining case of patient and twisted messages, the sum of dummy coefficient and interaction coefficient is always positive for all interest rates in this study. There is no switching point anymore. This means that patient messages have somewhat higher influence than twisted messages on choices for a group.

Now I turn to situations in which participants chose the least patient option (option 1) and the most patient option (option 4) in the individual setting. In the following analysis, the difference between the average of others' choices and one's own choice (in the individual setting) is used to represent other members' preferences relative to one's own preference. This implies that other members can only be more or equally patient in the former situation, while they can only be less or equally patient in the latter situation. The dummies of each message type as well as their interaction terms with interest rate on choice shifts are also included in the regressions for these situations.

Table 4-5 (model I) shows that starting from the least patient option (option 1) in the individual setting, others' preferences have a insignificant positive effect on the choice shift in the group setting. Messages have more effects than others' preferences in this situation. 'Twisted message' is convincing with the threshold interest rate of 22.0%, meaning that a more patient option is chosen when the interest rate is higher than 22.0%, which is the last three interest rates. In the 'Patient and twisted messages' case, the threshold interest rate becomes lower, namely only 18.2%, indicating that patient messages can convince participants to choose a more patient option at a lower interest rate compared to a pure 'twisted message' case.

In situations, in which the most patient option (option 4) was chosen in the individual setting, Table 4-5 (III) shows that others' preferences do not play a role in choice shifts from choices made for oneself to choices made for a group. 'Patient messages' prevent participants in this situation from becoming less patient when deciding for a group compared to when deciding for oneself. 'Twisted messages' are also persuasive in the sense that choices are shifted impatiently only at the first four interest rates, not at all interest rates. When patient and twisted messages are combined, only choices at the first interest rate are shifted impatiently. Taken together, patient messages are more persuasive than twisted messages when choices are made for a group.

Table 4-5: OLS regressions of changes in choices in the group setting for situations when the least or the most options were chosen in the individual setting

Dependent Variable	Changes in choices: Option 1 (least patient)		Changes in choices: Option 4 (most patient)	
Model	(I)	(II)	(III)	(IV)
Difference between an average of others' choices and one's own choice	0.21 (0.16)	0.15 (0.17)	0.04 (0.04)	0.04 (0.04)
Interest rate	-1.59*** (0.26)	-0.99** (0.46)	0.12* (0.07)	0.13* (0.07)
Patient message (dummy)			0.40*** (0.14)	0.42*** (0.13)
Twisted message (dummy)	-8.15*** (1.98)	-7.85*** (1.60)	-1.05*** (0.32)	-1.06*** (0.30)
Patient and twisted message (dummy)	-11.97*** (0.82)	-11.50*** (0.81)	-0.13 (0.12)	-0.15 (0.12)
Patient message * Interest rate	-	-	-0.17* (0.08)	-0.17** (0.08)
Twisted message * Interest rate	6.68*** (1.86)	6.57*** (1.57)	0.63*** (0.19)	0.62*** (0.18)
Patient and twisted message * Interest rate	10.13*** (0.63)	10.77*** (0.62)	0.13* (0.08)	0.14* (0.08)
Female		0.93*** (0.30)		-0.06 (0.05)
Age		0.11 (0.12)		-0.007 (0.008)
Monthly expenditure		<0.001 (<0.001)		<0.001 (<0.001)
Constant	2.42*** (0.50)	-0.42 (2.33)	-0.33*** (0.12)	-0.20 (0.20)
No. of groups	26	26	35	35
No. of observations	102	102	871	871
R^2	0.3196	0.4831	0.0941	0.0975

*Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; Robust standard errors clustered on the group level in parentheses.*

To sum up, the influences of all message types on choices for a group are consistent for all choices made in the individual setting with patient messages being most persuasive. All results are robust when socio-economic control variables are included as shown in Table 4-4 (II) and Table 4-5 (II) and (IV). This is consistent with the communication hypothesis.

Result 4: Preferences of other group members seems to be persuasive when choices are made for a group only when both group members are more patient than the decision maker.

Result 5: Communication plays a significant role when choices are made for a group. Patient messages are most influential compared to other types of messages.

4.5.4. The role of communication across subject pools

As a similar experiment was conducted with Thai coastal villagers (Boonmanunt, Lauer, Rockenbach and Weiss, 2017)(Chapter 3), the findings across subject pools can be compared. The most significant difference of the results across subject pools is the role of communication in the group setting. While communication does not have any additional effect on choices for a group on top of others' preferences among coastal villagers, it plays a tremendous role on the choices made for a group of university students. A possible explanation could be that students are more familiar with communication by exchanging written messages, while this is uncommon among villagers. For future studies, a more appropriate way to study communication in such a subject pool like villagers still has to be found. This method should give villagers or people with a limited literacy more comfort in communication while guarantee anonymity at the same time, which might have not been given in Boonmanunt, Lauer, Rockenbach and Weiss (2017).

4.6 Discussion and conclusion

This study compares intertemporal decisions made for oneself and for a group of Thai university students. I also examine two possible factors that underlie decisions on behalf of a group in an intertemporal context: other members' time preferences and communication between members, as in Boonmanunt, Lauer, Rockenbach and Weiss (2017). In line with Boonmanunt, Lauer, Rockenbach and Weiss (2017), I find that choices made for a group are significantly more patient than those made for oneself. Both channels contribute to the changes in choices for a group from choices for oneself, but in different ways.

Other members' preferences lead to changes in choices for a group from choices for oneself only when other members are more patient than the decision maker. While all types of messages are persuasive, patient messages have the largest influence on choices for a group. It might be that social desirability of patience causes this asymmetric conformity toward patience. As discussed in Boonmanunt, Lauer, Rockenbach and Weiss (2017) patience is sometimes considered to be a desirable trait across regions and cultures. For example, proverbs from different parts of the world encourage people to be patient, as do various religions and philosophers.[15] This conjecture connects this study to the study by Bolton, Ockenfels and Stauf (2015), which also finds asymmetric conformation in risky contexts. They find that decision makers tend to adjust their decisions toward risk aversion when they learn that a passive player is more risk-averse. On the other hand, decision makers do not adjust their decisions when a passive player is less risk-averse. This suggests

[15] In the Bible, it is stated, for example, that "Be patient toward all men". Buddha said also, for example, "And invulnerable armor is patience". Proverbs from different parts of the world tell people to be patient. For instance, a German proverb says, "Patience is a bitter plant, but it has sweet fruit". A Chinese proverb says, "Patience and the mulberry leaf becomes a silk gown", and a Kanuri proverb says, "At the bottom of patience is heaven".

asymmetric conformation toward risk aversion. Taken together, both risk aversion and patience might be considered socially desirable behaviors.

To sum up, the difference between intertemporal decisions for oneself and for a group due to an asymmetric conformation bias toward patience in university students is in line with the findings in coastal villagers. This suggests that these results are robust in a more standard subject pool without any experience of intensively being in groups in the real world.

For future research, it would be interesting to investigate the influence of others' preferences on choices for oneself to get better understanding about conformity in intertemporal contexts. Furthermore, extending this research to children subject pool might provide possible interventions that make children be more patient.

4.7 Appendix A: The theoretical framework

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

$$D(k) = \begin{cases} 1 & if\ k = 0 \\ \beta\delta^k & if\ k > 0, \end{cases} \tag{A4.1}$$

where $D(k)$ is the discount function; k is time period; δ is a discount factor; and β is a parameter for present-biased preference with $0 \le \beta < 1$. $\beta = 1$ 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:

$$U_t = u(c_t) + \beta\sum_{k=1}^{T}\delta^k u(c_{t+k}) \tag{A4.2}$$

Assume a time-separable CRRA utility function[16], 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 et al., 2015; Lührmann et al., 2014). The utility function has the following form:

$$U(x_t, x_{t+k}) = \begin{cases} x_t^\alpha + \beta\delta^k x_{t+k}^\alpha & if\ t = 0 \\ x_t^\alpha + \delta^k x_{t+k}^\alpha & if\ t > 0, \end{cases} \tag{A4.3}$$

where x_t is the amount allocated to the sooner date, while x_{t+k} is the amount allocated to the later date. The parameter α captures the curvature of the utility function.

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

$$Px_t + x_{t+k} = Y, \tag{A4.4}$$

where P is the gross interest rate, Y is the budget.

Maximizing (3) subject to (4) gives the following conditions:

$$\frac{x_t}{x_{t+k}} = (P\beta^{t_0}\delta^k)^{\frac{1}{\alpha-1}}, \tag{A4.5}$$

where t_0 is an indicator for whether $t = 0$. Rewriting the equation by substituting $x_{t+k} = Y - Px_t$ (from equation (4)) gives:

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

$$x_t = \frac{Y(P\beta^{t_0}\delta^k)^{\frac{1}{\alpha-1}}}{1+P(P\beta^{t_0}\delta^k)^{\frac{1}{\alpha-1}}}. \tag{A4.6}$$

This Equation (6) 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 (5):

$$\ln\left(\frac{x_t}{x_{t+k}}\right) = \frac{\ln(\beta)}{\alpha-1}t_0 + \frac{\ln(\delta)}{\alpha-1}k + \frac{1}{\alpha-1}\ln(P). \tag{A4.7}$$

We extend the model described in Andreoni, Kuhn and Sprenger (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.

<u>Case 1</u>: 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.

<u>Case 2</u>: 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

$$U_i = \omega_i\left(x_{i,t}^{\alpha} + \beta_i^{t_0}\delta_i^k x_{i,t+k}^{\alpha}\right) + \sum_{\substack{j=0 \\ j\neq i, j\neq h, j\neq l}}^{n} \omega_j\left(x_{i,t}^{\alpha} + \beta_i^{t_0}\delta_i^k x_{i,t+k}^{\alpha}\right) \qquad \text{(A4.8)}$$

$$+ \sum_{\substack{h=0 \\ h\neq i, h\neq j, h\neq l}}^{m} \omega_h\left(x_{h,t}^{\alpha} + \beta_h^{t_0}\delta_h^k x_{h,t+k}^{\alpha}\right)$$

$$+ \sum_{\substack{l=0 \\ l\neq i, l\neq j, l\neq h}}^{q} \omega_l\left(x_{l,t}^{\alpha} + \beta_l^{t_0}\delta_l^k x_{l,t+k}^{\alpha}\right)$$

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:

$x_t^G = x_{i,t} = x_{j,t} = x_{h,t} = x_{l,t}$ and $x_{t+k}^G = x_{i,t+k} = x_{j,t+k} = x_{h,t+k} = x_{l,t+k}$.

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

$$U_i = \omega_i \cdot u_i + \omega_j \cdot u_j + \omega_h \cdot u_h + \omega_l \cdot u_l, \qquad \text{(A4.9)}$$

where $\sum \omega = 1$ and $\omega_i = \omega_j$.

Maximizing the weighted utility (9) in the case that all types exist, subject to the budget constraint: $Px_t^G + x_{t+k}^G = Y$, gives the following condition.

FOC: $\frac{x_t^G}{x_{t+k}^G} = \left(P\left((\omega_i + \omega_j)\beta_i^{t_0}\delta_i^k + \omega_h\beta_h^{t_0}\delta_h^k + \omega_l\beta_l^{t_0}\delta_l^k\right)\right)^{\frac{1}{\alpha-1}}$ (A4.10)

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

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

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

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

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.

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

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

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

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

$$\omega_h > \omega_l$$

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.

Agent i decides therefore 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 member

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

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

Case 3.2: With a same patient member

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

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

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 member

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

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

Case 4.2: With a same patient member

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

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

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

4.8 Appendix B: Design for time-preference elicitation

Table 4-6: 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	3598.47
0	14	1.43	3.71	12564.12
0	14	2	5.08	100479.55
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	2116.61
0	28	2	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	3598.47
14	14	1.43	3.71	12564.12
14	14	2	5.08	100479.55

Note: The effective annual interest rate is quarterly compounded.

Table 4-7: Complete decisions

No.	Payment dates	Option 1	Option 2	Option 3	Option 4	t (sooner date)	k (delay days)	P (gross interest rate)
1	TODAY	285	190 Baht	95 Baht	0 Baht	0		
	AND in 2 WEEKS	0 Baht	100 Baht	200 Baht	300 Baht		14	1.05
2	TODAY	270 Baht	180 Baht	90 Baht	0 Baht	0		
	AND in 2 WEEKS	0 Baht	100 Baht	200 Baht	300 Baht		14	1.11
3	TODAY	240 Baht	160 Baht	80 Baht	0 Baht	0		
	AND in 2 WEEKS	0 Baht	100 Baht	200 Baht	300 Baht		14	1.25
4	TODAY	210 Baht	140 Baht	70 Baht	0 Baht	0		
	AND in 2 WEEKS	0 Baht	100 Baht	200 Baht	300 Baht		14	1.43
5	TODAY	150 Baht	100 Baht	50 Baht	0 Baht	0		
	AND in 2 WEEKS	0 Baht	100 Baht	200 Baht	300 Baht		14	2
6	TODAY	285 Baht	190 Baht	95 Baht	0 Baht	0		
	AND in 4 WEEKS	0 Baht	100 Baht	200 Baht	300 Baht		28	1.05
7	TODAY	270 Baht	180 Baht	90 Baht	0 Baht	0		
	AND in 4 WEEKS	0 Baht	100 Baht	200 Baht	300 Baht		28	1.11
8	TODAY	240 Baht	160 Baht	80 Baht	0 Baht	0		
	AND in 4 WEEKS	0 Baht	100 Baht	200 Baht	300 Baht		28	1.25
9	TODAY	210 Baht	140 Baht	70 Baht	0 Baht	0		
	AND in 4 WEEKS	0 Baht	100 Baht	200 Baht	300 Baht		28	1.43
10	TODAY	150 Baht	100 Baht	50 Baht	0 Baht	0		
	AND in 4 WEEKS	0 Baht	100 Baht	200 Baht	300 Baht		28	2
11	in 2 WEEKS	285 Baht	190 Baht	95 Baht	0 Baht	14		
	AND in 4 WEEKS	0 Baht	100 Baht	200 Baht	300 Baht		14	1.05
12	in 2 WEEKS	270 Baht	180 Baht	90 Baht	0 Baht	14		
	AND in 4 WEEKS	0 Baht	100 Baht	200 Baht	300 Baht		14	1.11
13	in 2 WEEKS	240 Baht	160 Baht	80 Baht	0 Baht	14		
	AND in 4 WEEKS	0 Baht	100 Baht	200 Baht	300 Baht		14	1.25
14	in 2 WEEKS	210 Baht	140 Baht	70 Baht	0 Baht	14		
	AND in 4 WEEKS	0 Baht	100 Baht	200 Baht	300 Baht		14	1.43
15	in 2 WEEKS	150 Baht	100 Baht	50 Baht	0 Baht	14		
	AND in 4 WEEKS	0 Baht	100 Baht	200 Baht	300 Baht		14	2

4.9 Appendix C: Choices and measures of time preferences in M1 and M3 treatments

Table 4-8: Choices and measures of time preferences in M1 and M3 treatments

	M1		M3	
	For oneself	For a group	For oneself	For a group
Overall	3.49	3.69	3.34	3.46
Time frame I (today,+2wks)	3.46	3.70	3.4	3.54
Time frame II (today,+4wks)	3.34	3.61	3.18	3.33
Time frame III (+2wks,+4wks)	3.67	3.76	3.45	3.53
Measure of present bias	0.2	0.06	0.05	-0.01
Measure of discounting	3.67	3.76	3.45	3.53

Choices in the individual setting are not significant different between M1 and M3 treatments overall and for every time frame (Mann-Whitney rank-sum test, p-values are 0.28 overall and 0.63, 0.52 and 0.31 for time frames I, II and III, respectively). Choices in the group setting are also not significantly different between M1 and M3 overall and for every time frame (Mann-Whitney rank-sum test, p-values are 0.25 overall and 0.48, 0.49 and 0.48 for time frames I, II and III, respectively).

The measures of time preferences between M1 and M3 in both individual and group settings are not significantly different (Mann-Whitney rank-sum test, p-values are 0.28 for individual present bias, 0.45 for individual long-run discounting, 1 for present bias in the group setting and 0.48 for long-run discounting in the group setting).

4.10 Appendix D: 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 (A4.7) as a linear model. However, there is a problem at the corner solutions that the allocation ratio $\ln\left(\frac{x_t}{x_{t+k}}\right)$ is not well defined. To address this issue, the non-linear least squares regression, based on Equation (A4.6) 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 no variation in choices make it insufficient for the estimation. For decisions in the first round, 19 participants showed no variation in their choices. For decisions in the second round, additional 15 participants are dropped.

Estimates of parameters for choices in the individual setting

Aggregate estimates

The aggregate estimates of parameters from choices in the individual setting by the NLS regression are more evidence for present bias on the aggregate level. The aggregate estimate of β is 1.38, which is larger than 1.00, and the difference is statistically not significant (Wald test, $p = 0.15$). On the other hand, the aggregate estimate of δ is 1.00 and is not significantly different from 1 (Wald test, $p = 0.46$). 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 0.84 and significantly differs from 1 (Wald test, $p < 0.001$). This indicates that the utility function is not linear, but concave.

Individual estimates

Figure 4-1 shows the distribution of the estimates for β from the choices in the individual setting by the NLS regression. Variation in the β estimates is to be seen with the peak at 1.00. The individual estimates for β do not differ significantly from 1 (Wilcoxon signed-rank test, $p = 0.24$).

Figure 4-2 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, $p = 0.55$).

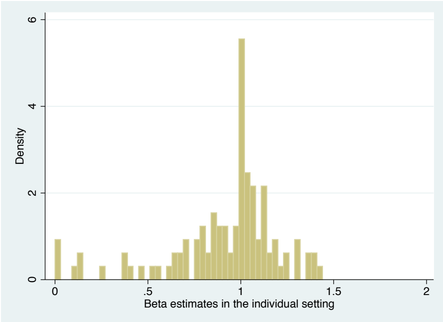

Figure 4-1: Estimates for β from choices in the individual setting

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

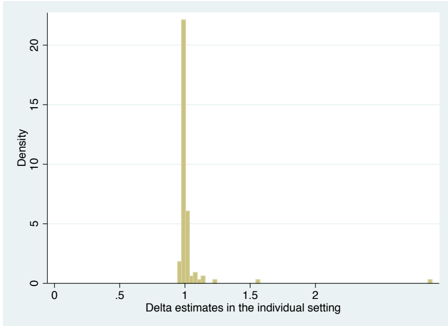

Figure 4-2: Estimates for δ from choices in the individual setting

Note: Two subjects are dropped out in this figure, since they have very high Delta

Estimates of parameters for choices in the group setting

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

Aggregate estimates

Table 4-9 shows that on aggregate, α is significantly smaller than 1, which means the utility function is non-linear but concave. The estimate for β in the individual setting is smaller than 1, which means that present bias exists, significantly in the Group treatment. The estimate for β for a group is larger than β for oneself, suggesting that present bias decreases. Participants are less present-biased on average. Aggregate estimates for δ are around 1 in both rounds in all treatments.

Table 4-9: Aggregate utility parameter estimates by NLS regressions

	Group		Message		Control	
	Individual (1)	Group (2)	Individual (3)	Group (4)	Individual (5)	Individual (6)
β	0.94 (0.03)	0.95 (0.03)	0.98 (0.03)	1.00 (0.02)	1.02 (0.04)	1.01 (0.02)
δ	1.00 (0.002)	1.00 (0.002)	1.00 (0.001)	1.00 (0.001)	1.00 (0.002)	1.00 (0.001)
α	0.81 (0.03)	0.83 (0.03)	0.88 (0.01)	0.92 (0.01)	0.83 (0.03)	0.88 (0.02)
No. of clusters	49	18	39	13	25	25
Observations	734	660	585	435	375	375
Adjusted R-squared	0.5611	0.471	0.4974	0.5711	0.5789	0.5617
H0: β = 1	F = 2.96 p = 0.09	F = 3.17 p = 0.09	F = 0.82 p = 0.37	F = 0.00 p = 0.97	F = 0.26 p = 0.62	F = 0.34 p = 0.56
H0: δ = 1	F = 0.28 p = 0.60	F = 1.18 p = 0.29	F = 0.46 p = 0.50	t = 4.91 p = 0.05	F = 2.7 p = 0.11	F = 6.26 p = 0.02
H0: α = 1	F = 56.32 p < 0.001	F = 36.97 p < 0.001	F = 63.84 p < 0.001	t = 124.30 p < 0.001	F = 31.10 p < 0.001	F = 36.46 p < 0.001

Individual estimates

Figure 4-3 and Figure 4-4 show the distributions of the estimates for β in the Group and Message treatments, respectively. The distributions of β estimates from decisions in the group setting seem to converge to 1. However, only the difference between β estimates in the individual and group settings in the Message treatment is weakly significant (Wilcoxon signed-rank test, p = 0.056 for Message treatment, p = 0.32 for Group treatment and p = 0.82 for control treatment).

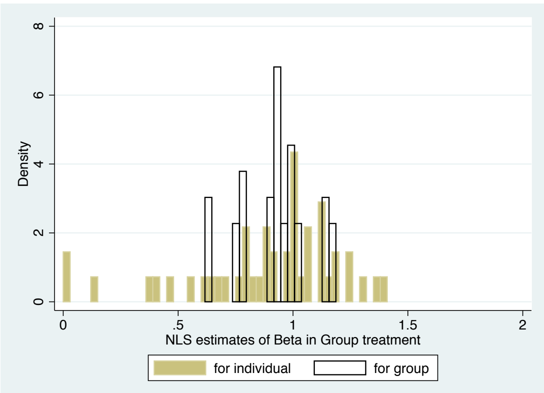

Figure 4-3: Estimates for β from choices in the Group treatment

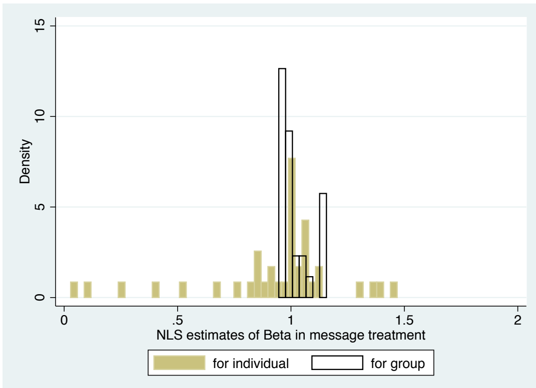

Figure 4-4: Estimates for β from choices in the Message treatment

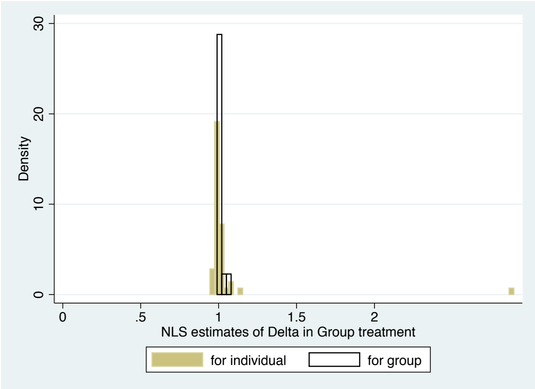

Figure 4-5: Estimates for δ from choices in the Group treatment

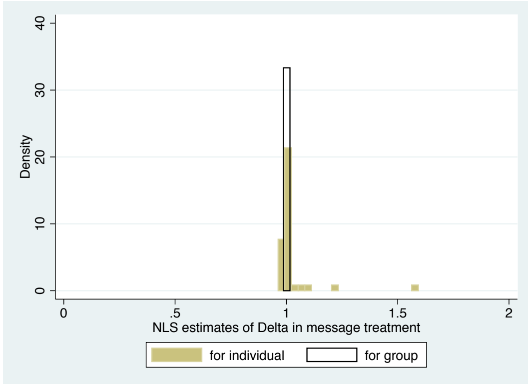

Figure 4-6: Estimates for δ from choices in the Message treatment

The estimates for δ in the individual and group settings are weakly significantly different in the Group and Message treatments (Wilcoxon signed-rank test, $p = 0.06$ for Group treatment and $p = 0.09$ for Message treatment) and are not significantly different in the control treatment (Wilcoxon signed-rank test, $p = 0.36$).

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