Fickle Groups:
An Experimental Assessment of Time Preferences*

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Abstract

Groups with potentially heterogenous time preferences, in households or firms, regularly make intertemporal decisions jointly related to consumption, savings, education and investment. While there is theoretical work on group's intertemporal preferences, it has not been fully empirically tested. This paper studies the empirical relationship between individual and group time preferences using reduced-form and structural methods. Unlike previous work, (i) we measure time preferences through the allocation of costly tasks over time, not monetary methods, (ii) use randomly created groups, (iii) and know time preferences of both groups as well as their constituent individuals. We find that group's are much more present-biased than individuals, a finding that is robust to a variety of alternative specifications. Connecting group behavior with individual members' behavior, we find that within groups, the individuals with higher present-bias are the ones driving group decisions. Further, we find that group's exhibit a higher degree of present-bias when the difference in measured discount rates between group members is larger. Finally, we find that present-bias in the group decisions is reduced when bargaining power in the group is less symmetric.

JEL Classification: D12, D15, C91, D81.

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1 Introduction

Intertemporal choices - decisions for which costs and benefits are spread out over time - are an important part of regular decision-making for households, policymakers and managers. They are relevant to decisions about consumption, and saving and investment, which are some of the most important choices made by economic agents. A variety of important real life outcomes are strongly associated with individuals' time preferences, including health status (Chabris et al. 2008, Bradford et al. 2017, Khwaja et al. 2006), educational attainment (Cadena and Keys 2015, Castillo et al. 2011), savings (Finke and Huston 2013, Laibson 1997), labor market earnings (Golsteyn et al., 2014) and take-up of beneficial programs, such as health screenings or financial education (Meier and Sprenger 2013, Picone et al. 2004). Due to these far-reaching effects, intertemporal choices do not lead only lead to divergent individual-level outcomes, but also differences at the macroeconomic level (Rae 1905, Sunde et al. 2022) as consumption and savings are important determinants of economic growth (Mankiw et al., 1992). Therefore, understanding intertemporal choice, using theory and data, has been a major focus of economists (Samuelson 1937;Koopmans 1960; Laibson 1997; O'Donoghue and Rabin 2001; Gul and Pesendorfer 2001; Fudenberg and Levine 2006; Jackson and Yariv 2015; Andreoni and Sprenger 2012a, Noor 2011).

A rich literature with close interplay between theory and data has substantially advanced our understanding of intertemporal decision-making by individuals since the early work of Samuelson (1937).[1] However, nearly the entirety of this literature focuses on individual decision-making, though many dimensions of intertemporal choice are better modeled at the group level. For instance, education, health, and savings decisions are typically made at the household level between partners and allocations of budgets over time are made by finance groups or committees within firms and legislatures. Within such groups, it is natural to have heterogeneous time preferences, which can lead to tension over important collective decision-making.[2] The fact that preference heterogeneity will exist within most groups is

[1] A few seminal examples from the empirical literature, which mostly use structural models to estimate the level and shape of discounting, are Hausman (1979), Lawrance (1991), Warner and Pleeter (2001), Laibson et al. (2007), Harrison et al. (2002), Andersen et al. (2008), Andreoni and Sprenger (2012a) and Andreoni and Sprenger (2012b). The literature is reviewed in detail by Ericson and Laibson (2019) and Frederick et al. (2002).

[2] Even in the context of individual choice, one can consider the existence of multiple selves with distinct

evident from the fact that women and men have different life expectancy and age gaps in partnerships exist, which means that individuals within partnerships have different horizons. Similarly, other decision-making groups such as committees in firms will exhibit substantial differences in gender, ages and cognitive ability. All these factors have been shown to be determinants of time preferences (Dohmen et al. 2010, ?, Frederick 2005, Andreoni et al. 2019), which suggests that such groups may have substantial within-differences in discount rates.

Consequently, this paper goes beyond the assumption of groups acting as a "representative agent" and asks the following question: are randomly-formed groups present-biased and how do the groups' constituent individuals' time preferences determine group-level time preferences?

To answer this question, we conduct a field experiment with 244 university students in Pakistan to measure individual and group-level time preferences in an effort allocation task over three weeks. We offer the participants the opportunity to allocate effort to take photos of a book using an app developed by the research team. These task were conducted as an individual or as a group, where both group formation and the selection of individual or group work were random. On the first day of the experiment (Day 1), each individual made the following decisions: allocation of effort for the next week (Day 8) and allocation of effort for the week after that (Day 15). Each decision was made for three different task rates: $R \in \{0.8, 1, 1.2\}$. A task rate of 1:0.8 would mean that every task the participant allocated to the present reduced the number of tasks allocated to the future by 0.8.. The participants were asked to make the same choice the next week (Day 8) before they attempted the task for that day. The same decisions were elicited from randomly formed groups as well. Hence, we have the same effort allocation decisions for every individual and group. One of the eighteen decisions made by each participant was chosen for implementation (the "decision that counts") based on a rule (explained in Section 2), which all participants were informed.

personalities, rather than a single homogeneous decision-making unit. Thaler and Shefrin (1981) contrasts the long-sighted "planner" within us to the short-sighted "doer," while Metcalfe and Mischel (1999) contrast our "hot" and "cool" systems. Other more recent work also models multiple selves with competing sets of interests within an individual, such as Fudenberg and Levine (2006, 2011), Brocas and Carrillo (2008a,b) and Noor and Takeoka (2022). Such evidence supports the application of collective choice models to characterize the behavior of individuals.

Theoretically, time inconsistency in groups can arise simply from the aggregation of heterogeneous preferences even when individuals on their own may be time consistent. These inconsistencies may occur due to variations in individual discount rates and innovations in the Pareto weight summarizing the collective decision-making process (Marglin 1963; Feldstein 1964; Jackson and Yariv 2015; Gollier and Zeckhauser 2005). Further, it has been shown that for a uniform distribution of discount rates in an otherwise homogeneous population, group utility maximization in a non-dictatorial way generates aggregate behavior that corresponds to hyperbolic discounting (Jackson and Yariv, 2015). As a result, if all else remains equal, it is optimal to favor impatient members of the group in early periods and patient members in later periods.

We analyze our data using both reduced form and structural estimation methods and document three main results.

First, using a two-limit tobit regression, we find that that individuals making immediate choices allocate around 12% fewer tasks to the earlier task day than those making the same decision a week before the first day of the task. At the same time, groups allocate 21% fewer tasks on the first day of task completion compared to a week before. The results suggest that the degree of time inconsistency is lower for individuals compared to groups, which is in line with previous research.

Second, we estimate a structural model, which corroborates our reduced-form results: groups are time inconsistent. The structural estimate is close to our reduced-form result, which shows that the theoretical model under consideration is a good fit for the experimental data. Further, we compare individuals' and groups' decisions. While, the estimate for the present-bias parameter shows the existence of present-bias in effort choice for both individuals and groups, the present-bias estimate is lower for individuals compared to groups. Further, individuals' weekly discount parameter is less than groups' parameter estimate. Hence, individuals and groups do indeed exhibit different present-bias and discount factors.

Third, to better understand the connection between individual and group time preferences, we regress group decision estimated time preference parameters on the individual decisions in the group. Due to the fact that we collect data both at the individual and group levels, we are able to use these within-group estimates of present-bias. These results show that the weekly discount factor heterogeneities of the individuals do explain group present-bias. We find that group present-bias is mostly driven by the individual with greater present-bias and that the variance in the group's individual members' discount rates and bargaining power explains group present-bias. These results are in line with Jackson and Yariv (2014)'s theoretical prediction that for a uniform distribution of discount rates in an otherwise homogeneous population, group utility maximization generates aggregate behavior that corresponds to hyperbolic discounting, and if there is some fundamental heterogeneity in temporal preferences by way of differing discount factors, then the only well-behaved collective utility functions that are both time consistent and respect unanimity are dictatorial.

Our results are important because we present both non-parametric and parametric characterizations of individual and collective intertemporal choice for the same set of participants, under experimentally controlled environments, based upon intertemporal allocations of effort.[3] We begin with an approach free of functional form using experimentally-induced exogenous variation, then move to theory-based parametric analysis of time inconsistency on the individual and group levels. By adopting this approach, our subsequent parametric estimates thus result from restrictive parametric assumptions rather than from a failure of the underlying theoretical framework, which is free of functional form and related to an assessment of the degree of differences between these two kinds of decision environments. In the structural part of our empirical analysis, the preference structure associated with the discounted utility approach is applied to model group behavior without modification. This is in line with the representative agent modeling structure mostly used in macroeconomics literature. This unitary approach assumes the collective acts as a single decision-making unit and therefore can be treated as a rational individual.

While a few important papers have empirically tested group-level intertemporal choice (Schaner 2015, Mazzocco 2007), these papers use monetary choice methods for measurement or study endogenously formed groups (and thus have no exogenous variation in intertemporal preferences at the group-level) such as spouses or only elicit intertemporal preferences at the individual or at the group level but never both.

[3]This occurs in the consumption choice rather than monetary choice domain. The monetary methods used typically have several confounding factors for the identification and estimation of the shape of time preferences, which we explain in detail later in the introduction.

Our contribution to this literature is three-fold. First, we explore intertemporal choice using better measurement. We measure time inconsistency based on intertemporal allocations of effort (negative consumption), which has shown to be a better method of elicitation of time preference (Sprenger 2015; Cohen et al. 2020; Augenblick et al. 2015). Second, we study exogenously formed groups, which is important because endogenously formed groups such as couples may select on time or risk preferences, incomes levels, and other personality traits. Further, as researchers collect data much after this couple formation has occurred, there are learning effects over time that may have changed preferences and moved them closer to each other (more aligned preferences). If couples match assortitatively on the marriage market, there may also be no real differences in time preferences and the data may only show differences due to measurement error which can be correlated with cognitive ability and financial literacy (Schaner, 2015). Third, we do not just measure time preferences for individuals or groups but both individuals and groups, which allows us to understand how individual behavior drives group behavior.

Finally, we use consumption-based measures for intertemporal choice measurement because the assumptions necessary for time-dated monetary payments to correctly measure intertemporal choice are not always satisfied (Sprenger 2015; Cohen et al. 2020). For example, participants may think of external financial decisions (i.e. arbitrage opportunities outside of the experiment) (Cubitt and Read 2007, Chabris et al. 2008) or they may think of their external consumption choices or participants may not fully trust the research team enough to neglect future transaction costs and payment reliability.[4] Andreoni and Sprenger (2012a), Giné et al. (2018) and Andersen et al. (2008) all document that when closely controlling transactions costs and payment reliability, dynamic inconsistency in choices over monetary payments is virtually eliminated on aggregate. All these challenges can create artificial dynamic inconsistencies. This literature has elicited an extremely wide variety of discount rates ranging from less than 1% (Thaler 1981) to more than 1000% (Holcomb and Nelson 1992).

[4]The main idea was originally raised by Thaler (1981) who, when considering the possibility of using incentivized monetary payments in intertemporal choice experiments noted, 'Real money experiments would be interesting but seem to present enormous tactical problems. (Would subjects believe they would get paid in five years?).'

The paper proceeds as follows. Section 2 presents the details of the experimental design. Section 3 provides an overview of the data we collected. Section 4 describes the reduced-form regression analysis including Two-Limit Tobit and Non-Linear Least Squares estimation, Section 5 the structural estimation results and Section 6 explores how individual-level preferences drive group-level preferences. Section 7 concludes.

2 Experimental Design

To understand dynamic inconsistency in real effort for individuals and groups, we conduct an experiment with 244 undergraduate students from different majors at the Lahore University of Management Sciences (LUMS) over a period of three weeks. LUMS is one of Pakistan's most prestigious universities and attracts the brightest from all across the country (and is not restricted to high-income families due to large, targeted programs for low-income families).

The research team asked participants to allocate effort for one kind of task in the real world with real monetary incentives as an individual and as a (randomly-chosen) group of two. On the first day of the experiment, each individual and group made the following decisions (separately): allocation for effort for Day 8 (exactly one week later) and allocation for effort for Day 15 (exactly two weeks after the start of the experiment). The same choices were made one week later on Day 8 (before the task was supposed to be done). Each decision was made for three different task rates. One of the eighteen allocation decisions was chosen for each participant based on a rule explained below and they were given a monetary reward of \$15 if the work was completed, and \$0 otherwise.

Timeline: On the first day of the experiment, Day 1, we give participants detailed instructions on how the experiment would work. We tell them that they will make decisions about effort allocation that day (Day 1) and the same decisions exactly one week later (Day 8) to allocate effort for a task between two days: Day 8 and Day 15 - exactly one week apart from each other. They will make these decisions, as individuals as well as randomly-chosen pairs, in sessions with the research team. The decisions would be taken twice - once on Day 1 and once on Day 8 (before the task would have to be conducted). Whether a participant first made a decision as an individual or a group was randomized so avoid potential ordering effects.

During all the training sessions, we instructed venue in-charges to ensure that participants within the same group exchanged their email addresses and shared their contact numbers with each other for further communication.

Effort Allocations: To further motivate the intertemporal trade-off, an additional factor in the decision-making was a "task rate". These decisions are made using the Convex Time Budget (CBT) methodology prposed by Andreoni and Sprenger (2012a). The allocations are made in a mobile application with slider bars so that it is easy to visualize (see Figure 1) where every slider bar corresponded to a specific task rate. We offered three task rates, $R \in \{0.8, 1, 1.2\}$ and a decision had to be taken for each one. A task rate of 1:0.8 means that every task the participant allocated to present v_1 reduced the number of tasks allocated to the future v_2 by 0.8. For simplicity, the task rates were always represented as $1 : R$ and the participants were fully informed of the value of $R \in \{0.8, 1, 1.2\}$ when making their decisions. Output exceeding v_1 targets on the first day was not transferable to v_2. The participant's decision can be formulated as allocating tasks $(v_1, v_2) = f(R, V)$ over time, subject to the present-value budget constraint. v_1 and v_2 satisfy the intertemporal budget constraint

$$v_1 + R \cdot v_2 = V.$$

Below, in Figure 1, we show an image of the main page of the application (an English translation is shown in the Appendix (Figure /ref).

To avoid corner solution scenarios in allocation decisions, when an individual or a group decided to allocate all their tasks to Day 8 or all to Day 15, we restricted the minimum number of pictures for the Day 8 task to 12. This automatically happened inside the app. With this automatic limit, we observe corner solution allocations decisions extremely rarely: it is only in 2.50% of the total 2196 allocation decisions that we observe a choice of $v_1 = 12$. Towards the end of the Day 8 session, all participants were informed which allocation had been (randomly) selected for them out of the 18 total decisions that they recorded during the experiment. For this purpose, we explained to them in the introduction how this decision would be selected. We called the selected task allocation decision the "decision-that-counts." On Day 1, two hours after the allocation decision session, participants were asked to complete their "decision-that-counts" allocations in the specified time period (21:30 to 22:30 pm Pakistan Standard Time).

These intertemporal bonus contracts can be used to investigate intertemporal preferences. The allocations participants make, (v_1, v_2), convey information on their discounting. Additional experimental variation permits identification of an important behavioral aspect of intertemporal choice: the existence of present-biased preferences.

When making decisions on Day 8, we did not remind participants of the decisions Day 1 allocations. It's important to note that on Day 1, participants were making decisions involving two future work dates (one and two weeks later), whereas on Day 8, they were making decisions for the same day and the week after. Before making decisions on Day 1, participants were told of the Day 8 decisions and were aware that exactly one of all allocation decisions would be implemented.

Jobs: The task was to take clear, legible pictures from any book of the participants' choice in one specific hour (21:30 to 22:30 Pakistan Standard Time) using the mobile application provided by the research team, and to upload the pictures on a server (all pictures were automatically geo-stamped and time-stamped). To avoid sample selection issues, we ourselves provided mobile phones and internet packages to all participants and taught the participants on how to use the application and send the data to the main server. The evening time was chosen to ensure that nobody had classes, family social obligations or religious obligations. This equalized outside options that could contaminate the purity of intertemporal choices. A complete practice run was conducted to ensure that everyone understood how the application would work. The task set a target of 200 pages ($V = 200$) in the individual setting and 400 pages ($V = 400$) in the group setting. If the pages were not legible, the picture would not be counted as a completed task.

Recruitment, Selection and Attrition: Two hundred and forty-four students at LUMS took part in the experiment on the first day, however, only X showed up for the whole experiment over the three week span of the experiment. The participants did not receive an independent show-up fee, only a completion fee of $15 if all tasks were accomplished according to their selected allocation. The X participants who did not show up are no different than the participants on allocations, income, degrees, etc.

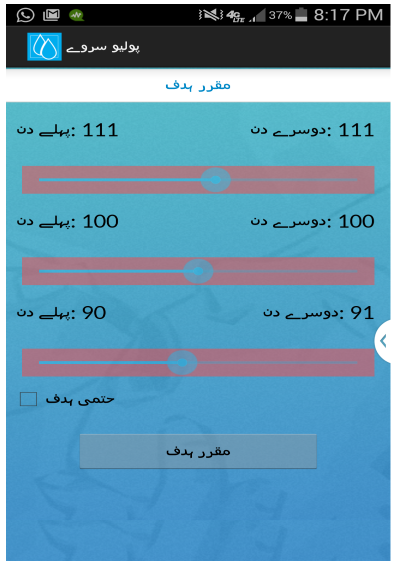

Figure 1: Slider Bar Used to Capture Task Allocations

Notes: The above slider bars show the individual task allocation decisions over the two weeks, i.e., $V = 200$. The blue letters in translate (literally) to “set target”. The next lines (from left to right) translate to “First day: 111; Second day: 111” for slider bar 0.8, “First day: 100; Second day: 100” for slider bar 1, and “First day: 90; Second day: 90” for slider bar 1.2. The text next to the box translates to “finalize target” and the black letters on the bar translate to “set target”.

The Allocation That Counts: Participants were informed that three factors determined their “decision-that-counts“: the one allocation out of the eighteen made by them that would randomly be chosen for them to implement. First, the allocated task could be either from a Day 1 or a Day 8 decision according to a 20% and 80% probability respectively. Second, the allocated task could either be an individual or a group task according to a 33% and 66% probability respectively. Third, the allocated task could be from one of the three task rates $R \in \{0.8, 1, 1.2\}$, which are all equally likely. This randomization process, which is in-line with Augenblick et al. (2015) ensures incentive compatibility constraint for all decisions. The design choice, which ensured that participants had a 20% chance of receiving a preference schedule of v_1 and v_2 targets from the first day of the decision-making process, was made to allow and intimate them about their own potentially present-biased behavior.

Monetary Reward: The monetary reward is based on individual or group performance depending on which allocation decision was randomly chosen for an individual. The reward is

$15 for the completion of the task fully according to the allocation decisions. Any deviation, even of one page, results in an incomplete task and carries no reward. In the group task, the reward is a total of $30, which is equally split between the two group members irrespective of their contribution to the task. No instructions are given about division of work for the group task.

3 Data and Measurement

During the first session (Day 1), we collected data on a variety of participant characteristics. We collected demographic and educational information such as age, ethnicity, degree major, part-time employment, family income, savings account, usage of study plans, and their relation with the pairing. Following Callen et al. (2015), we collected data on personality using a modified Big Five survey (Barrick and Mount 1991; Van der Linden et al. 2010; John et al. 2008)The Big Five personality traits, according to the Five Factor Model of personalities, are five separate dimensions of human personality that were designed to be descriptive and non-overlapping. These traits are agreeableness, emotional stability, extroversion, conscientiousness, and openness. and survey-based trust in strangers. We use a 60-question Big Five survey developed in Urdu and validated for use in Pakistan by the National Institute of Psychology at Quaid-i-Azam University, Islamabad, Pakistan.

3.1 Sample Descriptives

We provide a description of our sample of participants in Table 1. The mean participant age is 20.3 years and 39% of the sample are women. 62 percent had no access to a formal savings account at the time of the experiment, however, 73 percent had access to one sometime in the past. This is relevant because in the behavioral economics literature, savings accounts have been used to predict the degrees of patience or present-bias. As explained above, individuals were randomly paired together. The mean of the group-mate acquaintance index indicates that individual members knew each other at the start of the study (the index ranges from 0 - just met - to 5 years of acquaintances). The mean time duration of acquaintance is around 13 months. In the subsequent structural analysis we explicitly control for the time duration of acquaintance to explain group present-bias. In the context of this experiment, this variable tries to capture the effect of group dynamics, e.g. coordination externality, etc., in the stage of intertemporal allocation of tasks.

Table 1: Summary Statistics

	# of Obs	Mean	Standard Deviation	Minimum	Maximum
Demographic					
Age	244	20.32	1.75	17	27
Male	244	0.61	0.48	0	1
No on-campus job	244	0.91	0.28	0	1
No savings account	244	0.73	0.44	0	1
No savings account	244	0.62	0.48	0	1
Group-mate acquaintance index	244	3.04	1.28	1	5
Acquaintance time duration (months)	244	13.84	21.56	0	60
Big Five Survey					
Openness	212	3.30	0.45	2.17	4.42
Conscientiousness	212	3.43	0.52	1.75	4.92
Extroversion	212	3.25	0.33	2.16	4.44
Agreeableness	212	3.44	0.46	2.33	4.58
Neuroticism	212	2.82	0.57	1.25	4.67

Notes: This table reports summary statistics for our respondent population. We have a full sample of 244 students, though some students were not able to fill the Big Five survey. The group mate acquaintance index is. We use a 60-question Big Five survey developed in Urdu and validated for use in Pakistan by the National Institute of Psychology at Quaid-i-Azam University, Islamabad, Pakistan. Its variables were recorded on a 1-5 Likert scale.

4 Results: Reduced Form

In this section, we present reduced form analysis to test whether individuals and groups are time consistent. We run a Two-Limit Tobit Regression to analyze the effect on time preferences based on all the different experimental variation. The advantage of reduced-form analysis is that we do not have to make any assumptions about the functional form of the time preference.

4.1 Two-Limit Tobit Regressions

We present reduced form regression analysis for aggregate behavior focusing on time inconsistency. Given the experimental design, we regress the natural log of v_1 (task allocation for Day 8) on the dummy variable taking the value of 1 when the allocation decision is immediate (for the same day) and its full interaction with the individual decision, and decision-order

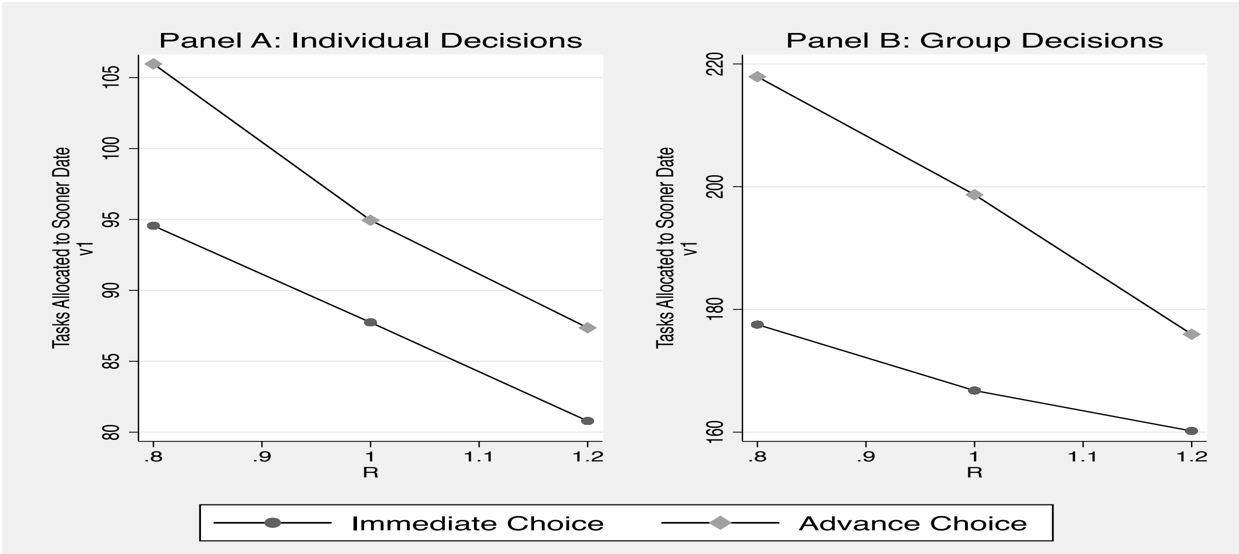

Figure 2: Discounting Behavior

Notes: Mean behavior in Individual and Group task allocated to sooner date combined.

dummies. Further, we control for experimentally induced variations in R (we include its natural log). As we set a minimum of 12 tasks to avoid corner solutions in allocation decisions, we use a two-limit Tobit regression, which corrects for censoring (Wooldridge, 2002).

We present this non-parametric evidence for time inconsistency in Table 2. The first column shows results from a specification wherein we combine individual and group decisions (also illustrated in Figure 2), which demonstrate that participants allocated significantly fewer tasks (as a percentage) to v_1 as R increases and when the allocation decision is immediate. This means that when the task rate is low, i.e. earlier tasks are cheaper to complete, participants allocate more tasks to earlier periods compared to when the task rate is high, i.e. earlier tasks are more expensive to complete. This shows that our participants understand the trade-offs involved and made rational choices. Further, we find that on average 15% fewer tasks were chosen on the first day of task completion (Day 8). In the second column, we add further explanatory variables: a dummy for individual decisions and its interaction with the immediate decision dummy variable. We find that that individual participants making immediate choices allocate around 12% fewer tasks to v_1 than those making the same decision a week before the first day of task completion. However, groups allocate 21% fewer tasks on the first day of task completion compared to a week before. The results suggest that the

Table 2: Two-Limit Tobit Regression Analysis

Dependent variable:	Log of Tasks Allocated to the 1st Day			
	(1)	(2)	(3)	(4)
β_1 : Log Task Rate	-0.46***	-0.46***	-0.46***	-0.46***
	(0.08)	(0.08)	(0.08)	(0.08)
β_2 : Immediate Decision	-0.15***	-0.21***	-0.14*	-0.20**
	(0.04)	(0.05)	(0.07)	(0.08)
β_3 : Individual Decision		-0.75***		-0.75***
		(0.02)		(0.02)
β_4 : Immediate Individual Decision		0.09**		0.09**
		(0.04)		(0.04)
β_5 : Individual Decision First			-0.04	-0.04
			(0.06)	(0.06)
β_6 : Immediate Individual Decision First			-0.02	-0.02
			(0.08)	(0.08)
β_0 : Constant	4.70***	5.20***	4.72***	5.23***
	(0.03)	(0.03)	(0.04)	(0.04)
# of Obs	2196	2196	2196	2196
# of Groups	122	122	122	122
F-stats	23.68	326.64	13.36	219.78
Hypothesis (*p-values*)				
$H_0 : \beta_2 = 1$	0.00			
$H_0 : \beta_2 + \beta_4 = 1$		0.00		
$H_0 : \beta_2 + \beta_6 = 1$			0.00	
$H_0 : \beta_2 + \beta_4 + \beta_6 = 1$				0.00

Notes: $^*p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$. The table presents the effect of Immediate Decision and its interactions with other experimentally induced variations using the Two-Limit Tobit Regression technique. The first presents results with aggregated decisions. The second column captures the estimates of the Immediate Decision for the groups and individuals separately. The third column shows results of the effect of decision ordering and its interaction with Immediate Decision. The fourth column includes all previous variables. We cluster standard errors at the group level.

degree of time inconsistency is lower in individual settings compared to groups settings: the immediate decision dummy estimate when interacted with the individual decisions dummy increased by a factor of 9%. The estimate $IndividualDecision$ is negative due to the variation in the total number of tasks over the two weeks' period between individuals and their respective groups. The total number of tasks were fixed at 200 and 400 in the individual and group settings respectively. The negative estimate signifies the fact that as an individual participants allocate fewer tasks to earlier dates compared to the group setting.

These findings are contrary to some recent studies (e.g. Carbone and Infante 2015; Denant-Boemont and Loheac 2011) that find that groups are less present-biased and more time consistent compared to individuals. We attribute this difference to three factors. First, these studies use Money Earlier or Later (MEL) experiments to elicit time preferences, which, as discuss above in detail, are now seen as imperfect measures of time preferences because there are many confounds for identifying the shape of time preferences from such monetary choices (Sprenger 2015; Cohen et al. 2020; Augenblick et al. 2015). Second, these studies conduct the experiments with couples, thus endogeneously formed groups, unlike our exogenous groups. Third, group present-bias estimates could be higher than individual present-bias (for exactly the same people) due to the underlying bonus structure. Since our tasks were relatively easy to perform and fundamentally perfect substitutes in nature, the effect of the coordination externality could have become an important factor. We explore these issues in more detail by putting some theory-based structure on the estimates later on in the paper.

Finally, in third column, we analyze the effect of the order in which task allocation decisions were taken. The order does not have any significant effect on behavior in either individual or group decisions. The estimates of Individual Decision First dummy and its interaction with the Immediate Decision dummy are statistically insignificant. This along with the non-changing Immediate Decision estimates and its interaction with the Individual Decision dummy estimates in the last column confirms the robustness of our finding. In the appendix, we also provide the results controlling for demographic variables and show that all our results qualitatively remain the same.

5 Results: Structural Analysis

5.1 Non-Linear Regression Analysis

Next, we use a structural model to estimate time preference parameters. We assume quasi-hyperbolic discounting with subjects allocating effort for a task to an earlier date, v_1, or to a later date, v_2. Under the assumption of a quadratic cost of effort function and that individuals or groups discount the future quasi-hyperbolically (Laibson 1997; O'Donoghue and Rabin 1999), the participants' preferences can be written as:

$$b_1 v_1^2 + \beta^{\mathbf{1}_{d=1}} \delta^k \; b_2 v_2^2$$

Normalizing $b_2 = 1$ and therefore dividing the intertemporal effort cost function by b_2

(to remove scaling effects), the above cost function can be re-written as:

$$\gamma v_1^2 + \beta^{\mathbf{1}_{d=1}} \delta^k \ v_2^2$$

Here, v represents a task performed on a given day (either earlier or later), $\gamma > 0$ and $\gamma = 1$ imply that the effort cost function is stationary over time and k captures delay length, which in this experiment was fixed at seven days (the gap between first decision and first day of task and first day of task and second day of task). The indicator $\mathbf{1}_{d=1}$ captures whether the decision is made immediately or in advance on the first day of task performance. The parameters β and δ encapsulate individual or group discounting with β capturing the degree of present-bias, active for participants who make immediate decisions, i.e., $\mathbf{1}_{d=1} = 1$. If $\beta = 1$, the model nests exponential discounting with the discount factor δ, while if $\beta < 1$ the decision maker exhibits a present-bias, being less patient in immediate, relative to advance, decisions.

When modeling group decisions, we assume the group members' are characterized by individual preferences and that the group acts as a decision-maker similar to an individual whose time preference parameters could be measured independently of its members' preferences. This modeling technique is in line with the representative agent setup mostly used in macro modeling. This unitary approach assumes that the collective acts as a single decision-making unit and therefore can be treated as a rational individual on its own.

Minimizing discounted costs subject to an intertemporal budget constraint of the experiment yields the following intertemporal Euler equation:

$$\gamma v_1^* R = \beta^{\mathbf{1}_{d=1}} \delta^k v_2^*. \tag{1}$$

Here v_1^* and v_2^* are the optimal tasks performed on Day 1 and Day 8 of the experiment. This tangency condition implies that when individual/group preferences are dynamically consistent, the optimal $(\frac{v_1^*}{v_2^*})$ does not depend on the parameter $\beta^{\mathbf{1}_{d=1}}$ but only depends on the task rate R, and the delay length k. Using the Euler equation with the intertemporal budget constraint and rearranging the equations yields the solution function for the optimal v_1^*:

$$v_1^* = \left(\frac{\beta^{\mathbf{1}_{d=1}}\delta^k V}{\gamma R^2 + \beta^{\mathbf{1}_{d=1}}\delta^k}\right)$$

and

$$\boldsymbol{v_1^*} = \begin{cases} \left(\frac{\beta^{\mathbf{1}_{d=1}}\delta^k V}{\gamma R^2+\beta^{\mathbf{1}_{d=1}}\delta^k}\right) & d = 1 \\ \left(\frac{\delta^k V}{\gamma R^2+\delta^k}\right) & d = 0. \end{cases}$$

The above equation implies that v_1^* is a non-linear function of R, $\mathbf{1}_{d=1}$, k and V.[5] If we assume that allocation decisions satisfy the above equation subject to an additive error term, ϵ, we arrive at the non-linear regression equation

$$v_{1\,it}^* = f(V, R_{it}, \mathbf{1}_{d=1}, k) + \epsilon_{it}. \tag{2}$$

The parameters β (present bias), δ, (discount factor) γ (curvature of cost function) can be estimated using non-linear least squares estimation at the individual or group levels (see Appendix 8 for details of the estimation). We present these estimates in Table 3. Throughout, we cluster standard errors clustered at the group level.

In the first column, we pool all decisions together and show combined results. We show that our main parameter of interest, β, the present-bias in effort provision, is valued at an aggregate $\beta = 0.78$ ($s.e. = 0.05$), which means that participants' are not time consistent. This estimate is close to the reduced form result of Table 2, which shows that the theoretical model under consideration is a good fit for the experimental data. The weekly discount factor, δ, averages around 0.98. Finally, we find that for the cost parameters' ratio, γ, we cannot reject the null hypothesis of the stationary cost of effort function, i.e. the intertemporal effort cost function is stationary over time.

In the second column, we compare individuals' decisions and groups' decisions. We note that the estimate for the present-bias parameter shows the existence of present-bias in effort choice for both individuals and groups (which confirms our reduced-form results). However,

[5]For this class of effort cost function, both relative risk aversion and intertemporal elasticity of substitution are functions of v.

Table 3: Non-Linear Least Squares Analysis

Dependent Variable:			v_{1it}^{*}		
Combined		*Ind. Vs. Group*		*Decision Order*	
$\beta_{Combined}$	0.78***	β_{Ind}	0.82***	$\beta_{IndFirst}$	0.77***
	(0.05)		(0.06)		(0.05)
$\delta_{Combined}$	0.98***	δ_{Ind}	0.96***	$\delta_{IndFirst}$	0.98***
	(0.04)		(0.03)		(0.06)
$\gamma_{Combined}$	1.07***	γ_{Ind}	1.00***	$\gamma_{IndFirst}$	1.17***
	(0.23)		(0.22)		(0.39)
		β_{Group}	0.71***	$\beta_{IndSecond}$	0.0.79***
			(0.06)		(0.10)
		δ_{Group}	1.01***	$\delta_{IndSecond}$	0.95***
			(0.04)		(0.03)
		γ_{Group}	1.23***	$\gamma_{IndSecond}$	0.85***
			(0.29)		(0.19)
# Observations	2196	# Observations	2196	# Observations	2196
# Groups	122	# Groups	122	# Groups	122
RMSE	0.54	RMSE	0.54	RMSE	0.54
Hypothesis					
$\beta_c = 1$, *p-value*:	0.00	$\beta_I = 1$, *p-value*:	0.00	$\beta_{IF} = 1$, *p-value*:	0.00
$\delta_c = 1$, *p-value*:	0.48	$\beta_G = 1$, *p-value*:	0.00	$\beta_{IS} = 1$, *p-value*:	0.03
$\gamma_c = 1$, *p-value*:	0.76	$\beta_I = \beta_G$, *p-value*:	0.03	$\beta_{IF} = \beta_{IS}$, *p-value*:	0.91

Notes: $*p < 0.1$, $**p < 0.05$, $***p < 0.01$. The table presents structural estimates of intertemporal hyperbolic discounting model using non-linear least squares estimation. The dependent variable is the amount of optimal tasks performed on Day 8 or Day 15 of the experiment. The first column presents combined individual and group decision estimates for β, δ, and γ. The second column presents the structural estimates of the model for the individuals and groups separately. The third column presents the structural estimates based on the effect of decision ordering (either individual allocation decision taken first or second). We use cluster standard errors at the group level.

the present-bias estimate is lower for individuals compared to groups. Further, individuals' weekly discount parameter is less than the groups' parameter estimate. Comparing individual parameter estimate of present-bias against the corresponding group estimate, the null hypothesis test of $\beta_I = \beta_G$ is rejected, as is the $\delta_I = \delta_G$ hypothesis. Hence, individuals and groups do indeed exhibit different present-bias and discount factors. These results are similar to our non-parametric analysis where the degree of time inconsistency is, on average, greater in group decisions compared to individual decisions, but at the same time, group decisions are more patient. The discount factor estimates and their individual vs group differences are consistent with Milch et al. (2009), who find that participants discount more as individual decision makers than they do in a group decision context. This finding that group decisions are more patient also shows that the discount factors for groups are in line with market interest rates unlike the discount factor for individuals.

Finally, comparing the cost parameter estimates' between individuals and groups, we observe that the estimate of γ is higher for groups compared to individuals, but $\gamma_I - \gamma_G$ has a coefficient of -0.23 with the *p-value* of 0.13, which indicates that the difference is not statistically significant. The individual decisions' estimated cost parameters' ratio $\gamma_I = 1.00$ ($s.e. = 0.21$). The null hypothesis of the stationary cost of effort function could not be rejected, since $\chi^2(1)$ test has a *p-value* of 0.99. For groups' estimated cost parameters' ratio $\gamma_G = 1.23$ ($s.e. = 0.29$), under the null hypothesis, groups' stationary cost of effort function also could not be rejected, since the $\chi^2(1)$ test has a *p-value* of 0.43. These results indicate that the underlying cost of effort functions for both individuals and group decisions are stationary over time and are statistically not different.

In the third column, the time preference parameters are estimated for an ordering effect using the full sample of decisions, i.e. we test whether taking an individual decision first or second made any difference to the results. We can observe that while there are differences between the coefficients of individual decision first versus group decision first, the difference is statistically insignificant. The same holds true for the discount factor. Hence, we find no support for ordering effects in our data. These results also confirm results from the non-parametric reduced form estimation shown in Table 2.

6 Channels: Individuals vs. Groups

The results above lead to two obvious questions. First, what are the relevant structural channels through which one can pin down and connect the more pronounced group present-bias (compared to individual) to its group members? Second, are there other confounding variables through which one could potentially explain group present-bias beyond the structural channels? The answers to these questions are important for assessing the empirical validity of our theories and understanding what fundamentally drives group decisions and their dynamics. In this section, we discuss the theoretical model that connects the group decision process to their individual constituents.

A natural assumption in many group settings is that its members are heterogeneous, e.g. within households or committees made up of different agents making intertemporal decisions. Given our finding that groups are more present-biased compared to their constituent individual members, in this section we models group decisions building on individuals' decisions with the aim of connecting the individual decisions with group allocation decisions observed in our data.

6.1 Theoretical Setup: Collective Decision Functions

We start by introducing a collective cost of effort function can be thought of as providing a "planner's" cost of effort function for a group. Examples include taking a weighted average of agents' effort functions ($F[C](v) = \sum_i \omega_i C_i(v)$), where C is the cost function and v is the effort provision. This is an example of a utilitarian approach; other examples would include the minimum of agents' cost of effort provision ($F[C](v) = min_i C_i(v)$), which would be a Rawlsian approach.

In the context of this experiment we know $C = (\delta_1, \beta_1, \gamma_1; ..; \delta_n, \beta_n, \gamma_n)$. Thus, we consider an important class of collective cost of effort functions: those that are time-separable. Jackson and Yariv (2015) show that this class of functions exhibits a particular sort of time inconsistency or intransitivity[6]: present-bias, which matches the empirical evidence

[6] The intransitivity here is quite different from Condorcet's (1785) description of the voting paradox and Arrow's Impossibility Theorem (1963) because our collective decision structure is quite different from the voting settings mentioned in these papers.

presented in the paper.

As postulated by Jackson and Yariv (2015), given all the participants in the experiment are time consistent for any profile $(\delta_1, \gamma_1; ..; \delta_n, \gamma_n) \in C^n$, a time-separable group cost of effort function takes the form:

$$F[\delta_1, \gamma_1, ; ...\delta_n, \gamma_n](v) = \sum_t \tilde{\delta}_t C(v_t),$$

such that $\tilde{\delta}_t = \sum_i \omega_i \delta_i^t$. Such time-separable collective functions are quite standard in the literature. For instance, standard utilitarian aggregation of individual utilities (or one that puts different weights on different individuals) is a special case. According to Jackson and Yariv (2015), for any profile $(\delta_1, \gamma_1; ..; \delta_n, \gamma_n) \in C^n$ such that for some k, j, $\delta_k \neq \delta_k$, a collective function of the form

$$F[\delta_1, \gamma_1, ; ...\delta_n, \gamma_n](v) = \sum_t \tilde{\delta}_t C(v_t),$$

such that $\tilde{\delta}_t = \sum_i \omega_i \delta_i^t$ for each t, and so

$$F[\delta_1, \gamma_1, ; ...\delta_n, \gamma_n](v) = \sum_i \omega_i C_i(v).$$

F is either dictatorial or present-biased.[7] It is pertinent to mention that before making group decisions, every participant in the experiment was asked to make unanimous decisions in the group since the bonus share was fixed for each group member. Therefore, the collective discount factor must be a weighted sum of the participants, and so must correspond to a weighted utilitarian collective cost of effort function.

The proposition encompasses many of the formulations of time inconsistent preferences. In our structural analysis, we assumed a quasi-hyperbolic formulation, which in this case corresponds to $\tilde{\delta}_1 = 1$ and $\tilde{\delta}_t = \beta\delta^{t-1}$ for all $t > 1$. As long as behavior has a separable structure and satisfies unanimity, the proposition shows that a present-bias is to be expected.

Using this proposition, a set of testable hypotheses can be generated and subsequently tested. We use groups' time preference estimates (specifically focusing on groups' present-

[7]For detailed proofs, please see Jackson and Yariv (2014) and Jackson and Yariv (2015).

bias related to the present-bias estimate) and their individual members' structural estimates (including the discount rate, present-bias, and effort cost parameters' estimates) to empirically test the effects of theory-based heterogeneities on group present-bias. These within-group heterogeneities include the differences in individual members' (i) discount factor, (ii) parameter governing the cost of effort, and (iii) bargaining position in the group.

Regarding bargaining power, we know that in a utilitarian formulation, group decisions depend on the preferences of the individual members, and the relative strengths of the individual members' weights in the group decisions, captured by Pareto/bargaining weights. In addition to the empirical introduction of a bargaining mechanism into the group decision-making process by Manser and Brown (1980) and McElroy and Horney (1981), there has been the development of so-called collective models, which assume that groups can achieve efficient decisions (Chiappori 1992; Browning and Chiappori 1998). Following Browning and Chiappori (1998), in the context of this experiment, the group's intertemporal effort cost function can be expressed as:

$$C_G = \omega_i C_i + \omega_j C_j.$$

where

$$\omega_i + \omega_j = 1. \;\; and \;\; (\omega_i, \omega_j) \geqslant 0.$$

These restrictions satisfy the unanimity condition in the group/collective decision-making process

$$C_l = \; \gamma_l v_{1l}^2 + {\beta_l}^{\mathbf{1}_{d=1}} {\delta_l}^k \; v_{2l}^2 \quad and \quad l = \{G, i, j\}.$$

where C_G is the group's intertemporal effort cost function, C_i and C_j represent the individual member i and j's intertemporal effort cost function respectively, and ω_i and ω_j denote members i and j's bargaining power respectively, which measures how individual preferences are aggregated into groups' joint decisions. In our experimental setting, since we observe both individual and group decisions, this means that we can measure/estimate to what extent each member influences the group decisions. Using a multinomial logit model, we estimate ω_i and ω_j by running the following regression equation for each group:

$$v_{1G_p} = \omega_i v_{1i_p} + \omega_j v_{1j_p} + \epsilon_p,$$

$$s.t.\ \ \omega_i + \omega_j = 1. \quad and \quad p = \{1, 2, 3, ..., 122\}.$$

After estimating (ω_i, ω_j) for each group, we construct $|\Delta(\hat{\omega}_{_{IND}})|$, which is the absolute difference between the groups' individual members' bargaining/Pareto weights. Using these absolute differences between the individual members, we further construct $(|\Delta\hat{\omega}| \approx 1)_G (= 1)$, which is the dummy indicator for the group in which one of the members has approximately all the bargaining power. The summary statistics of these dummy indicators are presented in 7. The roles and effects of these variables on group present-bias are described in Section 8.

6.2 Empirical Results

6.2.1 Summary Statistics

Now, using the above theoretical underpinnings, we present empirical results to show how individual decisions are connected to group outcomes. In Table 4, we present within-group estimates of discounting, present-bias, and effort cost parameters for individuals and groups, i.e. for each group and its constituent individuals, we estimate the parameters of equation (2) using non-linear least squares for 122 groups and their 244 constituent individual participants.

Table 4 reports the median, 5th and 95th percentiles as well as the minimum and maximum values for individuals' and groups' annual discount rate $\hat{\delta}$, $\hat{\beta}$, and $\hat{\gamma}$. We find that the results are broadly consistent with estimates at the aggregate level (shown above in Table 3). The median estimated weekly discount rate is 0.92 (same as the aggregate value). The median individual present-bias estimate, 0.97, is higher than the median group present-bias estimate, 0.90. The median individual and group cost of effort parameter estimates are the same - 0.69.

For the majority of individuals and groups, the employed estimation strategy generates reasonable parameter estimates. However, extreme observations do exist. Figure 3 presents

Table 4: Summary Statistics: Discounting, Present-Bias, and Effort Cost Parameter Estimates

	N	Median	5th Percentile	95th Percentile	Minimum	Maximum
Group						
$\hat{\delta}$	122	0.92	0.75	0.99	0.55	0.99
$\hat{\beta}$	122	0.90	0.18	2.32	0.02	10.8
$\hat{\gamma}$	122	0.69	0.19	1.33	0.14	2.80
Individual						
$\hat{\delta}$	244	0.92	0.76	0.97	0.66	1.00
$\hat{\beta}$	244	0.97	0.13	2.79	0.02	15.1
$\hat{\gamma}$	244	0.69	0.18	1.51	0.06	2.80

Notes: We use results from the non-linear squares (NLS) estimator used in Table 3. We show summary statistics for discounting, present-bias and effort cost parameter estimates for all groups and all individuals separately.

histograms of time preference, $\hat{\beta}$, and discounting parameter estimates, $\hat{\delta}$. We can see that a large proportion of subjects have low discount rates and high present-bias.

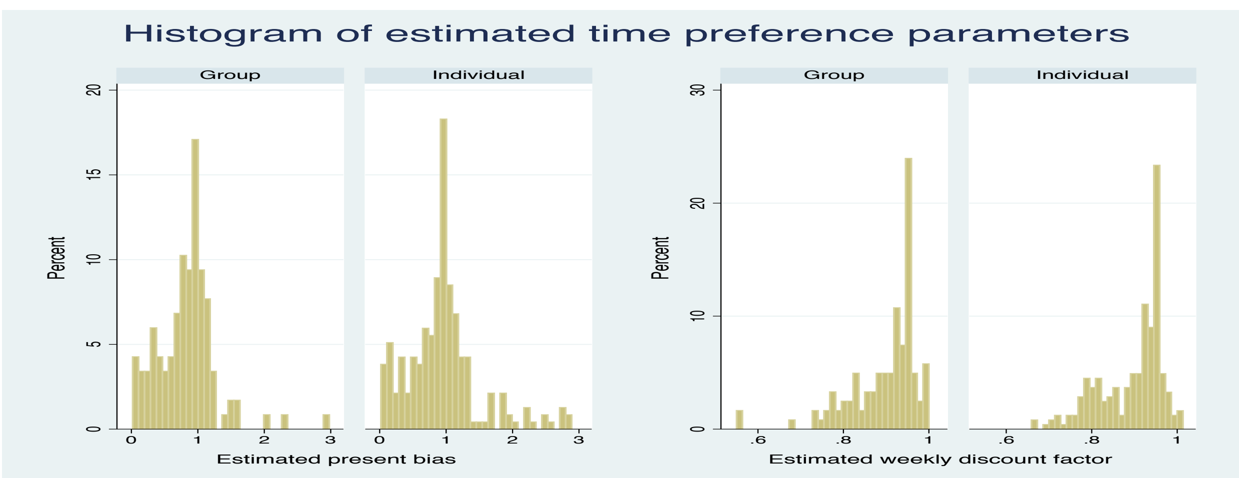

Figure 3: Estimates Histogram

As each group consists of two randomly paired individuals, in Table 5, we present across-group estimates for the median, 5th and 95th percentiles and the minimum and maximum discounting, present-bias, and effort cost parameters for individuals. This allow us to compare the spread of our estimates for individuals (Table 5) with the spread of our estimates

Table 5: Summary of Across-Group Min and Max Parameter Estimates

	N	Median	5th Percentile	95th Percentile	Minimum	Maximum
Minimum						
$\hat{\delta}$	122	0.88	0.72	0.95	0.66	0.95
$\hat{\beta}$	122	0.81	0.09	1.23	0.03	11.5
$\hat{\gamma}$	122	0.49	0.15	1.12	0.57	2.80
Maximum						
$\hat{\delta}$	122	0.95	0.79	0.99	0.75	1.00
$\hat{\beta}$	122	1.07	0.39	3.93	0.03	15.1
$\hat{\gamma}$	122	0.79	0.28	1.74	0.14	2.80

Notes: We use results from the non-linear squares (NLS) estimator used in Table 3. We calculate summary statistics for individuals across all groups dividing them up in the minimum constituent individual and the maximum constituent individual in each group.

for groups (Table 4). We can see that the group median parameter estimates in Table 4 are always greater than the minimum and less than the maximum of the median of the estimates presented in Table 5. The same is true for the 5th Percentile and 95th Percentile estimates of groups compared with their minimum and maximum. This finding is in line with Gollier and Zeckhauser (2005)'s model of aggregation of time preferences, in which the rate of impatience of the representative agent is a weighted mean of individual rates of impatience, although this may not hold at the extreme points.[8]

In Figure 4, we see the distribution of time preference parameters: present-bias and weekly discount factor for the minimum and maximum in the group along with its corresponding collective estimates. The figure visually highlights two important results. First, groups' time preference estimates are bounded by their individual members' estimates. Second, the group present-bias estimates tend to be the closer to within-group minimum estimates. In other words, the person who has higher present-bias in the group dominates the group and drives the overall group-level present-bias.

[8] Gollier and Zeckhauser (2005) also showed that heterogeneous individual exponential discounting yields collective hyperbolic discounting.

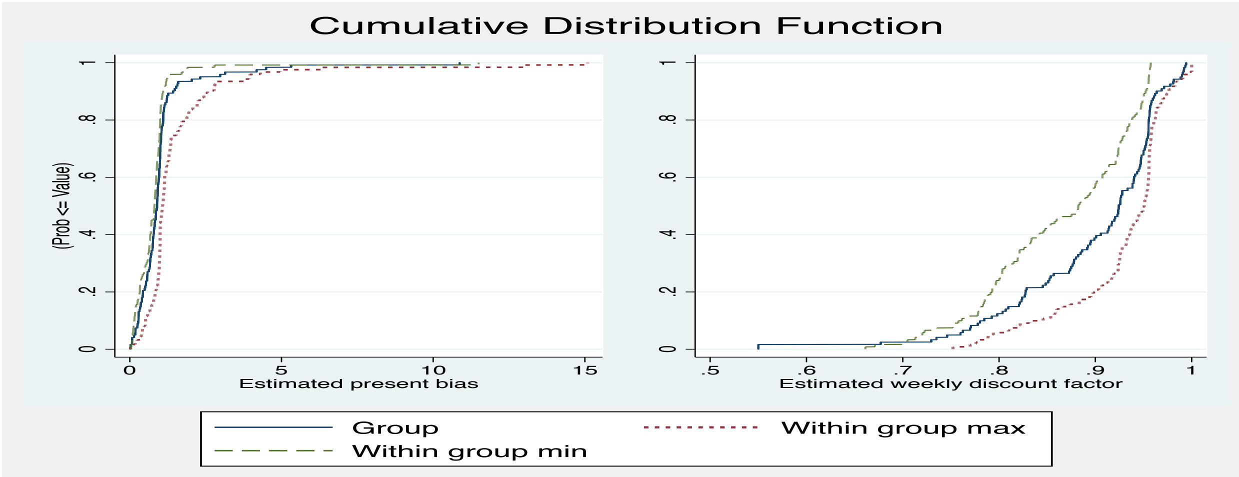

Figure 4: Estimated CDF

6.2.2 Relationship Between Individual and Group Parameters

The above, stylized, theoretical set-up motivates another important hypothesis for the experiment. Having constructed $\hat{\beta}^i_{min}$, $\hat{\beta}^i_{max}$, $\hat{\delta}^i_{min}$, $\hat{\delta}^i_{max}$ for each randomly-created group, we can investigate how individual time preferences effect group time preferences. We use a model in which the group time preference parameter is a linear function of its constituent members:

$$\hat{\beta}_g = \alpha_1 + \kappa_1 \hat{\beta}_{min} + \kappa_2 \hat{\beta}_{max} + \epsilon_{1g} \qquad , \qquad \hat{\delta}_g = \alpha_2 + \eta_1 \hat{\delta}_{min} + \eta_2 \hat{\delta}_{max} + \epsilon_{2g}$$

First, we investigate whether there is a difference between individual and group decisions that is independent of individual members' time preferences. Specifically, we test the hypothesis that $\alpha_i = 0$ for $i = (1, 2)$ ($\alpha_i = 0$ would imply no relationship between individuals and groups' preferences). Second, we investigate the hypothesis that the coefficients of individual decisions sum up to one:

$$\sum_{i=1}^{2} \kappa_i = 1 \qquad , \qquad \sum_{i=1}^{2} \eta_i = 1$$

Together, these two tests imply that the group decision is a convex combination of individual decisions. Hence, the coefficient of the latter can be interpreted as the weights of different members in shaping the group decisions.

Third, we also examine the *mean hypothesis*, which implies that group decisions are simply a function of mean individual decisions:

$$\hat{\beta}_g = \alpha_1 + \frac{\kappa}{2}\hat{\beta}_{min} + \frac{\kappa}{2}\hat{\beta}_{max} \quad , \quad \hat{\delta}_g = \alpha_2 + \frac{\eta}{2}\hat{\delta}_{min} + \frac{\eta}{2}\hat{\delta}_{max}.$$

This implies that the mean is a sufficient statistic for the group's decision. If $\kappa = 1$, then the mean present-bias parameter exactly predicts the component of the group present-bias parameter which varies with individual preferences (i.e. can we reject the hypothesis that $\kappa_1 = \kappa_2$?). Fourth, the version of the mean hypothesis that further requires the mean to exactly predict the group present-bias parameter, is the *strong mean hypothesis*, and requires us to test whether $\kappa_1 = \kappa_2 = \frac{1}{2}$. These arguments also hold true for the long-run discount parameter $\hat{\delta}_g$.

Table 6: OLS regressions of group choices on individual choices

Dep. Var:	$\hat{\beta}_g$			$\hat{\delta}_g$	
	(1)	(2)		(3)	(4)
$\kappa_1 : \hat{\beta}_{min}$	0.79***	0.79***	$\eta_1 : \hat{\delta}_{min}$	0.19	0.15
	(0.08)	(0.08)		(0.14)	(0.21)
$\kappa_2 : \hat{\beta}_{max}$	0.11*	0.11*	$\eta_2 : \hat{\delta}_{max}$	0.74*	0.76
	(0.04)	(0.04)		(0.40)	(0.46)
α_1 : Constant	0.20***	0.22**	α_2 : Constant	0.03	0.04
	(0.05)	(0.08)		(0.32)	(0.30)
Order Effect	N	Y	Order Effect	N	Y
# Observations	122	122	# Observations	122	122
R^2	0.71	0.71	R^2	0.11	0.11
RMSE	0.64	0.64	RMSE	0.13	0.14
Hypothesis (*p-values*)					
Weak Mean	0.00	0.00	Weak Mean	0.31	0.35
Strong Mean	0.00	0.00	Strong Mean	0.05	0.13
Convex Combination	0.00	0.00	Convex Combination	0.04	0.01

Notes: $*p < 0.1$, $**p < 0.05$, $***p < 0.01$. The table presents OLS regressions of group choices on individual choices. Columns (1) and (2) present estimates of individuals' present-bias regressed on their corresponding group estimate, while Columns (3) and (4) do the same for individuals' long-run discount factor. Columns (2) and (4) control for the effect of decision ordering. We use robust standard errors.

In Table 6, we report results from regressing the group decision estimated time preference parameters on the individual decisions in the group. Models (1) and (3) show basic linear specifications, while models (2) and (4) test for robustness of the results by including controls for order effects. In both models of present-bias, columns (1) and (2), the coefficient, κ_1, is positive and significant. This is an important result signifying the fact that the individual with higher present-bias, essentially the more "constrained" individual, dictates the overall group present-bias dynamics. The positive constant term of the model indicates the complementarity within the group's intertemporal behavior. In both models of long-run discount factor, columns (3) and (4), we show that although the more patient individual is barely significant in explaining the groups' long discount rate, the coefficient becomes insignificant when we control for the order effects. Hence, the patient individual cannot explain groups' long-run discount factor.

For level shifts, our results support the hypothesis of a level shift for present-bias, while for the long-run discount rate we cannot reject the null hypothesis of no shift, i.e., $H_0 : \kappa_2 = 0$. The third part of the table reports the results from our post-estimation hypotheses, namely weak ansd strong mean hypotheses and convex combinations, which were developed above for the four OLS models reported in Table 6. For $\hat{\beta}_g$, we reject both the weak and strong versions of the mean and the convex combination hypotheses, i.e., both individual choices are not equally important to explain the groups' present-bias. On the other hand, for $\hat{\delta}_g$, we are unable to reject the weak and strong hypotheses' indicating that the individuals' mean is a sufficient statistic for the group's decision.

Next, we investigate why how groups' task allocation decisions are determined by the present-bias of theri constituent individuals. As mentioned earlier, theoretically, in a group context, inconsistencies can arise simply from the aggregation of heterogeneous preferences due to variations in individual discount rates and cost functions' parameters Jackson and Yariv (2015). Hence, now we explicitly test how variations in individual discount rates, effort cost parameters, as well as differences in within-group bargaining weights could generate group-level behavior that is more present-biased than individual behavior. We also test other important individual factors that shape group behavior such as the coordination externalities within groups.

In Table 7, we show summary statistics for the individual-level variables that may effect group-level behavior: we show the absolute difference between each groups' individual members for various measures such as weekly discount rate, effort cost parameter and bargaining power (we use $\hat{\omega}$ to construct a dummy indicator, $(|\Delta\hat{\omega}| \approx 1)_G (= 1)$, which indicates a group

Table 7: Summary Statistics

Variables	Mean	Standard Deviation	Minimum	Maximum
$\vert\Delta(\hat{\delta}_{IND})\vert$	0.06	0.07	0	0.26
$\vert\Delta(\hat{\gamma}_{IND})\vert$	0.36	0.41	0	2.15
$\vert\Delta(\hat{\omega}_{IND})\vert$	0.85	0.29	0	1
$\vert(\Delta\hat{\omega} \approx 1)\vert_G(= 1)$	0.72	0.44	0	1
$(\hat{\beta} \approx 1)_{both}(= 1)$	0.05	0.21	0	1
Acquaintance Time Duration (months)	13.84	21.56	0	60

Notes: No. of observations is 244. $|\Delta(\hat{\delta}_{IND})|$ is the absolute difference between the groups' individual members' weekly discount rate. $|\Delta(\hat{\gamma}_{IND})|$ is the absolute difference between the groups' individual members' cost of effort parameters. $|\Delta(\hat{\omega}_{IND})|$ is the absolute difference between the groups' individual members' bargaining/Pareto weights. $(|\Delta\hat{\omega}| \approx 1)_G(= 1)$ is the dummy indicator for the group in which one of the members has approximately all the bargaining power. $(\hat{\beta} \approx 1)_{both}(= 1)$ is the dummy indicator, which takes the value of 1 for those groups in which both members are time consistent, approximately.

in which one of the members has approximately all the bargaining power - $|\Delta(\hat{\omega}_{IND})| > 0.98$). We show that the absolute difference between each groups' individual members' weekly discount rate ($|\Delta(\hat{\delta}_{IND})|$) has a mean value of 6% with a standard deviation of 0.07. The absolute difference between each groups' individual members' cost of effort parameters ($|\Delta(\hat{\gamma}_{IND})|$) has a mean of 0.36 with a standard deviation equal to 0.41. The absolute difference between each groups' individual members' bargaining/Pareto weights ($|\Delta(\hat{\omega}_{IND})|$) has a mean of 0.85, indicating that within groups the members have different bargaining power and for most of the groups the chances of having a non-dictatorial set-up are quite high. Finally, we show that the high-bargaining power variable has a mean of 0.72, which shows that in a majority of groups the probability of having a dictatorial member (borrowing the terminology from Jackson and Yariv (2015)) is high i.e. they ignore the preferences of all but one agent.

Lastly, it is pertinent to mention that in the context of our design, the possibility that groups in which both participants are individually time consistent does not pose any additional challenge for our main experimental findings since we observe both group and individual decisions. Focusing on how aggregation relates to time inconsistency, we explicitly controlled for the underlying individual preferences to isolate the effects of aggregation. In cases where both participants are individually time consistent, we construct the variable $(\hat{\beta} \approx 1)_{both}(= 1)$, a dummy indicator taking the value of 1 for those groups in which both members are time consistent (which we define as both members having a $\hat{\beta}$ between 0.95 and 1.05). This variable has a mean of 0.05 indicating that in the overall sample, only 5% of groups have both members who are nearly time consistent.

Finally, in Table 8, we regress individual-level absolute differences for different variables on the group time-preference parameter. In Column 1, we regress the absolute value of the difference between each groups' members' discount rates, cost functions, bargaining power, and bargaining power dummy. We test for the robustness of this result in Column 4, where we add control variables: the absolute value of the difference in Big Five, age and gender. These results show that the weekly discount factor heterogeneities of the individuals do explain group present-bias. They also show that the presence of a dictator or dominant individual based on his/her bargaining power reduces the present-bias in the group. These results are in line with Jackson and Yariv (2014)'s theoretical prediction that for a uniform distribution of discount rates in an otherwise homogeneous population, group utility maximization generates aggregate behavior that corresponds to hyperbolic discounting, and if there is some fundamental heterogeneity in temporal preferences by way of differing discount factors, then the only well-behaved collective utility functions that are both time consistent and respect unanimity are dictatorial. For these two columns, we see that, given there are no variations in individual discount rates and in effort cost parameters, the group's allocation decisions would represent time-consistent patterns given the individuals are exponential discounters.

In Columns 2 and 5, we include acquaintance duration as a control to the previous two specifications. The results show the effect of the coordination externality on the group's present-bias estimate. As the *Acquaintance Duration* between the individual members increases, it is natural to think that the individual's coordination problems lessen. This in turn decreases the group present-bias tendency. In both columns, its estimate is significant at 10%. Under the $H_0 : Constant = 1$, $F(1, 121)$ have a *p-values* that show, given that there are no variations in individual discount rates and in effort cost parameters, the group's allocation decisions would represent time-consistent patterns even if the individuals are exponential discounters with no *Acquaintance Duration*. Lastly, in Columns 3 and 6, we further add the absolute value of the difference in Big Five personality traits to our main specifications. These results show that Big 5 personality traits do not have the power to explain the groups' tendency for present-bias. The effect of a presence of a within-group dictator is not significant in these columns and this may be attributable to fluctuation of overall sample size.

Table 8: Individual vs. Group Regression Analysis

Dependent variable:			$\hat{\beta}_G$			
	(1)	(2)	(3)	(4)	(5)	(6)
$\lvert\Delta(\hat{\delta}_{IND})\rvert$	-3.84**	-3.07**	-3.16**	-3.86**	-3.00**	-3.09**
	(1.25)	(1.19)	(1.28)	(1.26)	(1.23)	(1.32)
$\lvert\Delta(\hat{\gamma}_{IND})\rvert$	0.14	0.21	0.18	0.13	0.24	0.19
	(0.26)	(0.24)	(0.25)	(0.28)	(0.24)	(0.25)
$\lvert\Delta(\hat{\omega}_{IND})\rvert$	-0.25	-0.17	0.07	-0.21	-0.21	0.06
	(0.23)	(0.27)	(0.31)	(0.27)	(0.26)	(0.28)
$(\lvert\Delta\hat{\omega}\rvert \approx 1)_G(=1)$	0.58**	0.43**	0.30	0.57**	0.43**	0.30
	(0.20)	(0.19)	(0.20)	(0.21)	(0.18)	(0.18)
$(\hat{\beta} \approx 1)_{both}(=1)$	-0.27	-0.36	-0.38	-0.30	-0.30	-0.35
	(0.23)	(0.30)	(0.32)	(0.30)	(0.30)	(0.32)
Acquaintance Duration		0.01*	0.01*		0.01*	0.01*
		(0.01)	(0.01)		(0.01)	(0.01)
$\lvert\Delta(Big\ 5)\rvert$			-0.08			-0.05
			(0.14)			(0.15)
$\lvert\Delta(Age\ (in\ years))\rvert$				-0.04	0.02	0.06
				(0.06)	(0.05)	(0.07)
$\lvert\Delta(Gender)\rvert$				-0.09	0.17	0.11
				(0.22)	(0.18)	(0.20)
Constant	1.02***	0.76***	0.72**	1.11***	0.65**	0.56
	(0.14)	(0.19)	(0.25)	(0.24)	(0.24)	(0.34)
# of Groups	122	122	109	122	122	109
Adj R^2	0.06	0.30	0.30	0.07	0.31	0.31
RMSE	1.13	0.98	1.02	1.13	0.97	1.02
$H_0 : Constant = 1$						
p-value	0.87	0.19	0.27	0.65	0.15	0.19

Notes: $^*p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$. Standard errors are clustered at the group level. Column (1) presents the estimates of variations in group members' weekly discount factors, cost of effort parameters, bargaining power estimates, presence of dictator, and both time-consistent members dummies . Column (2) presents the estimates of effect of acquaintance duration on group present-bias, controlling for the variables in column (1). Column (3) captures the estimates of effect of within-group differences in Big 5 personality traits, controlling for the variables in column (2). Columns (4), (5), and (6) represent the estimates of theory and non-theory-based factors, controlling for within-group differences in age and gender.

To summarize, the main message of Table 8 is that groups whose members have misaligned discount rates will be present-biased, and the presence of a dictator within the group improves the group present-biased estimate. To emphasize that divergent preferences within the group are sufficient to render time inconsistency, even controlling for time-consistent individuals and the presence of a dictator within the group, the variation in discount factors has significantly affected the group present-bias. Similarly, the effect of coordination externality, which is captured by the *Acquaintance Duration* variable, is also important in understanding the group present-bias.

7 Conclusion

This paper analyzes individual and collective decisions through the preference elicitation method over unpleasant task consumption. The study uses experimental data to analyze task consumption decisions by groups of individuals who have to reach a consensus regarding allocation of tasks over time. For this purpose, a joint experimental elicitation of time preferences was performed for the groups as well as for their individual members.

The main results of the paper are as follows: First, on aggregate, a present-bias exists in participants' behavior, i.e., the participants' intertemporal allocation decisions exhibited time inconsistency. Second, the degree of present-bias was more pronounced in a group's task allocation decisions as compared to an individual's task allocation setting. Third, the order in which decisions were made, whether making the individual task allocation first and then the group task allocation or vice versa had no effect on the degree of present-bias. Lastly, using within-groups estimates of present-bias and discount factor, the variations in group's individual members discount rates do explain group present-bias, as postulated by Jackson and Yariv (2015).

We acknowledge that the results could be partly explained, by a selection bias. In our experiment, as in any experiment involving longitudinal measures, subjects were supposed to commit to three sessions over a time span of three weeks. Here, a specificity of our subjects is probably their ability to commit and schedule (Frederick et al. 2002; Perez-Arce 2011; Dohmen et al. 2010). The estimates of present-bias and discount rates for individual choices we found are no higher than those found in the literature, although the empirical literature on task consumption is very limited. Moreover, we were mainly interested in comparisons. It is plausible that the selection bias impacted all decisions to a similar extent, thus we have no big effect on our comparisons. Finally, our coordinating device allowed groups to quickly converge towards a given decision. In this respect, our results have implications for the way households, boards and committees can achieve consistent decisions.

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8 Appendix

A1: Nonlinear Least Squares Method

Let there be N experimental subjects and P Convex Time Budget, (CTBs). Assume that each subject j makes her $v_{1tij}, i = 1, 2, ..., P$, decisions (both individual and group) according to the non-linear Euler equation mentioned above, but that these decisions are made with some mean-zero, potentially correlated error. That is, let

$$f(V, R, \mathbf{1}_{d=1}, k, \gamma, \delta, \beta) = \left(\frac{\beta^{\mathbf{1}_{d=1}} \delta^k V}{\gamma R^2 + \beta^{\mathbf{1}_{d=1}} \delta^k} \right),$$

then

$$v_{1t}{}_{ij}^{*} = f(V, R, \mathbf{1}_{d=1}, k, \gamma, \delta, \beta) + e_{tij}.$$

Stacking the P observations for individual j making her individual and group decisions, we have

$$\boldsymbol{v_{1t}}_j^* = \boldsymbol{f}(V, R, \mathbf{1}_{d=1}, k, \gamma, \delta, \beta) + \boldsymbol{e}_j.$$

The vector $\boldsymbol{e}_j$ is zero in expectation with covariance matrix $\boldsymbol{V_j}$, a $(P \times P)$ matrix, allowing for arbitrary correlation in the errors e_{ij} . We stack over the N experimental subjects to obtain

$$\boldsymbol{v_{1t}^*} = \boldsymbol{f}(V, R, \mathbf{1}_{d=1}, k, \gamma, \delta, \beta) + \boldsymbol{e}.$$

We assume that the terms e_{ij} may be correlated within groups (or individuals within the same group) but that the errors are uncorrelated across groups (or individuals within the same group), $E(\boldsymbol{e}_j^{'}\boldsymbol{e}_g) = 0$ for $j \neq g$. Therefore, $\boldsymbol{e}$ is zero in expectation with covariance matrix $\boldsymbol{\Omega}$, a block diagonal $(NP \times NP)$ matrix of clusters, with groups, covariance matrices, $\boldsymbol{V_j}$. We define the usual criterion function $S(V, R, \mathbf{1}_{d=1}, k, \gamma, \delta, \beta)$ as the sum of squared residuals,

$$S(V, R, \mathbf{1}_{d=1}, k, \gamma, \delta, \beta) = \sum_{j=1}^{N} \sum_{i=1}^{P} (v_{1t}{}_{ij}^{*} - f(V, R, \mathbf{1}_{d=1}, k, \gamma, \delta, \beta))^2,$$

and minimize $S(.)$ using non-linear least squares with standard errors clustered on the group level to obtain $\hat{\beta}$, $\hat{\delta}$, and γ. NLS procedures permitting the estimation of preference parameters at the aggregate or individual level are implemented in many standard econometrics packages (in our case, *Stata*).

Table 9: Two-Limit Tobit Regression Analysis

Dependent variable:	Log of Tasks Allocated to the 1st Day			
	(1)	(2)	(3)	(4)
β_1 : Log Task Rate	-0.49***	-0.50***	-0.49***	-0.50***
	(0.08)	(0.08)	(0.08)	(0.08)
β_2 : Immediate Decision (=1)	-0.12**	-0.12**	-0.10	-0.10
	(0.04)	(0.04)	(0.07)	(0.07)
β_3 : Individual Decision First (=1)			-0.02	-0.04
			(0.06)	(0.06)
β_4 : Immediate Individual Decision First (=1)			-0.03	-0.02
			(0.08)	(0.08)
$\beta_5 : Age\ (in\ years)$		0.02		0.02*
		(0.01)		(0.01)
$\beta_6 : Gender\ (Female\ =\ 0)$		0.03		0.02
		(0.05)		(0.05)
$\beta_7 : Has\ a\ On\ campus\ Job\ (Yes\ = 0)$		-0.03		-0.02
		(0.11)		(0.11)
$\beta_8 : Had\ a\ Savings\ Account\ (Yes\ = 0)$		0.06		0.06
		(0.07)		(0.07)
$\beta_9 : Has\ a\ Savings\ Account\ (Yes\ = 0)$		-0.02		-0.02
		(0.06)		(0.06)
β_0 : Constant	4.96***	4.42***	4.97***	4.35***
	(0.08)	(0.44)	(0.09)	(0.42)
# of Obs	1464	1464	1464	1464
# of Groups	122	122	122	122
F-stats	21.07	7.26	11.06	5.79
Adj R^2	0.02	0.02	0.02	0.02
Hypothesis (*p-values*)				
$H_0 : \beta_2 = 1$	0.00			
$H_0 : \beta_2 = 1$		0.00		
$H_0 : \beta_2 + \beta_4 = 1$			0.00	
$H_0 : \beta_2 + \beta_4 = 1$				0.00

Notes: $^*p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$. Standard errors are clustered at the group level. The table presents the estimates of Immediate Decision (=1) and its interactions with other experimentally induced variations using the Two-Limit Tobit Regression technique. Column (1) presents aggregated decisions, estimates. Column (2) captures the estimates of Immediate Decision (=1) along with demographic variables. Column (3) represents the results of effect of decision ordering and its interaction with Immediate Decision (=1). Column (4) represents the results of effect of the decision ordering and its interaction with Immediate Decision (=1), controlling for demographic variables.

A2: Additional Two-Limit Tobit Regression Analysis

Table A2.1 provides robustness results for the non-structural estimation specifications discussed in the paper. Using the intertemporal individual decisions, the results provide the comparison of the estimates, controlling for the demographic variables.

Table 10: Additional Individual vs. Group Regression Analysis

Dependent variable:	$\hat{\beta}_G$							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\lvert\Delta(\mathit{Age\ (in\ years)})\rvert$	-0.06							-0.06
	(0.14)							(0.14)
$\lvert\Delta(\mathit{Gender})\rvert$		-0.10						-0.20
		(0.41)						(0.45)
$\lvert\Delta(\mathit{Outside\ Class\ Study\ Hrs})\rvert$			-0.12					-0.12
			(0.08)					(0.07)
$\lvert\Delta(\mathit{On\ Campus\ Job})\rvert$				-0.61				-0.82
				(0.37)				(0.51)
$\lvert\Delta(\mathit{Family\ Income\ in\ Log})\rvert$					-0.17			-0.18
					(0.21)			(0.24)
$\lvert\Delta(\mathit{Past\ Savings\ Acc.})\rvert$						0.22		0.19
						(0.49)		(0.92)
$\lvert\Delta(\mathit{Curr.Savings\ Acc.})\rvert$							-0.59	1.05
							(0.37)	(0.76)
Constant	1.08***	1.04***	1.212***	1.06***	1.11***	0.97***	1.14***	1.42***
	(0.19)	(0.18)	(0.23)	(0.12)	(0.18)	(0.10)	(0.17)	(0.38)
# of Groups	122	120	120	120	110	122	122	110
R^2	0.00	0.00	0.01	0.01	0.00	0.00	0.01	0.06

Notes: *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$. Standard errors are clustered at the group level. The table presents the estimates of other important demographic variables' differences on groups' present-biased estimated variable.

A3: Additional Individual vs. Group Analysis

Table A2 shows the association of additional individual characteristics (mentioned in the demographic section) with the group estimated present-bias parameter. The results signify the fact that beyond discount factor heterogeneity there is no association between group present-bias and differences in groups' individual members' characteristics per se. Table A3 presents the robustness test of the point estimates obtained in Table 8. Controlling for the other important demographic variables mentioned in the empirical literature, the point estimates of variation in individual member discount factors and *Acquaintance Duration* between them remain the same. F stats also indicate that, given there are no variations in individual members' discount rates and in effort cost parameters, the group's allocation decisions would represent the time-consistent pattern even if the individuals are exponential discounters with no *Acquaintance Duration*.

Table 11: Individual vs. Group Regression Analysis

Dependent variable:	$\hat{\beta}_G$					
	(1)	(2)	(3)	(4)	(5)	(6)
$\lvert\Delta(\hat{\delta}_{IND})\rvert$	-3.84**	-3.47***	-3.76***	-3.86***	-3.26***	-3.53***
	(1.28)	(1.18)	(1.12)	(1.20)	(1.16)	(1.27)
$\lvert\Delta(\hat{\gamma}_{IND})\rvert$	0.20	0.24	0.23	0.32	0.23	0.37
	(0.22)	(0.30)	(0.22)	(0.25)	(0.22)	(0.25)
$(\hat{\beta}_{min} \approx 1)_{IND}(= 1)$	0.16	0.11			0.16	0.11
	(0.30)	(0.45)			(0.36)	(0.54)
$(\hat{\beta}_{max} \approx 1)_{IND}(= 1)$	-0.23	-0.34			-0.06	-0.04
	(0.13)	(0.23)			(0.12)	(0.16)
Acquaintance Duration			0.63**	0.63***	0.64**	0.66**
			(0.27)	(0.23)	(0.27)	(0.27)
$\lvert\Delta(\hat{\delta}_{IND})\rvert \times Acq\ Duration$			-6.29**	-6.64**	-6.37*	-6.60**
			(2.70)	(2.89)	(2.75)	(2.94)
Constant	1.23***	1.54***	1.13***	1.29***	1.05***	1.11
	(0.21)	(0.49)	(0.14)	(0.30)	(0.14)	(0.30)
Control for Demographic Variables	No	Yes	No	Yes	No	Yes
# of Groups	122	110	122	110	122	110
R^2	0.04	0.10	0.23	0.28	0.34	0.39
$H_0 : Constant = 1$						
p-value=	0.26	0.27	0.35	0.32	0.71	0.69

Notes: $^*p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$. Standard errors are clustered at the group level. Column (1) again represents the formal test of Jackson and Yariv's (2015) main hypothesis. Column (5) represents the robustness of the results obtained in column(1), controlling for differences in demographic variables mentioned in Table above. Columns (3) and (5) are the same as in Table 7, and columns (4) and (6) represent the corresponding robustness check of the results obtained.

A4: Experiment Protocol

Instructions

Thank you for participating in our experiment. We will begin shortly.

Eligibility:

To be in this study, you need to meet the following criteria:

- You must be willing to participate for three consecutive Fridays. Participation will require your presence on specific days as outlined.
- You will need at least one hour and at max three hours on Friday 13th March, Friday 20th March and Friday 27th March.

Informed Consent:

Placed in front of you is an informed consent form to protect your rights as a subject. Please read it. If you choose not to participate in the study you are free to leave at this point, deciding to leave later would seriously harm our resources allocated to this study. If you have any questions, we can address those now. We will collect the forms after the main points of the study are discussed.

Anonymity:

Your anonymity in this study is assured. All the information we acquire, will be used only for the purpose of communication with you. After the study, your email information will be destroyed and will not be connected to your responses in the experiment.

Venue:

- Venue for Friday 20th March will be the same.
- For Friday 27th March, you do not have to be present physically. You can work from anywhere remotely, given that you have an internet connection.

Rules:

- Please turn off your own cell phones.
- If you have a question at any point, just raise your hand.
- There will be a short survey once we are finished with the instructions.
- During the process of reviewing your answers in your survey, if we find your responses in violation of any of the instructions, you might get removed from the experiment.
- You will receive Rs.500 a participation fee. Participation means showing up on the first two Fridays.
- If you complete the assigned tasks on all required days of participation as instructed, a completion payment of Rs.1500 will be provided.
- You may receive additional earnings during the experiment if you participate in potential survey games.
- If you choose to end your participation before the completion of the experiment, please report this to study administrators at the mentioned email address.
- All payments will be made on 1st April in IGC office room 161. You will return the phones given to you for experiment purposes to IGC to receive this payment.

Task:

In this study there is only one task. This task will be completed over time. Some portion of the task may be completed sooner, and some portion of the task can be completed later depending on your choices and chance.

This task will consist of taking a specific number of pictures of books via cell phones. Remember, your phone has a unique IMEI number. Once you take a picture, you need to upload the picture using the application on the phone. Make sure your pictures are clear and the numbers are legible. If the numbers are not legible, they will not be counted. Some portion of the task may be completed on the second Friday, and some portion of the task can be completed on the third Friday. You will practice using the phone application before the actual task starts.

Task Rates:

The allocation decisions across two weeks depend on the task rate. The task rate will vary across your decisions. On the target-setting page of the application (installed the cell phones given to you), every slider bar corresponds to a specific task rate. For example, the first slider bar the task rate is 1:0.8, such that every task you allocate to the second Friday reduces the number of tasks allocated to the third Friday by 0.8. For simplicity, the task rates will always be represented as 1:X, and you will be fully informed of the value of X when making your decisions.

The Experiment Timeline:

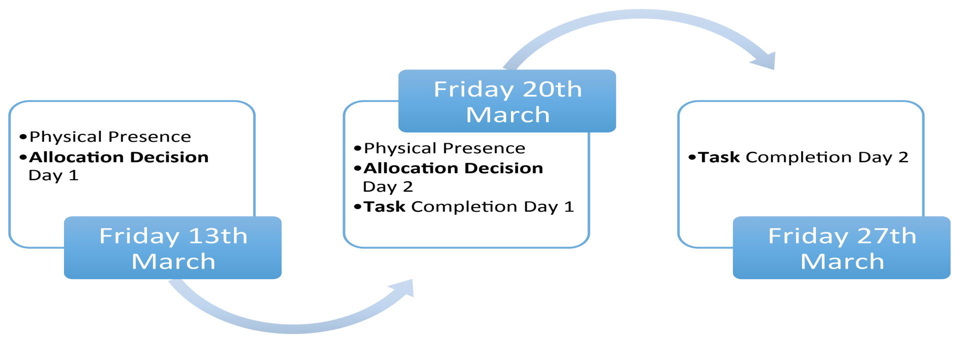

Figure 5: Timeline

Notes: Three weeks experimental timeline figure provided to all participants

Before explaining the activities to be done on each Friday you need to have an overall picture of the timeline.

First Friday (13th March 2015):

- First, all of the Subjects will be required to fill out different survey forms.
- After the Survey forms have been completed and collected, you will be asked to make a series of three decisions for task distribution as an individual.
- Once you have made decisions for individual task distribution, again you will be required to make three decisions and distribute the task as a group.

- Keep in mind that your decision today is for the task you will be doing on 20th and 27th March. This applies to both Individual and Group decisions.
- In each decision you are free to allocate your tasks as you choose.

Second Friday (20th March 2015):

- During our second session here in the very same venue, again you will be asked to make three Decisions (both individually and as a group) as you did during the first session.
- By this time we will have 12 decisions from every subject (3 Individual + 3 Group on the 13th and 3 Individual + 3 Group on the 20th).
- Exactly one of your 12 total decisions will be implemented randomly.
- We will discuss how this allocation decision is chosen during our training session.

- We refer to this allocation decision as the "decision-that-counts."■ The tasks you allocated yourself for the 20th and 27th in the decision-that-counts must be completed.

  If you do not complete the tasks according to the decision-that-counts, you will not receive the completion amount of Rs. 1500 and will receive on the participation fee of Rs. 500.

  In order for your tasks on the second or third Friday to be counted, they must be completed between 9:30 pm and 10:30 pm of that Friday.

  Surveys will be conducted, which will give you a chance to earn more money.

Third Friday (27th March 2015):

- You will have to complete your tasks for this day according to your decision-that-counts.
- You can do this remotely from anywhere.

How we will choose the decision-that-counts:

The process of selecting the decision-that-counts is simple probability. *Three stages to determine the decision-that-counts:*

1. First, you will be allocated either 13th March Decisions or 20th March Decisions according to a 20% and 80% chance, respectively.
2. Once you have been allocated to a specific date (13th or 20th March) either you will be given an Individual Task or a Group Task with a 33% and 66% chance, respectively.
3. After both of the steps given above are complete, you will receive one of the three decisions you made for that specific date and specific task type with equal chance.

EACH DECISION COULD BE THE DECISION-THAT-COUNTS, SO TREAT EACH DECISION AS IF IT WAS THE ONE DETERMINING YOUR TASKS.

Short Survey: Please answer the following questions:

1. How many weeks do we require you to participate?
2. In which of the three weeks are you asked to participate remotely and not come to this venue?
3. What is the percent chance that one of your 20th March allocations will be implemented?
4. If you face a 1:2 task rate for allocations between weeks 2 and 3, every task you allocate to week 2 decreases by how many number of the tasks you allocate to week 3?