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Influence and choice shifts in households: An experimental investigation

Xiaojun Yang [a,*], Fredrik Carlsson [b,1]

[a] National School of Development, Peking University, 100871 Beijing, China
[b] Department of Economics, University of Gothenburg, Box 640, 405 30 Gothenburg, Sweden

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ABSTRACT

In this paper, we examine the relative influence of individual decisions on joint household decisions, and whether and to what extent joint choices are more or less patient than individual choices in households. We find that both spouses have a significant influence on joint decisions, whereas husbands on average have a stronger influence than wives. Moreover, we find a substantial share of choice shifts from individual to joint household decisions, i.e. joint decisions are either more patient or more impatient than both individual choices. A number of observable characteristics are significantly correlated with these shifts in preferences from individual decisions to joint decisions.

1. Introduction

The empirical literature on household decision-making is by now extensive. Previous studies looking at actual decisions in the household suggests that the outcomes of household decisions depend on who in the household has control over the resources (Thomas, 1990; Browning, Bourguignon, Chiappori, & Lechene, 1994; Duflo, 2003; Lundberg, Pollak, & Wales, 1997; Namoro & Roushdy, 2008; Phipps & Burton 1998). In addition, by changing the control of income or access to financial assets, a set of field experiments reveal the importance of financial control in improving women's decision power and the decisions of the household (Ashraf, 2009; Ashraf, Karlan, & Yin, 2010; De Mel, McKenzie, & Woodruff, 2009; Mani, 2010;

* Corresponding author. Tel./fax: +86 10 62767657.
E-mail addresses: xjyang@nsd.pku.edu.cn (X. Yang), fredrik.carlsson@economics.gu.se (F. Carlsson).
[1] Tel.: +46 31 786 41 74; fax: +46 31 773 10 43.

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Robinson, 2012). Recently, controlled experiments have also been used to investigate the influence of spouses on joint decisions (Abdellaoui, Haridon, & Paraschiv, 2011; Bateman & Munro, 2005; Carlsson, He, Martinsson, Qin, & Sutter 2012; Carlsson, Martinsson, Qin, & Sutter 2013; de Palma, Picard, & Ziegelmeyer, 2011). Apart from having control over the decision environment, the perhaps main advantage of controlled experiments is that both individual and joint decisions can be observed and related to each other. Controlled experiments have allowed researchers to directly estimate the spouses' respective influences and relate them to the characteristics of the households and the individual decision makers.

Intertemporal choices are of great importance to households since they often concern decisions such as savings, investments, and education. With the exceptions of Abdellaoui et al. (2011) and Carlsson et al. (2012), the literature on households' intertemporal decisions is relatively scarce. In this paper we study households' and spouses' intertemporal decisions in a controlled experiment where decisions are made both individually and jointly.[2] We investigate two aspects of household decisions making. The first is the influence on joint decisions by the husband and wife. The second is to what extent joint household decisions are more extreme or polarized than individual decisions.

Using the framework in Carlsson et al. (2012), we relate the individual choices to the choices made jointly and investigate to what extent the husband and wife influence joint decisions, and compare their relative influence. There is evidence that group decisions can become more extreme or polarized than individual decisions (Ambrus, Greiner, & Pathak, 2009; Cason & Mui, 1997; Eliaz, Raj, & Razin, 2006; Moscovici & Zavalloni, 1969; Shapiro, 2010; Stoner, 1968; Sunstein, 2000; Sunstein, 2002). Theoretically, there are a number of factors that can explain the difference between group and individual decisions as well as shifts in decisions, such as social comparison concerns (Levinger & Schneider, 1969), diffusion of responsibility (Eliaz et al., 2006), and altruistic concerns (Shapiro, 2010). Similar to group decisions, many household decisions are discussed and reflect, to varying extents, individual members' preferences. Studying to what extent joint household decisions are shifted is therefore of particular interest since the "diffusion of responsibility" and altruism play potentially important roles in household decision-making.

The type of shift we investigate is whether the joint decision on how much to allocate to the sooner date is outside the range of allocations to the sooner date given by the individual decisions. If a joint choice is more patient than the individual ones, we refer to it as a *patient shift*. The opposite case, where the joint choice is more impatient than the individual ones, is referred to as an *impatient shift*. Since a household is a group where individuals know their partners well, household joint intertemporal decisions could be useful in helping some individuals overcome for example self-control problem (Kono, Matsuda, Murooka, & Tanaka, 2011). In this sense, individual spouses could make more patient decisions in a joint setting than they would have made the decisions separately. A plausible explanation for why the joint choices are shifted to be more patient is that the spouses care about each other's preferences, and apply patient preferences when they know that the outcome will affect their spouse (Shapiro, 2010). Thus, even if, say, the husband is a hyperbolic discounter he might think it is better if the joint decision is more patient and is therefore willing to shift the decision.

We conduct an artefactual field experiment with 164 couples in rural China. In this experiment, couples made both separate and joint decisions on how much money to allocate to an early date and a later date. In addition, instead of the widely used multiple price list elicitation method in time preference literature (Andersen, Harrison, Lau, & Rutström, 2006; Andersen, Harrison, Lau, & Rutström, 2008; Coller & Williams, 1999; Harrison, Lau, & Williams, 2002; Tanaka, Camerer, & Nguyen, 2010), we employ the Convex Time Budget experimental method suggested by Andreoni and Sprenger (2012) to elicit individual and couple's intertemporal allocation decisions. The main advantage of this method is to account for the curvature of utility function.[3] The subjects can thus continuously allocate a certain amount of money between a sooner date and a later date. In the experiment, the subjects were asked to make ten different decisions where the interest rate and whether the early date is immediate or not are varied. With this approach we obtain detailed information about the characteristics of individual and joint choices, including the relationship between individual and joint decisions and to what degree joint choices can be shifted outside the range of individual choices.

The rest of this paper is organized as follows. In Section 2 we introduce the details about experimental design and procedure. Section 3 presents the analytical framework. We present and discuss descriptive results and regression results in Section 4. Finally, Section 5 concludes the paper.

2. Experimental design and procedure

2.1. Location of the experiment and description of the sample

The experiment was conducted in two counties of the Gansu province, which is located in the northwest of China. The two counties are Linxia and Jingning, which are located in the southwestern and southeastern parts of the province, respectively. As can be seen in Table 1A in Appendix A, in each county, we randomly chose three townships, and in total 13 villages were randomly selected.

[2] Here and henceforth, the respondents indicate husbands, wives or couples.

[3] There have been some concerns about the Convex Time Budget, in particular regarding the amount of information actually obtained from the experiments (Harrison, Lau, & Rutström, 2013). The main concern is the potentially large amount of corner observations, i.e. subject that either allocates all the money to the early date or the late date alternative.

In eight of the villages we randomly chose 10–25 households in each village with official marital status from the village registration list provided by the village leaders. In the other five villages, we randomly selected around five households in each village, also with official marital status.[4] With the assistance of one village cadre, two randomly matched enumerators (always one male and one female) approached the selected households. If both the husband and wife voluntarily agreed to be interviewed after our welcome announcement, the village cadre left. If one of the spouses was not home when the enumerators arrived at their house, the enumerators waited for a while or made an appointment to come back later. We had to make sure to interview the selected households in each village within one day in order to keep information about the experiment from spreading. If an appointment could not be made or if one spouse in a couple refused to be interviewed,[5] the enumerators visited the neighbor instead. Finally, 164 couples agreed to voluntarily participate in the experiment.

Table 1 describes the summary statistics of the sampled households. The average ages of the husbands and wives are 49 and 46 years, respectively. On average, the husbands have 5 years of education and the wives 2.5 years. As regards individual questions, husbands and wives have surprisingly similar responses. For example, the average income contribution to the households of the wives is around 40%. Husbands are the main decision makers in everyday life, but wives have more decision power when it comes to daily expenses such as food and clothes. As for the common household characteristics, the average household has five members, and the average length of marriage is 26 years. In 2010, the average household's gross income per capita was 7064 yuan.[6]

2.2. Experimental design

We apply the Convex Time Budget method suggested by Andreoni and Sprenger (2012) to investigate subjects' intertemporal choices.[7] In Table 2, the 10 intertemporal choice sets for each respondent are described. There are only two timeframes with the same delay time of one month: the near period between today and one month from today and the far period between two months and three months from today. To investigate whether respondents have present-biased preferences, we use "today" not "tomorrow" in the experimental design. However, this could imply different transaction costs between payments today and future payments (Andersen et al., 2008). As can be seen in the Table 1, both husband and wife expressed quite high level of trust that they would receive the future payments. In addition, respondents were told that they would get two vouchers, one for sooner payments and one for later payments, signed by the project coordinator. The voucher indicated the amount of cash and corresponding date the respondent could redeem the money. The five interest rates we used in the experiment were tested and decided upon based on the results of the pilot experiment.[8] Respondents needed to allocate the given 20 tokens between a sooner and a later date with increasing interest rates.

As described in detail below, subjects were presented with two plates. The red plate represented the sooner date (today or two months from today) and the orange plate represented the later date (one month from today or three months from today). Their task was to decide how many tokens to put on each plate, where in all choices each token was worth 2 yuan if it was allocated to the red plate. One token was worth $2 \times (1 + r)$ yuan if it was allocated to the orange plate. r is the rate of return for waiting, and it increased from the first choice to the fifth choice.

The respondents made both individual and joint decisions. As described below the order was randomly determined. When they made the individual choices they were clearly told that the money was theirs, and when they made the joint choices they would receive the same amount each. Thus, even when the decisions were made jointly, each spouse would receive their own individual money. The rationale to have this design is to make the individual decisions and joint decisions comparable. It is of course possible that the individual choices were made taking into consideration the preferences of the spouse, and we have no way to control for that. However, what we did was to stress that the choices would not be revealed to the spouse and that the money was individual and not to be paid to the household.

2.3. Experimental procedure

We employed and trained 10 interviewers, from now on called experimenters, to conduct the experiment. Once a couple had agreed to participate in the whole survey, one of the experimenters gave a brief introduction of the tasks. Then the

[4] The survey mainly consisted of two separate experiments. In the eight villages, we mainly conducted the experiments with individual and joint decisions as used in current paper. In the other five villages, we mainly conducted another experiments about respondents' own decisions, predictions and decisions for spouse. Since we control for the effect of who has initial control over the tokens in the joint decisions, we increase sample size by randomly selecting additional respondents in the other five villages (see the sample distribution in Table 1A).

[5] Three households refused to be interviewed. Among them, two households could not participate in the survey mainly because the wives stated they were too busy. One household refused to continue the experiment when the enumerators told them they could obtain some payments from our experiment. They did not tell us the concrete reason—they just did not want to continue.

[6] At the time of the experiment, 1 USD = 6.59 CNY.

[7] An alternative method to account for utility function curvature is to elicit both risk and time preferences using multiple price list method, which is referred as Double Multiple Price List (DMPL) method (Andersen et al., 2008). Andreoni, Kuhn, and Sprenger (2015) argue that the large proportion of corner observations with the CTB method improves the out-of-sample predictive validity compared to DMPL method. In addition, Angerer, Lergetporer, Glätzle-Rützler, and Sutter (2015) use both multiple price list method and time-investment-exercise (simplified version of CTB) to elicit children' time preferences, and find that both methods yield similar results and the behaviors can be explained by the same factors.

[8] During the pilot studies, we first used the interest rates used by Gine, Goldberg, Silverman, and Yang (2012), i.e., 0.1, 0.25, 0.5, 0.75, and 1. However, especially at the high interest rates, there were almost no trade-offs; hence we reduced the rates to 0.05, 0.1, 0.25, 0.4, and 0.6.

Table 1
Descriptive statistics of individual and household characteristics (N = 164 households).

	Husband		Wife	
	Mean	Std. dev.	Mean	Std. dev.
Individual characteristics				
Age (years)	48.78	9.34	46.26	9.11
Higher than primary school (1 = yes)	0.50		0.19	
Communist party member (1 = yes)	0.12		0.01	
Individual attitudes				
General decision maker (1 = husband; 2 = joint; 3 = wife)	1.24	0.46	1.38	0.59
Wife income contribution share	0.40	0.17	0.39	0.17
Husband income contribution share	0.60	0.17	0.61	0.17
Decision maker on savings (1 = husband; 2 = joint; 3 = wife)	1.31	0.49	1.34	0.51
Decision maker on daily expense (1 = husband; 2 = joint; 3 = wife)	2.36	0.78	2.18	0.81
Decision maker on durable goods (1 = husband; 2 = joint; 3 = wife)	1.55	0.53	1.55	0.61
Decision maker on expensive fixed asset (1 = husband; 2 = joint; 3 = wife)	1.55	0.52	1.50	0.54
Trustiness on the future payments (1 = totally do not trust; 2 = do not trust; 3 = neither trust nor distrust; 4 = trust; 5 = totally trust)	4.56	0.82	4.49	0.77
Household characteristics				
Household is minority (1 = yes)	0.15			
Household population (persons)	4.98	1.50		
The length of marriage (years)	26.06	9.80		
Log of equivalence scaled total gross income (yuan); Equivalence = (adults + 0.5 $*$ children)$^{0.75}$	9.03	0.68		

Table 2
Description of the 10 decisions in the time preference experiment.

Sooner date	Later date	Token budget	Interest rate	Sooner value of one token	Later value of one token
0	30	20	0.05	2	2.1
0	30	20	0.1	2	2.2
0	30	20	0.25	2	2.5
0	30	20	0.4	2	2.8
0	30	20	0.6	2	3.2
60	90	20	0.05	2	2.1
60	90	20	0.1	2	2.2
60	90	20	0.25	2	2.5
60	90	20	0.4	2	2.8
60	90	20	0.6	2	3.2

couple together answered a set of questions about the household. The rest of the procedure depended on the order of the parts of the experiment (see Section 2.4). However, we will for simplicity only describe in detail one of the orders used.

In the version where individual decisions were made before the joint decisions, the respondents were (following the first initial questions) physically separated into two rooms where they could not hear each other; one experimenter followed the wife and one followed the husband. The experimenter read out the experimental instructions to the respondent, and the respondent was told that s/he could earn some money and that the amount earned depended on his/her decisions in the experiment. The respondent needed to make 10 separate decisions, and one of these decisions would be randomly chosen to be paid out by rolling a 10-sided dice at the end of the survey. The number that came up on the dice decided which choice would determine the respondent's earnings. Thus, each decision had an equal chance of being used in the end.

To help the respondents understand the experiment, they first made two trial decisions.[9] The purpose of the trial decisions is to help respondents make more informed decisions and avoid misunderstandings of the experimental tasks. The drawback with trial decisions is that the experiment takes too long and hence causes respondents to be fatigued. However, our experience from the pilot experiment was that the trial tasks were crucial for the understanding of the experiment. Once the experimenter was certain that the respondent had understood, s/he was asked to make the first five independent decisions about how to allocate 20 tokens between today and one month from today. To help the respondent remember which dates the two plates represented, the experimenter put a sign in front of each plate with the corresponding date and the value of a token. When the respondent finished her/his allocations, the experimenter translated the total tokens on each plate into Chinese yuan and wrote the decision on the whiteboard. The respondent also had the chance to revise the allocations before moving to the next choice.

[9] The trial decisions were about how to allocate 10 tokens between one month from today and two months from today. Before the respondent did this, the experimenter asked some control questions about the meaning of the plates and the tokens. The respondent started to make the trial decisions only when s/he had understood the meaning of the plates and the tokens. The trial decisions were the same regardless of the order between individual decisions and joint decisions.

The elicitation procedure was similar for the second five independent choices. Yet the respondent was reminded that s/he needed to wait for both the sooner payment (two months from today) and the later payment (three months from today).

When both the husband and the wife finished, they were brought together for the joint decisions. However, they did not have any prior information about the joint decisions when they finished their individual decisions. The couple was told that they would make 10 intertemporal choices similar to the individual decisions they had just made. The main difference was that both of them would obtain the same amount of payments according to one of the joint decisions, which would be randomly selected by rolling a 10-sided dice. Before each decision was made, they were encouraged to speak to each other and discuss the decision, as they needed to agree on how to allocate the money between the sooner and later dates. The couple followed the same elicitation method as the individual decisions. When the respondents finished the joint decisions, one of them was randomly selected to roll the 10-sided dice to determine the earnings. They then were separated to roll the 10-sided dice for one of individual decisions. The aim of this design is to mitigate the endowment effect of earnings from individual decisions on joint decisions.

On average, the whole survey lasted for one and a half hours for each household. The average experimental payment for each household was around 180 yuan, which equals three days of non-farm wages for a local full-time worker.

2.4. Order effects and initial control over the tokens

In the design, we control for two important order effects. The first one is about the order of individual and joint decisions. Half of the households made the individual decisions first and then the joint decisions. The other half of the households made the joint decisions first and then the individual decisions. While the natural order would be to first conduct the individual experiment and then the joint, we want to test if the ordering affects the behavior in the joint decision experiment. There could, for example, be learning effects, or the respondents may try to smooth out the earnings over time and the two parts of the experiment.

The second order effect concerns the order of the two parts of the time preference experiment. Half of the households answered the five questions regarding money allocated between today and one month from today first, while the other half started with the five questions regarding money allocated between two months and three months from today.

In addition, we control for experimenter effects by interchanging their interviewing subjects in each household. For example, if the male experimenter interviewed the husband and the couple in one household, then the female experimenter needed to interview the husband and couple in the next household.

Finally, in the joint experiment, to control for the effects of who had the initial control over the tokens on the joint decisions, we had four alternatives for how the tokens were initially distributed. The first reference situation was that the experimenter just put the 20 tokens between the husband and the wife, but did not say anything else about who was responsible to put tokens on the plates. The second situation was that the experimenter gave the 20 tokens to the wife, making her in charge of putting the tokens on the plates. In the third situation, the experimenter gave the 20 tokens to the husband, who was initially responsible to put the tokens on the plates. The fourth situation was that the experimenter gave 10 tokens to the wife and 10 tokens to the husband, making both of them in charge of putting the tokens on the plates. For all cases, both spouses could adjust the amount of tokens on the plates until they had reached an agreement, i.e., they were not told that only one or both should put the tokens on the plates.

3. Analytical framework

3.1. Underlying preferences

In the experiment, for a given interest rate, r, the subjects had to decide how much of a given initial amount of money to allocate to a sooner date, c_t, and a later date, $c_{t+\tau}$, where t indicates the sooner dates, i.e., $t = 0$ or $t = 60$ days; τ is the delay time, i.e., $\tau = 30$ days. c_t and $c_{t+\tau}$ represents the monetary allocations to the sooner date and later date, respectively, and $c_{t+\tau}$ includes the rates of return, r, in different choices. Since the experiment was fairly complex and we could not ask subjects to make too many decisions, we chose to keep the delay time constant. The data still allows us to estimate time preferences, present bias, and the curvature of the utility function, given a set of assumptions.

In our analysis we assume a constant absolute risk aversion (CARA) utility function $\left(u = -\frac{1}{\rho}e^{-\rho c_t}\right)$, where ρ is the coefficient of absolute risk aversion.[10] Following Andreoni and Sprenger (2012), the utility function and budget restriction can be written as:

$$U = u(c_t) + \beta\delta^{\tau}u(c_{t+\tau}) \tag{1}$$

$$\text{s.t. } \frac{c_{t+\tau}}{1+r} + c_t = m \tag{2}$$

[10] The main advantage of CARA utility function is that the background parameters can be dropped out from the marginal condition. Since we do not have background consumption information, we prefer the CARA utility function in the following model estimation. Actually, we also get the similar estimated parameters based on constant relative risk aversion (CRRA) utility function.

where β is the present bias parameter ($\beta > 0$), δ is the discount factor, τ is the delay time, and m is the experimental budget. The marginal condition for a utility maximizing individual can be written:

$$\exp(-\rho(c_t - c_{t+\tau})) = \begin{cases} \beta\delta^{\tau}(1+r) & \text{if } t = 0 \\ \delta^{\tau}(1+r) & \text{if } t > 0 \end{cases} \tag{3}$$

Take logs and rearrange, Eq. (3) can be rewritten as:

$$c_t - c_{t+\tau} = \frac{\ln\beta}{-\rho}P + \frac{\ln\delta}{-\rho}\tau + \frac{1}{-\rho}\ln(1+r) \tag{4}$$

where P is a dummy variable equal to one if $t = 0$. Note that in our case, τ is constant, so the second term is the intercept. We estimate the following model

$$(c_t - c_{t+\tau})_{ik} = \frac{\ln\beta}{-\rho}P + \frac{\ln\delta}{-\rho}\tau + \frac{1}{-\rho}\ln(1+r) + \varepsilon_{ik} \tag{5}$$

where k is the choice situation and ε_{ik} is an additive mean-zero error term. Because of the issue with corner solution, we estimate a two-limit Tobit model. In reduced form the model is expressed as:

$$(c_t - c_{t+\tau})_{ik} = \gamma_1 P + \gamma_2\tau + \gamma_3\ln(1+r) + \varepsilon_{ik} \tag{6}$$

The parameters of interest can be obtained by non-linear combination:

$$\widehat{\rho} = -\frac{1}{\widehat{\gamma}_3} \quad \widehat{\delta} = \exp\left(\frac{\widehat{\gamma}_2}{\widehat{\gamma}_3}\right) \quad \widehat{\beta} = \exp\left(\frac{\widehat{\gamma}_1}{\widehat{\gamma}_3}\right) \tag{7}$$

3.2. Relative influence of the spouses

We follow the approach outlined in Carlsson et al. (2012) and estimate the influence of each spouse by explaining the joint decisions by the individual decisions. Thus, our focus is on choices and not the underlying preference parameters. The joint sooner allocation decision for household i in choice situation k is specified as

$$c^{J}_{t_{ik}} = \alpha + \mu^{H}c^{H}_{t_{ik}} + \mu^{W}c^{W}_{t_{ik}} + \varepsilon_{ik} \tag{8}$$

where J, H, and W denote decisions made jointly, by the husband, and by the wife respectively, and ε_{ik} is an error terms reflecting unobservable factors that influence the joint decisions. Since $c^{J}_{t_{ik}}$ (allocation to the sooner date) is censored by 0 and 40, we will employ a Tobit model to estimate Eq. (8). The parameters μ^{H} and μ^{W} are measures of the husband's and wife's influence on the joint decision. From this also follows that we do not impose any restrictions on the influence parameters, i.e. we do not restrict the sum to be equal to unity. Finally, our specification does not rule out aspects such as altruistic concern for the spouse's consumption (or envy for that matter). This will be revealed by a relatively stronger influence of the spouse's preferences. The ratio between the two influence parameters, $\lambda = \frac{\widehat{\mu^{W}}}{\widehat{\mu^{H}}}$, is then a measure of the relative influence of the wife and the husband. If the ratio is above one, then the wife has a stronger influence on the joint decision.

3.3. Choice shifts

Next we investigate to what extent the joint choices are more extreme than the individual choices. Again, we focus on choices and not the underlying preference parameters. Since we focus on the comparison between individual and joint decisions, we use the sooner allocations to classify the joint decisions into three categories for household i in choice situation k: impatient shift, in between, and patient shift.[11] We employ a multinomial logit model using these three categories as the dependent variable, and investigate the factors that could explain the likelihood of a household joint decision ending up in a certain category.

$$P_{1ik}\left[c^{J}_{tik} > \text{Max}\{c^{H}_{tik}, c^{W}_{tik}\}\right] = f\left(|c^{H}_{tik} - c^{W}_{tik}|, r, t, x\right) + \varepsilon_{1ik} \tag{9}$$

$$P_{2ik}\left[c^{J}_{tik} \in [c^{H}_{tik}, c^{W}_{tik}]\right] = f\left(|c^{H}_{tik} - c^{W}_{tik}|, r, t, x\right) + \varepsilon_{2ik} \tag{10}$$

$$P_{3ik}\left[c^{J}_{tik} < \text{Min}\{c^{H}_{tik}, c^{W}_{tik}\}\right] = f\left(|c^{H}_{tik} - c^{W}_{tik}|, r, t, x\right) + \varepsilon_{3ik} \tag{11}$$

[11] It actually does not affect the categories if we instead use the difference between the later and sooner allocations to measure the patience. But it is much easier to implement if we only use the sooner allocation.

The first probability in Eq. (9) above is the probability of an impatient shift, i.e., the amount of money allocated to the sooner date in the joint decisions is larger than both the husband's and the wife's individual allocations. The second probability is that the joint decision is in between the spouses' individual decisions (or exactly the same). The third is the probability of a patient shift, i.e. the amount of money allocated to the sooner date in the joint decisions is smaller than both the husband's and the wife's individual allocations.

To investigate how the potential conflicts between husband's and wife's preferences affect the likelihood of a shift, we include the absolute value of the difference between husband and wife individual decisions. We control for the interest rate, the sooner date (in particular if the sooner date is today or not), a vector additional characteristics of the households and spouses, and an error term.

The likelihood of a joint shift is thus assumed to be a function of the absolute value of the difference between husband and wife individual decisions. If all three outcomes are feasible we have that $\sum_{i=1}^{3} P_i$. However, all three outcomes will not always be feasible, mainly due to corner decisions of the spouses. For example, if one spouse makes an extremely patient individual decision, then there is no possibility of a joint patient shift. In those cases the number of potential outcomes will be reduced.

The error term captures unobservable factors such as unobserved preference heterogeneity and mistakes in the decisions. However, the standard formulation with iid errors is very restrictive. In order to allow for individual heterogeneity we estimate a so-called scaled multinomial logit model, which is a restricted version of the generalized mixed logit model (Fiebig, Keane, Louviere, & Wasi, 2010). The scale factor for households i is $\sigma_i = \exp\left(-\frac{\gamma^2}{2} + \gamma w_i\right)$, where w_i is a random variation across households, and γ is a structural parameter; the model assumes that w_i is normally distributed. In addition we allow for observed heterogeneity by including the absolute value of the difference between husband and wife individual decisions as an independent variable. The intuition is that if there is small difference in preferences, then the variance will increase and thus the randomness of the outcome.

4. Results

4.1. Individual and joint allocations

In Table 3, we summarize the average allocations, in Chinese yuan, made to the sooner dates by the husbands, wives, and couples for all the decisions. As can be seen, the allocation to the sooner date decreases when the rate of return increases, which is an indication of that the subjects are aware of the basic trade-offs they face in the choice tasks. We also observe that wives' and joint decisions are on average more patient than husbands' decisions. Although most joint decisions are in between the husbands' and wives' decisions, husbands' decisions are much closer to joint decisions compared with wives' decisions. It indicates husbands could have more influence on the joint decisions at this aggregate level.

The table also reports the share of allocations that are corner allocations, i.e., when the subject allocates zero yuan to the sooner date and thus allocates everything to the later date. As expected, the share of corner allocations increases when the rate of return increases. More specifically, at the individual and couple level, 142 husbands, 149 wives and 152 couples have corner allocations (either zero or 40 yuan allocated to the sooner date), respectively.[12] In addition, at choice level, 59 percent of husbands' decisions, 63 percent of wives' decisions and 62 percent of joint decisions are allocated at corners. This result is quite comparable to Andreoni and Sprenger (2012).

As discussed in Section 3, we first employ the two-limit Tobit model to estimate Eq. (6). We estimate separate models for the husbands', wives', and joint decisions, and cluster the standard error at the household level. The estimated results are summarized in Table 4 (see column (1), (3), and (5)). As expected, the coefficient of the rate of return is negative and highly significant. The significant and positive sign of the present time dummy variable indicates that subjects on average have present-biased time preferences. Regarding the estimated preference parameters, the estimated coefficient of absolute risk aversion is statistically significantly different from zero, and very close to unity. In addition, different from Andreoni and Sprenger (2012), we find that the estimated present bias parameter $(\widehat{\beta})$ is statistically significantly different from one, whereas the daily discount factor is greater than one. Thus, both individual and joint decisions are present-biased. Note that since the present bias parameter is lower than one, the subjects still discount future payments.

To investigate what factors influence individual and joint decisions, we again employ the two-limit Tobit model to estimate Eq. (6) by including a set of individual and household characteristics. The estimated results are presented in Table 4 (see column (2), (4), and (6)). There are actually very few observable characteristics that have a statistically significant effect on the allocation decisions. For husband decisions, wife decisions and joint decisions, in minority households, subjects allocate more money to the sooner date, i.e., are more impatient. For husband decisions, the allocations to the sooner date decreases with wife's income contribution. Wife's income contribution could increase wife's relative influence in household, and wives are in general more patient than husbands as described in Table 3. In addition, older wives are more patient, whereas highly educated husband significantly decreases the allocations to later date in joint decisions. Nonetheless,

[12] Among the corner solutions, 52 husbands (32%), 46 wives (28%), and 55 couples (34%) do not have interior allocations, respectively (i.e. they allocate zero or 40 yuan in all 10 choices). This is quite similar to the share in Andreoni and Sprenger (2012): 37%.

Table 3
Husband's, wife's and joint allocations to the sooner dates in Chinese yuan.

Sooner date	Interest rate	Husband		Wife		Joint		|Husband – joint|	|Wife – joint|
		Mean	Share corner (%)	Mean	Share corner (%)	Mean	Share corner (%)		
0	0.05	22.5 (16.2)	23	24.1 (15.9)	17	20.8 (15.8)	24	8.6 (11.6)	11.4 (12.5)
0	0.1	18.4 (15.9)	28	17.9 (15.1)	26	16.5 (15.2)	30	8.6 (11.5)	10.7 (11.6)
0	0.25	12.7 (14.3)	39	10.0 (12.9)	48	10.3 (12.6)	44	7.1 (9.9)	9.4 (11.1)
0	0.4	9.7 (13.2)	49	7.0 (11.3)	59	7.8 (11.7)	52	6.1 (9.5)	7.1 (9.8)
0	0.6	7.1 (12.2)	62	4.3 (9.5)	76	4.9 (9.9)	70	4.4 (7.6)	5.4 (9.9)
60	0.05	16.8 (14.9)	30	12.7 (13.5)	38	14.7 (15.0)	37	10.5 (12.7)	11.0 (13.0)
60	0.1	11.9 (13.1)	40	8.9 (11.9)	47	9.6 (12.0)	47	8.2 (11.0)	8.3 (10.9)
60	0.25	8.2 (11.5)	51	4.8 (8.4)	64	6.2 (9.6)	58	5.3 (8.4)	5.6 (9.0)
60	0.4	5.8 (10.0)	60	2.9 (6.7)	77	4.1 (8.1)	68	4.2 (7.2)	3.5 (6.8)
60	0.6	3.8 (8.7)	73	2.0 (5.6)	84	2.5 (7.1)	83	2.8 (6.4)	2.5 (6.2)

Note:
1. Figures in the parentheses are standard deviation.
2. Share corner is the percentage of zero allocation to the sooner date.
3. The last two columns are the absolute difference between husband decisions and joint decisions, and between wife decisions and joint decisions.

Table 4
The determinants of husband's, wife's, and joint decisions; dependent variable is the difference between sooner and later allocations ($c_t - c_{t+\tau}$).

	Husband		Wife		Joint	
	(1)	(2)	(3)	(4)	(5)	(6)
Present time dummy (1 = today)	23.685*** (4.943)	23.060*** (4.886)	33.690*** (4.871)	33.479*** (4.770)	25.191*** (4.530)	24.916*** (4.458)
Time delay (30 days)	−0.314** (0.160)	0.923 (2.015)	−0.561*** (0.150)	0.584 (1.907)	−0.554*** (0.154)	1.558 (2.469)
Interest rate (log(1 + r))	−199.916*** (15.855)	−199.026*** (15.748)	−245.201*** (19.547)	−244.385*** (19.092)	−212.963*** (15.200)	−212.711*** (15.003)
Husband age (years)		−0.085 (0.443)				−0.627 (1.033)
Husband higher than primary school (1 = yes)		8.685 (9.015)				15.969* (8.763)
Wife age (years)				−0.912** (0.438)		−0.208 (1.092)
Wife higher than primary school (1 = yes)				10.640 (11.535)		−8.295 (11.765)
Wife's income contribution (%)		−49.163* (28.398)		−13.145 (26.609)		−38.501 (27.012)
Household is minority (1 = yes)		45.795*** (14.277)		46.355* (24.190)		36.884** (15.869)
Log of equivalence scaled total gross income (yuan)		−2.528 (6.218)		2.571 (5.835)		−2.078 (7.289)
If first separate then joint decision (1 = yes)		1.008 (9.840)		12.205 (7.954)		−5.709 (9.594)
If first five choices are between today and one month (1 = yes)		17.856* (9.229)		−4.577 (8.078)		11.188 (15.501)
Daily discount factor ($\widehat{\delta}$)	1.002 (0.001)		1.002 (0.001)		1.003 (0.001)	
Present bias ($\widehat{\beta}$)	0.888 (0.020)		0.872 (0.015)		0.888 (0.017)	
CARA curvature ($\widehat{\rho}$)	0.005 (0.000)		0.004 (0.000)		0.005 (0.000)	
Observations	1640	1640	1640	1640	1640	1640
Uncensored	671	671	600	600	630	630
Log pseudolikelihood	−4473.217	−4419.397	−3948.506	−3877.814	−4156.064	−4094.861
Prob > *F*	0.000	0.000	0.000	0.000	0.000	0.000

Notes:
1. Experimenter effects and village dummies are controlled in model (2), (4) and (6). Initial tokens control dummies are also controlled in model (6).
2. All regressions are clustered at household level. Figures in parentheses are robust standard errors.
* Represents significance at 10%.
** Represents significance at 5%.
*** Represents significance at 1%.

Table 5
The influence of individual decisions on joint decisions; dependent variable is the sooner allocations (c_t).

	(1)	(2)	(3)
Husband's decision	0.475*** (0.022)	0.449*** (0.030)	0.461*** (0.034)
Wife's decision	0.328*** (0.022)	0.326*** (0.032)	0.321*** (0.038)
Husband's decision × if first separate then joint decision (1 = yes)		0.052 (0.040)	
Wife's decision × if first separate then joint decision (1 = yes)		0.008 (0.042)	
Husband's decision × 20 tokens to wife			0.067 (0.048)
Husband's decision × 20 tokens to husband			−0.058 (0.048)
Husband's decision × 10 tokens to each			0.069 (0.052)
Wife's decision × 20 tokens to wife			−0.027 (0.053)
Wife's decision × 20 tokens to husband			0.085 (0.054)
Wife's decision × 10 tokens to each			−0.047 (0.056)
Observations	1640	1640	1640
Uncensored	630	630	630
Log pseudolikelihood	−3315.429	−3314.453	−3310.339
Prob > *F*	0.000	0.000	0.000

Notes:
1. The results reported in table are marginal effects. Two order dummies, experimenter effects and village dummies are controlled in all model specifications.
2. All the regressions are clustered at household level. Figures in the parentheses are robust standard errors.
3. * and ** represent the significant level at 10% and 5%.
*** Represents the significant level at1%.

Table 6
Size of observed shifts.

	Mean	Std. dev	Median	No. of obs.
Impatient shift	9.456	8.323	8	180
Patient shift	9.213	7.946	8	155

household income does not significantly impact individual decisions or joint decisions. There is no statistically significant effect on decisions by the order of the individual and joint decisions. Husbands however, are more impatient when they first make five choices between today and one month.

4.2. Relative influence of the spouses

We now move to the relationship between the individual decisions and the joint decisions. We estimate models where we explain the joint decisions with the husbands' and wives' decisions, as specified in Eq. (8). We employ a Tobit model to estimate all model specifications. The standard errors are clustered at household level, and the marginal effects are presented in Table 5.

In the first model, we only control for the husbands' and wives' individual decisions. As can be seen, both spouses have a significant impact on the joint decision in the sense that there is a positive and significant correlation between the individual decisions and the joint decision. However, both coefficients are well below one, suggesting that on average neither spouse has complete control over the joint decision. The relative influence of the two spouses can be estimated as the ratio between the wife's individual decision coefficient and the husband's individual decision coefficient. This parameter is 0.69, which means that the husband on average has a stronger influence on the joint decision than the wife. The value of the relative influence parameter has a clear and simple explanation. It is the ratio of marginal effects of the two spouses' influence on the joint decisions. The husbands' influence parameter is around 0.48. This means that if the husband allocates, say, 10 yuan more to the sooner date in the individual experiment, then the allocation to sooner date in the joint experiment increases by 4.8 yuan. For the wife, the increase in the joint experiment for the same change is 69% of this, i.e. 3.3 yuan. Moreover, we can reject the hypothesis that the relative influence parameter is equal to one (p-value = 0.000).

In the second model, we add interaction terms between husband's and wife's decisions and a dummy variable equal to one if the individual decisions were made before the joint decisions. The estimated results in column (2) show that there is no significant order effect on the influence of individual decisions on joint decisions. In the third model, we interact the spouses' individual decisions with the treatment dummy variables concerning who had initial control over the tokens. As can be seen, none of the interaction terms are statistically significant. This is different from the study by de Palma et al. (2011), where, in an experiment on risky choices, women who ultimately implement the joint decisions show more decision power.

4.3. Choice shifts

In this section we examine to what extent joint decisions are more patient or impatient than individual decisions at the choice level. Based on the classification of responses in Section 3, we find that 11% of the joint choices are more impatient than both the husbands' and wives' individual choices, while 9% of the joint choices are more patient. Thus, in 80% of the choice situations, the joint choice is in between, or equal to, the spouses' individual choices. At the same time, a majority of the households experience a shift. In 27% of the households there is at least one impatient shift, in 25% there is at least one patient shift, and in 15% there are both patient and impatient shifts.

Furthermore, the size of shifts is often sizeable. Table 6 reports the mean and standard deviations of the observed shifts, measured as the difference between the joint allocation on the early period and the corresponding lowest or highest individual allocation. The minimum size of a shift is 2 yuan (since each token is worth 2 yuan) and the maximum size is 40 yuan. The average size of both patient and impatient shifts is around 9 yuan, i.e., a little bit more than 4 out of 20 tokens.[13] This means that what we observe most likely is not simply due to noise in the joint decision as compared with the individual choices.

Next we estimate a multinomial logit model where the dependent variable is the three joint shift categories and the standard errors are clustered at the household level. The first model we report is a standard multinomial logit model that includes four dummy variables: the time order dummy (if the first five choices are made between today and one month), and three initial tokens control dummies (20 tokens given to wife, 20 tokens given to husband, 10 tokens given to each). We do this because the scaled multinomial logit model would not converge when we include the four dummy variables. The second model we report is thus the scaled multinomial logit model without including the dummy variables. Table 7 reports the model results with the patient shift as the reference category.

[13] We also find that among the impatient shifts, 49% are closer to the husband's individual choice, i.e. the husband is more impatient than the wife, and 17% are closer to the wife's individual choice. Among the patient shifts, 41% are closer to the husband's individual choice, and 41% are closer to the wife's individual choice.

Table 7
The determinants of the likelihoods of impatient and patient shifts.

		MNL with dummies	Scaled MNL
Impatient shift		7.406*** (2.200)	9.631*** (2.522)
In between		4.860*** (1.820)	5.497*** (1.659)
Impatience shift	Interest rate (r)	−3.575*** (0.732)	−3.987*** (1.042)
	Present time dummy (1 = today)	0.248 (0.254)	0.358 (0.284)
	Husband age (years)	−0.102*** (0.039)	−0.121*** (0.045)
	Husband higher than primary school (1 = yes)	0.579** (0.279)	0.680** (0.318)
	Wife age (years)	0.049 (0.039)	0.060 (0.043)
	Wife higher than primary school (1 = yes)	−1.145*** (0.381)	−1.170*** (0.454)
	Wife's income contribution (%)	−1.200 (0.971)	−1.008 (1.058)
	Household is minority (1 = yes)	−2.139*** (0.429)	−2.198*** (0.560)
	Log of equivalence scaled total gross income (yuan)	0.491** (0.220)	−0.696*** (0.256)
	If first five choices are between today and one month (1 = yes)	0.318 (0.278)	
	If initial 20 tokens given to wife (1 = yes)	0.207 (0.380)	
	If initial 20 tokens given to husband (1 = yes)	0.337 (0.389)	
	If initial 10 tokens given to each (1 = yes)	−0.563 (0.367)	
In between	Interest rate (r)	−1.187*** (0.598)	−1.094* (0.616)
	Present time dummy (1 = today)	0.072 (0.203)	0.086 (0.212)
	Husband age (years)	−0.010 (0.029)	−0.005 (0.032)
	Husband higher than primary school (1 = yes)	0.182 (0.224)	0.191 (0.232)
	Wife age (years)	−0.004 (0.029)	−0.009 (0.032)
	Wife higher than primary school (1 = yes)	−0.179 (0.292)	−0.120 (0.310)
	Wife's income contribution (%)	−2.097*** (0.774)	−2.158*** (0.788)
	Household is minority (1 = yes)	−1.212*** (0.292)	−1.091*** (0.289)
	Log of equivalence scaled total gross income (yuan)	−0.257 (0.180)	−0.318* (0.173)
	If first five choices are between today and one month (1 = yes)	0.301 (0.226)	
	If initial 20 tokens given to wife (1 = yes)	0.225 (0.293)	
	If initial 20 tokens given to husband (1 = yes)	−0.004 (0.321)	
	If initial 10 tokens given to each (1 = yes)	−0.379 (0.281)	
Variance function			
Tau			0.401* (0.232)
Absolute difference between husband's and wife's sooner allocation			−3.025 (4.459)
Obs.		1526	1526

* Denotes statistical significance at the 10%, levels.
** Denotes statistical significance at the 5% levels.
*** Denotes statistical significance at the 1% level.

Note that the multinomial and scaled multinomial logit model results are similar in relative size and statistical significance. Moreover, all the four dummy variables are statistically insignificant. We therefore from now on focus on the scaled multinomial logit model. To begin with we find that the likelihood of a shift depends on the interest rate, but not on whether the early payment involves today or not. The likelihood of a patient shifts is higher with a higher interest rate, and the likelihood of an impatient shift or a joint choice in between individual choices is lower with a higher interest rate. That the likelihood of a shift does not depend on whether the sooner payment is today or not is interesting. It suggests that shifts are not driven by a change in the present bias concern, but instead by a change in the discount factor.

Regarding households characteristics, there are a number of interesting results. The likelihood of an impatient shift is higher in households where the husband has higher than primary education, whereas the likelihood of this shift decreases with wife's education level. In addition, the likelihood of shifts is lower in households where the wife has a higher income contribution. Furthermore, the likelihood of a patience shift is higher in minority households and in households with a relatively higher income. Given that we see patience as something advantageous for the households in the long run, it is thus more likely in these households that the joint decision is better than the individual decisions.

Regarding the variance function we find a statistically significant structural parameter, which indicates that there is an unobserved heterogeneity in variance across households. More importantly, the coefficient of the absolute difference in husband and wife allocation is not statistically significant, which means that we do not find any support for a hypothesis that the variance is larger for households with a smaller difference in individual decisions. Taken together with the fact that the size of the choice shifts is sizeable, it is not likely that the shifts are just random shifts.

5. Conclusions

In this paper we have investigated the relative influence of spouses' preferences on joint decisions, and the occurrence of choice shifts from individual decisions to household joint decisions regarding intertemporal choices.

We find that both spouses have a significant impact on the joint decision. Wife's relative influence parameter is equal to 0.69, which means that the husband has a stronger influence than wife. Furthermore, we find that there are substantial shifts between individual and joint decisions. At the choice level, 11% of the joint choices are more impatient than the individual choices, while 9% are more patient. In addition, by accounting for the preference heterogeneity and mistakes in the decisions making, we employ a scaled multinomial logit model to investigate the relevant factors that could affect the likelihood of choice shifts. We find that the interest rate and a set of individual and household characteristics impact the likelihood of choice shifts.

One obvious question is of course whether these shifts are good or bad. Patience is often seen as a virtue, and as shown by Becker (1980), based on a conjecture of Ramsey (1928), income distribution in a long-run steady state is determined by the lowest discount rate; i.e., the household with the lowest discount rate will own all the capital. This conclusion of course rests on a number of simplifying assumptions, but, taking these as given, a more patient shift would be beneficial for the household. This is also supported by an empirical literature on the relationship between patience and life outcomes (see e.g. Chabris, Laibson, Morris, Schuldt, & Taubinsky, 2008; Moffitt et al., 2011; Sutter, Kocher, Glätzle-Rüetzler, & Trautman, 2013). For example, Sutter et al. (2013) conducted experiments, on risk and time preferences, with children and adolescents and found that impatience is a significant predictor of health-related behavior, savings and conduct at school.

In this paper, we find both patient shifts and impatient shifts. It indicates that there is no clear pattern in the sense that joint household choices tend to generate beneficial shifts, i.e., patient shifts. In addition, our findings provide additional evidence on the efficiency and rationality of group decisions. As discussed in the introduction, there is evidence that group decisions are more in line with the standard game-theoretical predictions of rationality and selfishness than individuals (see Charness & Sutter, 2012; Kugler, Kausel, & Kocher, 2012). What we find in our experiment is that there are almost as many cases where the joint decisions are improved (patient shifts) as where the joint decisions are worse (impatient shifts) in a joint household decisions setting. This is consistent with for example Hertzberg (2012), who documents that a household could have hyperbolic discounting preferences even if the two spouses are time-consistent if the spouses have misaligned altruistic preferences over each other's outcomes. Clearly, more empirical studies are needed to examine in what types of households these shifts are more likely to occur.

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Appendix A

See Table 1A.

Table 1A
Distribution of participating households.

County	Township	Village	Household
Linxia	Yulin	Yufeng	20
		Yaowan	25
	Tuqiao	Dalu	16
		Chongtaiyuan	5
	Nanyuan	Xiaozhai	5
		Jiangjiazhai	10
Jingning	Bali	Guandaocha	20
		Dalv	15
		Jiping	10
	Siqiao	Mougou	25
		Yangchuan	5
	Weirong	Beiguan	5
		Ligou	3

Appendix A. Supplementary material

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.joep.2015.11.002.

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