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Household Decision Making in Rural China: Using Experiments to Estimate the Influences of Spouses

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Abstract

Many economic decisions are made jointly within households. This raises the question about spouses' relative influence on joint decisions and the determinants of relative influence. Using a controlled experiment (on inter-temporal choice), we let each spouse first make individual decisions and then make joint decisions with the other spouse. We use a random parameter probit model to measure the relative influence of spouses on joint decisions. In general, husbands have a stronger influence than wives. However, in richer households and when the wife is older than the husband, we find a significantly stronger influence of the wife on joint decisions.

Key words: household decision making, spouses, relative influence, random parameter model, field experiment, time preferences.

JEL classification: C91, C92, C93, D10

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1. Introduction

Many important economic decisions are made by households, implying joint rather than individual decisions. For example, decisions regarding labor supply, savings, and investments are often made jointly within the household. This implies that such decisions will be a function of the preferences of household members and the relative influence of each household member on the joint decisions. However, it is not straightforward to measure the relative influence of spouses on joint decisions. One often used approach has been to look at who is in control of the household income and correlate this with household behavior and outcomes.[1] However, this approach has its obvious limitations as a means to study the relative influence of spouses since with field data it is by definition difficult to obtain data on preferences/choices of the spouses and the joint household decisions. Therefore, an alternative and increasingly popular approach is to use experiments or survey methods to study household decision making, since they allow for collection of data for both individual and joint decisions under controlled conditions. This means that spouses first have to make individual choices on a series of tasks, after which they are united and have to make joint choices on the same or a similar set of tasks. By construction, the researchers then have both measures of the individual preferences and of the joint choices, and can thus explain the joint choices with the individual preferences. This approach has been used to study household decision making in many different domains, such as risk taking (Bateman and Munro, 2005; Iversen et al., 2006; Munro et al., 2008; de Palma et al., 2010), consumption choices (Arora and Allenby, 1999; Browning and Chiappori, 1998), behavior in social dilemma situations

[1] For instance, Thomas (1994), Lundberg et al. (1997), Phipps and Burton (1998), Duflo (2003), and Qian (2008) find that, for instance, child health and survival rates, nutrition, expenditures for different goods and services (such as tobacco and child care), and the educational attainment of children depend strongly on whether the household income is controlled by the husband or the wife.

(Cochard et al., 2010), and stated preferences (Quiggin, 1998; Dosman and Adamowicz, 2006; Strand, 2007; Beharry-Borg et al., 2009).

In the present paper, we investigate the relative influences of husbands and wives on joint household decisions by conducting a high-stakes artefactual field experiment (Harrison and List, 2004) in rural China. The experimental task is to make inter-temporal decisions in which spouses have to choose between earlier but smaller rewards and later but higher rewards. While investigating household decision making in inter-temporal choice is a contribution in itself – in particular since inter-temporal choices (e.g., on investments, education, farming) are very important for the development of poorer regions – our main contribution is that we develop a method for estimating the relative influence of husbands and wives. To achieve this, we build on earlier work by Dosman and Adamowicz (2006) and Beharry-Borg et al. (2009), who use hypothetical survey questions to study stated preferences, separately for each spouse and then jointly for the couple. They assume a bargaining model where the joint decision depends on a weighted average of the two spouses' preferences. This is (unnecessarily) restrictive since it does not allow for the influence of other (socio-demographic) aspects and does not allow for the possibility that joint choices can be more extreme than those made by either of the spouses (something which can be expected to happen in some cases; see Mazzocco, 2004, or Eliaz et al., 2006). Our approach is more general by using a random parameter model where we first estimate the preferences of each spouse from his/her individual choices. From these two models – respectively dealing with the husbands' and wives' individual choices – we then estimate the predicted probability of choosing an alternative from each choice situation of the experiment. By this way we can obtain a measure of the strength of the preferences of the spouses. These predicted probabilities are then included as explanatory variables in a model explaining the joint decisions.

Our approach allows us to estimate the relative influence of husbands and wives and also what socio-demographic household characteristics affect this relative influence. We find that in 90% of households, the husband has a stronger influence on household decisions than the wife. With respect to the factors determining the relative influences of husbands and wives, we are able to identify three important variables. Wives have a stronger influence on the joint decisions in high-income households and in households where the wife is older than the husband. The influence of wives is also stronger if the couple reports that the wife is in charge of small investment decisions in the household. The latter finding confirms earlier studies showing that it is important who controls the household income. The former findings, however, add to the literature the insight that the relative influence of husbands and wives depends also on important socio-demographic household characteristics. The random parameter modeling approach proposed here is suitable to detect these factors. Using this approach, together with eliciting the behavior of spouses and couples in an incentivized experiment, allows us to contribute to a better understanding of what drives household decision making. The outline of the paper is as follows: Section 2 introduces the experimental design and procedure, Section 3 presents the empirical model, Section 4 reports the experimental results, and Section 5 concludes the paper.

2. Experimental design and procedure

2.1. Location of the experiment

The experiment was conducted in October 2007 in several villages of Majiang County in the province of Guizhou, which is located in the southwestern part of China. The province is one of the least developed provinces in China, with inhabitants having on average 6.75 years of schooling and with a GDP per capita of 6,742 Chinese yuan (yuan hereafter) in 2007, which is equal to only 32% of the national average of 21,049 yuan (NBS, 2008).

Seven villages from five townships were randomly chosen, and in each village, 10-24 households with official marital status were randomly selected based on the official registration list provided by the local government. The number of households chosen in each village was proportional to the size of the village. The interviewers were sent to the households' homes, and each household was first asked to answer a survey concerning farming and forestry issues. Then spouses could voluntarily choose to participate in the experiment. In order to prevent villagers from spreading the word about the experiment within a village, we employed 20 interviewers so that all experiments in a village were finished within a couple of hours. The experiment lasted for less than one hour for each household and the expected average individual payoff from the experiment was 30 yuan, which corresponds to an average payoff of roughly two days of paid work. This means that our experiment provided much greater incentives than a usual laboratory experiment. In total, 101 couples voluntarily participated in the experiment; no couple refused to participate.

The socioeconomic characteristics of the sampled households are shown in Table 1. The average yearly per capita income is 4,203 yuan. Women contribute on average 42% of the total household income. Among the couples in our sample, the average length of marriage is 26 years, and the average number of children is 2.7.[2]

<Table 1 to be here>

[2] It is important to note that the one-child policy only applies for the ethnic majority of Han. The county in which we conducted the experiment is an ethnic minority autonomous prefecture, meaning that many families in this region are not affected by the official one-child policy. This explains the relatively large number of children in our sample.

2.2. Experimental design

The time preference experiment consisted of 18 pair-wise choices as shown in Table 2. To avoid order effects, the subjects faced a randomized order of the choices in the experiment and not the order presented in the table. In the experiment, subjects had to make a choice between Option A (early reward) and Option B (late reward). For example, in the first set, subjects chose between receiving 12 yuan today and 13 yuan in four days. The reward amount varied from 9 to 21 yuan. The timing of the early reward was either today (i.e., on the day of the experiment) or in four days, and the timing of the late reward was four or eight days from the day of the experiment.[3] The difference between the early and the late rewards was one, three, or five yuan.[4]

<Table 2 to be here>

Two experimenters were sent to each household to conduct the experiment. After agreeing to participate, the two spouses were separated into two rooms. Once they were seated, the instructions were read out by the experimenters. Throughout the experiment, the subjects completed the tasks step by step by following the experimental instructions. The

[3] It is possible that subjects have strong preferences for receiving the money today because of trust issues. As explained later, we used a signed certificate from Peking University containing information on when and how participants would be paid if they chose the late reward. We believe that this was important for the subjects' ability to trust us that they would be paid. Moreover, in the results section we show that there is no sign of present-biased preferences within the time frame of the experiment, i.e., time preferences do not depend on whether we compare today to 4 days, or 4 days to 8 days. We designed the time preference experiment with only a few days' delay between the early and late rewards mainly for two reasons. First, the short time horizon could avoid any concerns about inflation. Second, for practical reasons, choosing a short delay allowed us to keep the time that interviewers had to be in the field reasonably short (since they could bring the money to relatively close-by villages while running experiments in another village on the same day), thus significantly reducing the costs of the experiment.

[4] Given the design of the experiment, with a very short time difference between the early and late reward, the implicit annual discount rates were very high. However, the main aim of our experiment is to investigate the relative influences of husbands and wives in household decision-making, rather than estimating discount rates *per se*.

whole experiment consisted of four parts. In Part 1, each spouse individually answered a detailed questionnaire about socio-demographic characteristics, health status, and social capital. In Part 2, each spouse made individual decisions in the time preference experiment. In Part 3, the two spouses were reunited and had to give agreed-upon answers regarding the financial situation of the household and some additional household characteristics. Part 4 was identical to Part 2, except that the spouses had to make joint decisions after reaching an agreement on which options to choose for each of the 18 choice tasks. Note that each part was introduced sequentially only after the previous part had been completed.

When introducing Part 4, participants were informed that the reward amount in the selected option would be paid to each of the spouses. This procedure was used to keep each spouse's direct monetary incentives constant across Parts 2 and 4. Both experimenters were present during the joint decision experiment and they recorded a joint decision only after both spouses had given their consent. Both in Part 2 and in Part 4, participants were instructed in advance that one of the 18 decisions in each part would be played out for real at the end of the experiment by drawing one card from a deck of cards, numbered 1 to 18. Subjects were also informed that they would be paid directly after completion of the whole survey and experiment if they chose a reward amount due "today", while if they chose to be paid later (in four or eight days), they would be given a signed certificate by Peking University indicating the amount of money redeemable on the specified date. The payment would be delivered to their home by a project assistant at a time of day specified by the couple and they needed to show the certified paper in order to receive the payment. In Part 2, it was stressed that the payment for Part 2 would be made in private for husbands and wives in different rooms.

3. Empirical model

The data needed to measure the relative influence within a household comprise both the individual preferences of each spouse and the joint decisions of the couple. In the experiment, we observe the choices between alternatives rather than the preferences directly. The alternatives in turn can be described by a set of attributes, i.e., the reward amounts at certain times. We analyze the decision problem with a random utility framework developed by McFadden (1973). The utility function consists of two parts, an observable non-stochastic part, *v*, and an unobservable stochastic part, *ε*. If there are only two alternatives to choose between, then the probability of choosing alternative A for individual *i* in choice situation *j* is equal to the probability that individual *i*'s utility from choosing alternative A is higher than the utility from choosing alternative B:

$$P_{ij}(A) = P\left[v_i(X_{jA}) + \varepsilon_{ijA} > v_i(X_{jB}) + \varepsilon_{ijB}\right], \tag{1}$$

where X denotes a vector of attributes of the alternatives. From the experiment, we want to measure the relative influence of the wife (W) and of the husband (H). In order to estimate this, we first need to estimate the individual preferences of the husband and of the wife separately. For a wife in household *i*, the probability of choosing an early reward (A) in choice situation *j* is

$$P_{ij}^{W}(A) = P\left[u_i^{W}(time_{jA}, amount_{jA}) + \varepsilon_{ijA}^{W} > u_i^{W}(time_{jB}, amount_{jB}) + \varepsilon_{ijB}^{W}\right], \tag{2}$$

where alternative A is the early reward and alternative B is the late reward. Assuming utility is a linear function of the timing and amount of the rewards, the probabilistic model can be rewritten as

$$\begin{aligned} P_{ij}^{W}(A) &= P\left[\alpha_i^{W} + \beta_i^{W} time_{jA} + \gamma_i^{W} amount_{jA} + \varepsilon_{ijA}^{W} > \beta_i^{W} time_{jB} + \gamma_i^{W} amount_{jB} + \varepsilon_{ijB}^{W}\right] \\ &= P\left[\alpha_i^{W} + \beta_i^{W}(time_{jA} - time_{jB}) + \gamma_i^{W}(amount_{jA} - amount_{jB}) + (\varepsilon_{ijA}^{W} - \varepsilon_{ijB}^{W}) > 0\right], \end{aligned} \tag{3}$$

where α_i^W is introduced to allow for a preference for early or late rewards that is not explained by the difference in timing and amount of the rewards. This could be an indication of a general preference for early rewards or simply a reflection of a left-hand or right-hand side preference when choosing the options.

In the experiment, there are two possible levels of the timing of the early rewards – zero (now) and four days from now – and two possible levels of the timing of the late rewards – four days and eight days from now. In order to allow for non-linear effects of the timing of the rewards, and the reward structure we express the probability of choosing an early reward as

$$P_{ij}^W(A) = P\left[\alpha_i^W + \beta_{i08}^W D_{08} + \beta_{i48}^W D_{48} + \gamma_{i1}^W amount_{jA} + \gamma_{i2}^W \Delta amount_j + \eta_{ij}^W > 0\right], \quad (4)$$

where D_{08} is a dummy variable equal to one when the early reward is received today and the late reward in eight days from now, and D_{48} a dummy variable equal to one when the early reward is received in four days and the late reward in eight days from now. $\Delta amount_j = amount_{jB} - amount_{jA}$, $\eta_{ij}^W = \varepsilon_{ijA}^W - \varepsilon_{ijB}^W$, and β and γ are parameters to be estimated. Since the reference case is a reward today versus a reward in four days, we expect that β_{i08}^W is negative. If β_{i48}^W is not significantly different from zero, then subjects do not suffer from a present bias within the time frame of the experiment (see, e.g., McClure et al., 2004, 2007, and Read et al., 1999). The sign of the coefficient of the differences in rewards, γ_{i2}^W, is expected to be negative. Moreover, the size of the early reward, $amount_{jA}$, is included in the model to control for a possible income effect.

For a husband in household *i*, the probability of choosing an early reward in choice situation *j* is expressed in the same way as

$$P_{ij}^H(A) = P\left[\alpha_i^H + \beta_{i08}^H D_{08} + \beta_{i48}^H D_{48} + \gamma_{i1}^H amount_{jA} + \gamma_{i2}^H \Delta amount_j + \eta_{ij}^H > 0\right]. \quad (5)$$

The preferences of a wife and a husband can be estimated with standard discrete choice models. However, we apply random parameter models where the coefficients of the attributes

are assumed to be randomly distributed due to unobserved preference heterogeneity (see Train, 2003). In order to facilitate estimations, we keep the intercept as a fixed parameter. Using random parameter models enables us to estimate individual-specific predicted choice probabilities for each choice situation, denoted as $\hat{P}_{ij}^{H}$ and $\hat{P}_{ij}^{W}$, even if we do not include individual characteristics as explanatory variables. We assume that all the random parameters are normally distributed. Since we have repeated observations, we further assume that the random parameters are constant across choice sets for a given respondent, i.e., the individual time preferences are stable. Finally, we assume that the error term is normally distributed so that we can estimate random parameter binary probit models. The models are estimated using simulated maximum likelihood.

In the next step, we estimate a similar model explaining the choices in the joint part of the experiment. In this model, the probability of choosing the early reward is again a function of the attributes of the alternatives. In addition, we include two variables reflecting the individual preferences of the spouses. The obvious choice might seem to be the individual choices made by the spouses. Yet, the main drawback of using individual choices is that they reveal little information about the strength of the preferences. We therefore use the predicted probabilities of the spouses' individual choices ($\hat{P}_{ij}^{H}$ and $\hat{P}_{ij}^{W}$) instead. By doing this, we can measure the influences of the spouses' preferences on the joint decisions. The probability of choosing the early reward (A) for household *i* in choice situation *j* in the joint time preference experiment is then specified as

$$P_{ij}^{J}(A) = P\left[\alpha_{i}^{J} + \beta_{i08}^{J} D_{08} + \beta_{i48}^{J} D_{48} + \gamma_{i1}^{J} amount_{jA} + \gamma_{i2}^{J} \Delta amount_{j} + \delta_{i}^{H} \hat{P}_{ij}^{H} + \delta_{i}^{W} \hat{P}_{ij}^{W} + \eta_{ij}^{J} > 0\right]. \quad (6)$$

This model is also estimated as a random parameter binary probit model. All the random parameters are again specified as normally distributed and assumed to be constant across the choice situations for a given household.

What we are interested in here is obtaining household-specific estimates of the two parameters relating to the absolute influences of the husband and the wife on the joint decisions, i.e., the parameters of the predicted individual choice probabilities. The ratio of these two parameters can then be used to identify the relative influences of the husband and wife on the joint decisions. In the following analyses, we focus on the relative influence of the spouses, i.e., the ratio between the wife's influence parameter and the husband's influence parameter.

$$Influence_i = \frac{\hat{\delta}_i^W}{\hat{\delta}_i^H} \tag{7}$$

If the ratio is larger than one, then the wife has a stronger influence on the joint decisions than the husband, and vice versa.

In order to obtain the estimates of $\hat{\delta}_i^W$ and $\hat{\delta}_i^H$, we rely on simulation, i.e., we estimate distributions of the parameters rather than individual-specific parameters. This is done by using Bayes Theorem (Train, 2003). If $h(\beta \mid y_i, \theta)$ denotes the distribution of a parameter vector β conditional on a sequence of choices (y_i) and the population parameter (θ), Train (2003) shows that the mean β for an individual *i* making a specific choice is

$$E[\beta_i \mid y, \theta] = \int \beta \cdot h(\beta \mid y_i, \theta) = \frac{\int \beta P(y_i \mid \beta) f(\beta \mid \theta) d\beta}{\int P(y_i \mid \beta) f(\beta \mid \theta) d\beta}, \tag{8}$$

where $f(\beta \mid \theta)$ is the distribution of β in the population. The expression in equation (8) is thus an estimate of the parameter for a particular individual (in our case a spouse or a household). This estimate in turn comes from the estimated population distribution that we obtain with the random parameter models. This expression does not have a closed form and we therefore again have to rely on simulation methods. The simulated approximation to equation (8) is

$$\tilde{E}[\beta_i \mid y, \theta] = \sum_r w^r \beta^r = \sum_r \frac{\beta^r P(y_i \mid \beta^r)}{\sum_r P(y_i \mid \beta^r)}, \quad (9)$$

where β^r is the r-th draw from the population density $h(\beta \mid y_i, \theta)$.

We are primarily interested in the distribution of the ratio of the two parameters relating to the influences of the husband and the wife on the joint decisions. However, we are also interested in finding household characteristics that can explain the variation of the variable $Influence_i$ among the households. In the final part of the analysis, we estimate a truncated regression model where the relative influence is explained by a number of individual and household characteristics, such as education level of the spouses, absolute income, relative income contribution of the spouses, age of the spouses, and length of marriage.

4. Results

Table 3 reports the frequency with which husbands, wives, and couples choose the early rewards. The aggregate data in Table 3 shows that husbands on average choose early rewards more often than wives, and that the share of early rewards in the joint choices is often closer to the average of the husbands' choices. However, chi-square tests do not reveal any significant distributional differences in the choices between husbands, wives, and joint choices.[5] More importantly, this is only a description of the average choices, and it provides no information on what happened at the level of single households.

<Table 3 to be here>

In eight households, the husband and the wife made exactly the same choices in all 18 choice situations. We will exclude these households from the rest of the analyses since it is

[5] We conduct chi-square tests for each of the 18 choice sets, and the results of the 54 chi-square tests reveal that there are no statistically significant differences between the different decision situations (husbands vs. wives, husbands vs. joint decisions, wives vs. joint decisions).

impossible to obtain any information about the individual spouses' relative influences on the joint decisions from these observations. This leaves us with 93 married couples for estimation and analysis.

Now we turn to the econometric model to analyze the individual and household decisions. The first step of the analysis is to estimate the random parameter models for the individual choices. We estimate random parameter binary probit models. All models are estimated in Nlogit 4.0 using 500 Halton draws. The results are presented in the first two columns of Table 4. Not all mean coefficients are significant, but all estimated standard deviations are, indicating that we capture unobserved heterogeneity both among husbands and among wives. The constant is positive and significant for both groups, which indicates that there is a preference for early rewards not related to the variation in the timing of the rewards and the amounts of the rewards. The coefficient of the dummy variable for four days versus eight days is insignificant for both husbands and wives, and since the reference case is today versus in four days, this is an indication that the subjects do not have present-biased preferences within the time frame of the experiment. However, the coefficient of the dummy for today versus in eight days is significantly positive meaning that, not surprisingly, when the time difference between the early and the late reward increases, the likelihood of choosing the early reward increases. The size of the early reward has no significant impact on choices, which implies no income effect regarding the initial endowment of early rewards in the experiment. Yet, the difference between the early and the late reward has a significant impact on choices. As expected, if the difference between the late and the early reward increases, the likelihood of choosing the early reward decreases.

The next models to be estimated deal with the probability of choosing the early reward in the joint decisions. The results are presented in the last two columns of Table 4. The first model does not include the predicted probabilities of the husband and the wife. In terms of

significance, the first model's results are the same as the two individual estimates. There is a preference for early rewards; longer delay in late rewards and smaller reward differences between early and late rewards increase the likelihood of choosing the early rewards. In the second model, the predicted choice probabilities of the husband and wife are used as explanatory variables in addition to the characteristics of the alternatives. The parameters of the predicted probabilities of the husband and of the wife are highly significant, indicating that, on average, both the husband's and the wife's preferences influence the joint decisions. The mean estimated coefficient is larger for husbands, suggesting that, on average, husbands have a stronger influence on joint decisions than wives. The mean estimate of the relative influence is 0.79; using a t-test, this ratio is statistically significantly different from one (p-value = 0.032). The relative influence measure actually shows how much more influence husbands have, since the ratio is directly related to the ratio of the marginal effects. An increase in the predicted individual probabilities of choosing the early reward increases the probability that the early reward is chosen in the joint decisions for both husbands and wives, but the increase in the joint probability for wives is on average only 79% of the increase for husbands.

<Table 4 to be here>

The next step is to generate household-specific mean estimates of the two parameters related to the influence of the husband and the wife, and then calculate the ratio of the wife's and the husband's predicted probability parameters for each household. If the ratio is larger than one, the wife has more influence than the husband, and vice versa. The mean ratio is 0.71, the maximum 2.42, and the minimum 0.26. Using a t-test the ratio is significantly different from one (p-value = 0.000). The estimated mean based on the individual estimates is slightly lower than the population mean of 0.79. The ratio based on the individual estimates is higher than one for 10% of the households, implying that in only 10% of households, the wife

has more influence than the husband on joint decisions. A plot of the distribution of the relative influences on the joint decisions is presented in Figure 1.

<Figure 1 to be here>

As can be seen in Figure 1, the estimated random parameter model does not predict a large variation in the relative influences on joint decisions. However, it is still interesting to explore which household characteristics can explain the variation. This is done by estimating a truncated regression model (truncated at zero) with the relative influence as the dependent variable. We include a number of household characteristics that could explain the relative influence, such as household income, length of marriage, and having children. In addition, we include a number of characteristics that have the potential to shift the relative influence of spouses: a wife who is more educated than the husband, a wife who is older than the husband, and husband's parents living in the same household.[6] Finally, we include a self-reported measure of the influence on small investment decisions in the household. The results of the truncated regression model are presented in Table 5.

<Table 5 to be here>

Given the relatively small variation in the dependent variable, it is difficult to explain the variation in the relative influence on joint decisions within households. However, three characteristics have significant effects. First, if the household is richer, then the wife has a stronger influence on joint decisions. Second, if the wife is older than the husband, she has a stronger influence. Third, the relative influence is correlated with a couple's self-report on who is in charge of small investment decisions. In a household where the husband typically makes the household's small investment decisions, the husband's influence on the joint decisions in the experiment is stronger.

[6] In rural China, couples live either alone or with the husband's parents. Couples hardly ever live with the wives' parents.

5. Conclusions

In this paper, we have measured the relative influence of husbands and wives on joint household decisions in a field experiment conducted in the homes of 101 married couples in a poor, rural region of China. The average earnings from the experiment were equal to the average pay for two days of work. Hence, participants had strong incentives to make decisions that corresponded to their preferences. The experimental task was to make inter-temporal decisions in which an earlier, but smaller, reward could be traded for a later, but larger, reward. Both spouses had to make decisions, first individually and then jointly. In general, we found that participants were rather impatient, both in the individual and the joint decisions. Yet, the focus of our paper has been to estimate how the individual preferences of husbands and wives determine the joint household decisions.

As a first step in understanding these household decisions, we aimed at disentangling the husband's and the wife's influences on joint inter-temporal decisions and determining the factors that affect the relative influences. As our methodological approach, we applied random parameter models that have allowed us, first, to estimate the time preferences of spouses separately and, second, to use the separate estimates as explanatory variables in a model explaining each household's joint decisions. Hence, the random parameter model provides a very suitable tool to estimate the influences of spouses in a household.

We have found that, on average, husbands have a stronger influence on joint decisions than wives. This reflects the traditional Chinese norm that husbands are mainly in charge of household decisions. Our estimations reveal that in 90% of households, the joint household decisions are more influenced by the husband's individual time preferences than the wife's. It is also remarkable that across the 93 households used in the analysis, we find relatively small variation in the relative influences, suggesting that the spouses' relative influences are persistent. Despite the small variation, it is interesting to note the factors that have a

significant influence on the spouses' relative strength in influencing the joint decisions. Our most important finding in this respect is the fact that in richer households, the relative influence of spouses shifts significantly in favor of the wife's time preferences. This is a clear indication that (increasing) wealth improves the relative power of women in households. Moreover, we found that wives have more influence on joint decisions if they are older than their husbands. Finally, wives have more power in households where they are in charge of small investment decisions. The latter finding confirms earlier findings pointing to the importance of who is in charge of the household income. Previous studies have shown that changing who controls the income in a household leads to changes in patterns of consumption, savings, education for children or even survival rates of children (e.g., Thomas, 1994; Lundberg et al., 1997; and Qian, 2008). Based on our methodological approach, we were able to show that underlying this indirect evidence for the influence of income control on households' economic behavior is the fact that controlling income allows wives to influence joint decisions; and as a result, the wives' preferences are better reflected in the joint decisions.

References

Arora, N., G. Allenby (1999), "Measuring the Influence of Individual Preference Structures in Group Decision Making", *Journal of Marketing Research* 36: 476-487.

Bateman, I. and Munro, A. (2005), "An Experiment on Risky Choice amongst Households", *Economic Journal* 115: C176-C189.

Beharry-Borg, N., D. Hensher, and R. Scarpa (2009), "An Analytical Framework for Joint vs Separate Decisions by Couples in Choice Experiments: The Case of Coastal Water Quality in Tobago", *Environmental Resources Economics* 43: 95-117.

Browning, M., and P. A. Chiappori (1998), "Efficient Intra-household Allocations: A General Characterization and Empirical Tests", *Econometrica* 66: 1241-1278.

Cochard, F., H. Couprie, and A. Hopfensitz (2010), "Do Spouses Cooperate? And if Not: Why?" Toulouse School of Economics, Working paper series 09-134.

de Palma, A., Picard, N., and Ziegelmeyer, A. (2010), "Individual and Couple Decision Behavior under Risk: Evidence on the Dynamics of Power Balance", *Theory and Decision* forthcoming.

Dosman, D., and W. Adamowicz (2006), "Combining Stated and Revealed Preference Data to Construct an Empirical Examination of Intrahousehold Bargaining", *Review of the Economics of the Household* 4:15-34.

Duflo, E. (2003). "Grandmothers and Granddaughters: Old Age Pension and Intra-Household Allocation in South Africa", *World Bank Economic Review* 17: 1-25.

Eliaz, K., Raj, D., Razin, R., 2006. Choice Shifts in Groups: A Decision-Theoretic Basis. *American Economic Review* 96: 1321-1332.

Harrison, G., and J. A. List (2004), Field Experiments. *Journal of Economic Literature* XLII: 1013-1059.

Iversen, V., Jackson, C., Kebede, B., Munro, A., Verschoor, A. (2006), "What's Love Got to

Do with It? An Experimental Test of Household Models in East Africa", Royal Holloway, University of London, Discussion Paper in Economics 06/01.

Lundberg, S., Pollak, R. A., Wales, T. J. (1997). "Do Husbands and Wives Pool Their Resources? Evidence from the U.K. Child Benefit", *Journal of Human Resources* 22: 463-480.

Mazzocco, M., 2004. Savings, Risk Sharing and Preferences for Risk. *American Economic Review* 94: 1169-1182.

McFadden, D. (1973), "Conditional Logit Analysis of Qualitative Choice Behavior", in: *Frontiers of Econometrics*, P. Zarembka (Ed.), Academic Press, New York, 105-142.

McClure, S., K. Ericson, D. Laibson, G. Loewenstein and J. Cohen (2007), "Time Discounting for Primary Rewards", *The Journal of Neuroscience* 27(21): 5796-5804.

McClure, S., D. Laibson, G. Loewenstein and J. Cohen (2004), "Separate Neural Systems Value Immediate and Delayed Monetary Rewards", *Science* 306: 503-507.

Munro, A., I. Bateman, and T. McNally (2008), "The Family Under the Microscope: An Experiment Testing Economic Models of Household Choice", National Graduate Institute for Policy Studies, Japan. Working Paper.

NBS (2008), "China Statistical Yearbooks", China Statistical Publishing House, Beijing.

Phipps, S., Burton, P. (1998), "What's Mine Is Yours? The Influence of Male and Female Income on Pattern of Household Expenditure", *Economica* 65: 599-613.

Qian, N. (2008), "Missing Women and The Price of Tea In China: The Effect of Sex-Specific Earnings on Sex Imbalance", *Quarterly Journal of Economics* 123: 1251-1285.

Quiggin, J. (1998), "Individual and Household Willingness to Pay for Public Goods", *American Journal of Agricultural Economics* 80: 58-63.

Read, D., G. Loewenstein and S. Kalyanaraman (1999), "Mixing Virtue and Vice: Combining the Immediacy Effect and the Diversification Heuristic", *Journal of Behavioral*

Decision Making 12: 257-273.

Strand, J. (2007), "Public-good Valuation and Intra-family Allocation", *Environmental and Resource Economics* 38: 527-543.

Thomas, D. (1994). "Like Father, Like Son: Like Mother, Like Daughter: Parental Resources and Child Height", *Journal of Human Resources* 29: 950-988.

Train, K. (2003). "Discrete Choice Methods with Simulation", Cambridge University Press, New York.

Tables and Figures

Table 1. Descriptive statistics of household characteristics (N = 101 households)

Variable	Description	Mean	Std. Dev.	Min	Max
Income per capita	Income per capita per year in Chinese yuan [a]	4,203	8253	200	84,117
Wife income contribution	Wife's share of the household income [b]	0.418	0.152	0	1
Length of marriage	Number of years the couple has been married	26.47	12.46	1	52
Number of children	Number of children the couple have	2.675	1.401	0	7

Notes:

[a] This is the per capita average of all family members.

[b] This is a joint self-reported measure, where both husband and wife had to agree about the income contribution of the husband and the wife.

Table 2. Description of the 18 pair-wise choices in the time preference experiment

Set	Option A (early reward)		Option B (late reward)	
	Time (days)	Amount (yuan)	Time (days)	Amount (yuan)
1	0	12	4	13
2	0	17	4	18
3	0	11	4	14
4	0	16	4	19
5	0	10	4	15
6	0	15	4	20
7	0	11	8	12
8	0	16	8	17
9	0	10	8	13
10	0	15	8	18
11	0	9	8	14
12	0	14	8	19
13	4	13	8	14
14	4	18	8	19
15	4	12	8	15
16	4	17	8	20
17	4	11	8	16
18	4	16	8	21

Note: 0, 4, and 8 in column “Time” refer to today and in four and in eight days from now, respectively.

Table 3. Frequencies of early reward choices in the time preference experiment (N = 101 households)

Set	Option A (early reward)		Option B (late reward)		Share of early reward choices		
	Time (days)	Amount (yuan)	Time (days)	Amount (yuan)	Husband	Wife	Joint
1	0	12	4	13	0.73	0.67	0.79
2	0	17	4	18	0.74	0.64	0.79
3	0	11	4	14	0.38	0.28	0.38
4	0	16	4	19	0.42	0.38	0.39
5	0	10	4	15	0.24	0.13	0.19
6	0	15	4	20	0.28	0.17	0.21
7	0	11	8	12	0.75	0.70	0.81
8	0	16	8	17	0.72	0.68	0.81
9	0	10	8	13	0.57	0.51	0.56
10	0	15	8	18	0.56	0.52	0.54
11	0	9	8	14	0.40	0.30	0.30
12	0	14	8	19	0.38	0.33	0.28
13	4	13	8	14	0.64	0.61	0.76
14	4	18	8	19	0.72	0.67	0.76
15	4	12	8	15	0.52	0.35	0.46
16	4	17	8	20	0.39	0.3	0.39
17	4	11	8	16	0.32	0.19	0.22
18	4	16	8	21	0.28	0.17	0.24
Overall average share of early reward choices					0.50	0.42	0.49

Note: 0, 4, and 8 in column “Time” refer to today and in four and in eight days from now, respectively.

Table 4. Estimated results for random parameter binary probit models for husband, wife, and joint decisions

	Husband	Wife	Joint	
Mean parameters	Coeff.	Coeff.	Coeff.	Coeff.
Constant	2.065***	1.530***	4.164***	-0.133
	(0.282)	(0.306)	(0.429)	(0.446)
Dummy 4 vs. 8 days	0.025	0.002	0.302*	0.266
	(0.126)	(0.124)	(0.170)	(0.163)
Dummy 0 vs. 8 days	0.922***	1.034***	1.331***	0.316**
	(0.136)	(0.132)	(0.196)	(0.155)
$Amount_{Early}$	-0.010	-0.007	0.012	-0.035
	(0.019)	(0.021)	(0.025)	(0.027)
$Amount_{Late} - Amount_{Early}$	-0.933***	-0.920***	-1.766***	-0.824***
	(0.050)	(0.044)	(0.112)	(0.072)
Husband: predicted probability				3.751***
				(0.262)
Wife: predicted probability				2.337***
				(0.221)
Standard deviation parameters				
Dummy 4 vs. 8 days	0.216**	0.089	0.216	0.227
	(0.095)	(0.098)	(0.140)	(0.144)
Dummy 0 vs. 8days	0.995***	0.879***	1.219***	0.855***
	(0.118)	(0.107)	(0.155)	(0.137)
$Amount_{Early}$	0.132***	0.167***	0.219***	0.132***
	(0.008)	(0.009)	(0.015)	(0.009)
$Amount_{Late} - Amount_{Early}$	0.764***	0.391***	0.742***	0.409***
	(0.042)	(0.024)	(0.053)	(0.034)
Husband: predicted probability				1.713***
				(0.157)
Wife: predicted probability				1.360***
				(0.156)
No. of households	93	93	93	93
Pseudo R2	0.45	0.39	0.54	0.39

Notes:

Figures in parentheses are the standard errors of the coefficients.

*, **, and *** denote that the coefficient is statistically significant at the 10%, 5%, and 1% level, respectively.

Table 5. Marginal effects of the truncated regression model on the relative influence of the wife

Variable	Description (Mean value)	Mar. eff.
Constant	-	0.025 (0.386)
Log Equivalence scaled income	Log of equivalence scaled household income in Chinese yuan. Equivalence scale = (Adults + 0.5 x Kids)^0.75 (9.03)	0.076** (0.035)
Wife income contribution	Wife's share of total household income (0.40)	-0.314 (0.238)
Length of marriage	Number of years the couple has been married (24.81)	0.005 (0.003)
Have children	= 1 if couple has at least one child (0.42)	0.018 (0.070)
Wife more educated	= 1 if wife has a higher education than the husband (0.14)	0.049 (0.096)
Wife older	= 1 if wife is older than husband (0.29)	0.165** (0.074)
Influence on small investment decisions	When it comes to small investment decisions, for example buying equipment for the house, would you say that: 1 = mainly wife decides, 2= decide jointly, 3 = mainly husband decides (2.17)	-0.072* (0.044)
Living with husband's parents	= 1 if the couple is living with the husband's parents (0.24)	-0.129 (0.083)
No. of households		93

Notes:

Figures in parentheses are the standard errors of the coefficients.

*, **, and *** denote that the coefficient is statistically significant at the 10%, 5%, and 1% level, respectively.

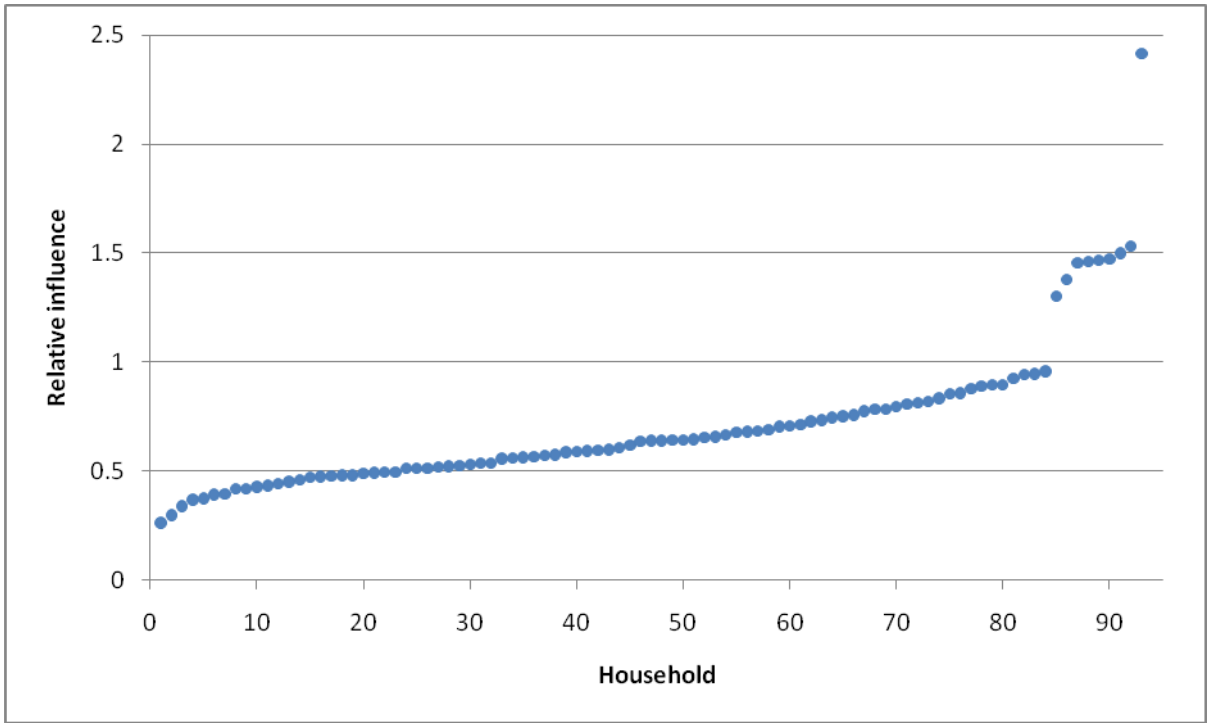

Figure 1. Distribution of relative influences on joint decisions

Appendix: Experimental script for eliciting inter-temporal choices individually and jointly

Separate decisions (for each of the two spouses respectively)
"In this experiment, we will ask you to make decisions between earning money at different points in time. You will be asked to make 18 decisions. Let us look at the first decision [*show card 1*]. In this case you can either receive 12 yuan today if you choose alternative 1 or receive 13 yuan in four days if you choose alternative 2.

At the end of this survey, when your household has answered all the questions, you will draw a card one time for this part to determine the one of the 18 decisions to be actually paid. Even though you will make 18 decisions, only one of these will end up affecting your earning, but you will not know in advance which decision will be used. Each decision has an equal chance of being used in the end.

Please note that if a time today is chosen, you will receive the money right after the survey. If a time different from today is chosen, we will write this "We owe you paper" [*Show the certification to the subject*]. This is a legally binding paper from Peking University assuring you that payment will be done in the future. In practical terms, we will come back to your household at the time chosen to pay you the money."

"Do you have any questions?" [*Experimenters need leave enough time and opportunity to the subjects*] If NOT, "Shall we proceed with the 18 decisions?"

Joint decisions
"In this part of experiment, we will ask you to make decisions between earning money at different points in time. But this time we want you to make decisions together. The questions are exactly the same as before.

The way to determine your payments is the same as before, but this time each of you will receive the amount of money stated in the chosen alternative. That is, you will draw a card one time to determine the one of the 18 decisions to be used. If a time today is chosen, you will receive the money right after the survey. If a time different from today is chosen, we will write the 'We owe you paper' to both of you, and will come back to your household at the time chosen to pay both of you the money."

"Do you have any questions?" [*Experimenters need leave enough time and opportunity to the subjects*] If NOT, "Shall we proceed with the 18 decisions?"