Taking it in turn: an experimental test of theories of the household

Munro, Alistair; McNally, Tara and Popov, Danail
National Graduate Institute for Policy Studies, Japan

15. May 2008

Taking it in turn: an experimental test of theories of the household.

by

Alistair Munro[*,‡]**,**

Tara McNally*

and

Danail Popov*

* Department of Economics, Royal Holloway College, University of London, Egham, TW20 0EX.

‡ (Corresponding author. Email to alistair-munro@grips.ac.jp): National Graduate Institute for Policy Studies, Tokyo, Japan.

Abstract.

Using a sample of established couples, we conduct an experiment on household decision-making. Individual partners first make a series of dichotomous choices between household goods and vouchers for experiences and then the couple jointly face the same choices. A random lottery device is used to incentivize the decisions. We find clear evidence of turn-taking as a method of resolving disagreements. In other words, when one partner wins one disputed question, it raises the probability that the other partner wins the next dispute. Given the arbitrary order of the questions this suggests that standard decision-theoretic models of household behaviour are inadequate and that instead, much behaviour might be concerned with relationship maintenance rather than the allocation of goods.

Keywords: Household choice, Experiment, Family, Invariance, Turn-taking.
JEL Codes: C920, D130, D80.

Introduction.[*]

Turn-taking is a well-known part of the story of how established groups make a sequence of decisions when there is conflict over the best options. If one person gets their preferred option in one decision, then it makes them more likely to yield to other members of the group on the next contested decision.

Turn-taking may arise for a number of reasons. In one class of explanations, it may be a means of sharing the gains from bargaining over a sequence of discrete choices, especially when side-payments are not possible. From a non-cooperative bargaining perspective, (e.g. Lau and Mui, 2003), it may also be a method for enforcing a Nash equilibrium of a repeated game. These explanations of turn-taking are intuitive and straightforward. However, there is a second notion that is less easily rationalised within a traditional[1] game theoretic framework, but which is also familiar from real life and readily discernible within the social psychology literature on household decision-making (e.g. Nock, 1989). In this version, against a backdrop of heightened emotions and deep vulnerability, decisions are used as a vehicle to exchange signals about understanding, mutual respect, love and so on.[2] A central purpose of turn-taking is then to reassure and reward, to promote relationship specific capital (Becker, 1981), what is often termed, *relationship maintenance* (e.g. Stafford and Canary, 1991).

Within traditional decision-theoretic models the primitives are the set of options and the preferences of the individuals over resource allocations. Allowing for a stochastic element to decisions, the pattern of choice should not be dependent on the way the choice set is presented or framed. Where group choice is concerned, many formal models also incorporate a preference aggregation component, but retain the choice set and preferences as primitives. Economic models of the household, such as the unitary model or collective choice models (Browning and

[*] The work reported here was financed by the UK's ESRC, grant no. RES-000-22-2081. We thank Kim Corfman and Donald Lehmann for providing unpublished details of their work.

[1] By traditional we mean a framework where the utility, U_i of player i is a function of material payoffs, M, $U_i : M \to IR$, but not beliefs about other players' intentions as in psychological game theory. Note, M may include within it the material payoffs of other players – in other words the framework does not exclude altruism, envy etc.

Chiappori, 1998) most clearly fit this description, but it also applies to a broader class of models from the consumer psychology literature such as the widely cited theory of group decisions offered by Davis, 1973. Traditional game theoretic motives for turn-taking are entirely consistent with this framework. However, in the relationship maintenance story the pattern of dispute resolution may depend on the order in which the choice set is presented. Thus, if relationship maintenance is important, then a model of household decision-making based solely on the primitives of preference over goods can be flawed.

Although the relationship maintenance story of household decision-making may be appealing, direct evidence from actual choices is scant. So, in this paper we report on an experiment on a sample of established couples who were asked to make a series of dichotomous choices between widely available goods, first separately and then jointly. A distinctive feature of our experiment is that the choices made individually and jointly are incentivised using the familiar random lottery system. Though many choices were not disputed (i.e. the individual partners separately chose the same option), we find clear evidence for turn-taking in the resolution of those choices where individual answers diverged. Since the couples had the whole set of questions in front of them as they made their joint decisions, we take this as evidence against theories of household decision-making in which only preferences over goods matter.

The plan of the remainder of the paper is as follows: in the next section we provide a brief background to the experiment and consider the relevant literature. In section 3, we describe the experimental procedure with results presented in the following section. Section 5 concludes the paper. Before going on though, it is worth making two clarifying remarks that anticipate our results.

First, much of the recent experimental work on individual decision-making is concerned with whether individuals are rational. Our paper has nothing to say on this particular issue for couples. One reason is that group choice models require a preference aggregation component.

---

[2] Paul Simon, quoted in Lich-Tyler, 2001, writes that 'negotiations and love songs are often mistaken for one and the same. This is a general theme of our paper.

Since this component is undefined by axioms of rational choice[3] and can legitimately vary between households, it can be difficult to examine whether collective choice is rational or otherwise. One might still question whether it is rational for a group's choice to depend on the order in which decisions are presented. After all, many experiments on the framing invariance of individual choice are tests of rationality. Our contention is simply that turn-taking in ongoing groups can be rational, in part because the objects of preference are not confined to the consumption of goods.

Our second preliminary remark is that our design and our results do not presume that relationship maintenance is the only force driving household decisions. There is abundant evidence of the role played by power, expertise and preference intensity in household decisions (e.g. Corfman et al, 1994). The aim therefore of the present experiment is to see whether turn-taking also plays a part.

Background and Design.

As we noted above, turn-taking may have different bases. Within traditional game theory, it may be part of equilibrium in a repeated game. Consider for instance the 'Battle of the Sexes' game depicted in Figure 1. In this familiar story, the players have some wish to coordinate their actions. Two alternative options are available, each favoured by one person. There are three Nash equilibria: two pure and one mixed. In an infinitely repeated version of this game with two sufficiently patient players the Folk theorem implies that any feasible average pair of payoffs greater than (0,0) can be achieved in a sub-game perfect Nash equilibrium. In particular an average of (3.5,3.5) can be achieved by alternating the two strategy pairs (A,A) and (B,B). Lau and Mui, 2003, show how this symmetric and efficient outcome can be brought about through a process of trial and error, while Browning and Colman, 2004, demonstrate the evolutionary stability of turn-taking in some repeated versions of the Battle of the Sexes. In an experiment using US college students, Prabrey 1992, uses a game similar to the Battle of the Sexes to show that turn-taking is the most popular strategy in indefinitely repeated versions of the game.

[3] The Pareto principle might seem like a natural candidate for a rational aggregation rule, but this is not a feature of some non-cooperative theories of household behaviour e.g. Chen and Woolley, 2000.

Similarly Sonsino and Sirota, 2003, find that 57% of their subjects converge to an alternating pattern of play in a Battle of the Sexes experiment played in gender-mixed pairs of engineering students. They also find that anonymity reduces but does not eliminate this kind of reciprocating behaviour.

		Player 2	
		A	B
Player 1	A	5,2	0,0
	B	0,0	2,5

Figure 1. A Battle of the Sexes Game.

In cooperative games, alternation may also be an effective means of sharing the spoils from repeated bargaining in a manner that avoids exit when utility is non-transferable. Suppose for instance that two individuals bargain in a relationship that may last indefinitely. Option A is always worth 3 to player 1 and option B is worthless to her in all periods. Option A is worth nothing in all periods for player 2, whereas option B is always worth 3. Each player discounts the future by 50% per period and present value of the outside option is always 2. In this situation, two periods in which the same player loses produces a net present value of at most 1.5. Hence, even if they subsequently get their preferred option in all future periods, two periods without a win would lead to exit and the end of the game. Alternation is potentially sustainable, though and produces a present value of 4 to the person who gets their preferred option initially and 2 for the partner.

These are examples of what Sobel, 2005 calls *instrumental reciprocity* – tit-for-tat behaviour in a repeated game by players who are selfish. With *intrinsic reciprocity*, players have interdependent preferences of a type that promotes reciprocating actions. Psychological game theory (Geanokopolos et al, 1989, Dufwenberg and Kirchsteiger, 2004) offers one way to characterize this behaviour in formal game theoretic terms.[4] In that literature, player's payoffs

[4] There are other approaches. Baumeister et al, 1995, note the importance of guilt and its avoidance as a factor in decisions. To the extent that people feel guilty for continually winning disputed decisions, then turn-taking can mitigate these feelings. Dufwenberg, 2002, applies this thinking to a marital investment game.

depend on beliefs about the intentions behind actions. In other words the utility, U_i of player i is a function of both M, material payoffs and, B_i, i's beliefs about the players' choices and beliefs:

$$U_i : M \times B_i \rightarrow IR$$

Generally in this framework individuals wish to be kind to players who are kind to them and punish unkind acts with unkindness (Dufwenber and Kirchsteiger, 2004). If not always pressing for one's preferred option is interpreted as kindness by the other player, then he or she may respond in a similar manner and turn-taking can arise.

Outside of game theory, much of the formal work on household (and group) decision-making rests on the theoretical framework laid out by Davis, 1973. In this paper, Davis proposes that decisions are a probabilistic function of three components: the choice set, individual preferences and the "social decisions scheme".[5] Thus, as with game theoretic models the pattern of choices for a given couple should be independent of the order in which the choices are presented. However, the framework initiated by Davis is quite permissive and thus it is not unusual to see decision history included as a variable in a Davis-style model of decision-making. For instance, Corfman and Gupta, 1992 argue that, "for groups that are not newly formed, the processes and outcomes of past decision are often important and should be included in models", page 54.

A predecessor to the Davis model that is closer to the game theoretic approaches is that produced by Polley, 1968. In this model, too though the primitives are the choice set and the preferences of the partners. Polley introduces the notion of 'utility debt' to describe a situation where the resolution of recent disputes is such that one partner is ahead compared to a norm representing the long-term distribution of the gains from the relationship. The probability of losing a dispute is increased when a person has a utility debt to their partner and thus the model contains a mechanism that predicts turn-taking.

Relationship maintenance is a term that refers to strategies and behaviours designed to support and nurture a relationship. In non-mathematical theories of household behaviour the idea that

[5] Game theoretic models of the household are compatible with Davis' framework. They are more restrictive because they impose equilibrium concepts and this limits the set of permissible social decision schemes. For instance, in cooperative models, the social decision scheme must be Pareto efficient.

relationship maintenance is a key part of decision-making is common (Nock, 1998). According to Stafford and Canary 1991, relationship maintenance strategies include positivity, openness, assurances, social network and task sharing. Positivity includes avoiding criticism and being cheerful and upbeat; openness refers to being willing to discuss feelings and share emotions; assurances include statements of love and commitment; social networks mean spending time with a partner's friends and family and task sharing is fairly self-explanatory. Each of these strategies helps maintain or improve indicators of relationship health, such as liking of partner, commitment and mutual control. They are an example of what Messick, 1999, terms 'alternative logics for social settings'. In turn the indicators are correlated with the persistence of the relationship and its satisfaction (Rubin, 1970). Turn-taking can be a component of several maintenance strategies. If the task is to make a decision, then turn-taking implies a shared responsibility for household choices. Turn-taking may also be associated with assurances: when a partner gives way on one choice it signals to the other partner that their preferences are understood and valued (Park et al, 1995). Taking it in turn might also be linked to positivity and openness – since it enables the partners to exchange signals about preference intensity without at the same time signalling intransigence and an undiscriminating rejection of the partner's wishes.

In theory, there may be a reconsideration after all pending decisions have been examined once by the partners. However, sincerity and honesty are often valued features of communication in a long-term relationship (Rubin, 1970). To reopen one decision after others have been apparently agreed may therefore send a damaging signal about the honesty of previous discussions. In short therefore, the relationship maintenance story is not simply about agreeing on consumption. It is also about the process by which agreement is reached, since this may affect each person's feelings for their partner. As such even when the consumption set is fixed, the order in which decisions are first considered can have an impact on the final pattern of consumption. It is this feature that distinguishes it from the traditional game theoretic model or the Davis framework. Separating the relationship maintenance story and psychological game theory is less simple as psychological game theory is very close to the spirit behind relationship maintenance. One reason is that even within a relationship maintenance perspective, players may use feelings strategically, as Davis, 1976 observes:

> ‘Waiting for the "next purchase" is an obvious approach if one feels that one will lose or "use up" goodwill by forcing a showdown on a contested decision. The husband can say, for example, "O.K., you buy the fur coat but I'm going to take the two-week fishing vacation with the boys."’ Davis, 1976, page 256.

Moreover, psychological game theory is clearly work-in-progress and so it would be churlish to focus on the set of existing models rather than the spirit of the approach with its emphasis on beliefs about intentions as an important component of utility. For the purposes of this study, the key point though is that any psychological game theoretic model in which beliefs B_i about intentions depend only on a) the final actions taken and b) the choice set from which these actions were selected, will not be compatible with widespread turn-taking in joint decisions.

Systematic evidence of turn-taking is relatively limited but comes from a variety of situations in which ongoing groups make discrete decisions. Ostrom, 1990, describes norms of turn-taking in agricultural communities worldwide. For instance, amongst Spanish farmers in Valencia taking water from irrigation canals is governed by principles of alternation. Within households, Gupta and Stecker, 1993, show that brand-switching in household purchase data is consistent with a model in which spouses take it in turn to choose their preferred option. They do not though have direct evidence on turn-taking. For households, perhaps the clearest data is provided by results from a pioneering experiment run by Corfman and Lehmann, 1987 which forms a direct precedent for our work. Both partners were first presented separately with a series of 54 items and asked to answer questions about their preference intensities for the items, likelihood of future purchase, reservation price etc. From their answers the researchers created a subset of dichotomous decisions, 12-18 questions for each of the 62 couples. Each of the pairs of goods was chosen in anticipation that the partners would have different preferences. These sets, which then differed between households, were subsequently shown to the couples. For each question they were asked first to indicate their individual preference intensity towards both of the options and then to come to a decision on the item that they would choose jointly. Around 39% of the questions did prompt disagreement and in an OLS analysis of the probability of winning a dispute, Corfman and Lehmann, 1987 found a small but significant ($p<0.05$) tendency for partners who ‘won’ on one question to have a lower probability of winning a subsequent disputed question. The importance of decision history has also been reported by Qualls and

Jaffe, 1992 and more recently by Ward, 2006, who used 61 US couples in an experiment closely modelled on that employed by Corfman and Lehmann. She also noted that decision history was more important for tasks where partners expressed strong preferences for one of the products.

One theoretical possibility with these results is that the partners were strategic in the first phase – reporting preferences so as to maximize the chances of preferred goods appearing in the second stage of the experiment. One obvious counter is that the choices in the experiment were hypothetical which makes strategic behaviour in the first phase rather pointless. However, this then raises the issue of the incentives in the second stage of the experiment, wherein subjects were asked first to report preference intensity and then to resolve their differences. Another potentially confounding issue is the attrition of couples between the first stage of the experiment and the second. It is conceivable that these factors may produce turn-taking – the hypothetical nature of the experiment may produce heuristics that minimize decision effort for instance.

Su et al, 2003, use a conjoint analysis with three decisions. Subjects first rank the options in each decision, but unlike the other studies reported here, there is no selection of goods between stages and no attrition between stages. Thus there is no incentive to misrepresent preferences so as to influence the choice set. However, they use a mail-based survey so that monitoring of subjects was not possible and subjects were also therefore able to see all parts of the experiment before answering any questions. Because there are several options to rank in each decision, a simple test of whether partners take it in turns to win is hard to construct. However, intriguingly, they find that self-reported levels of coercion by partners are negatively linked to coercive behaviour in the previous decision and positively linked to dissatisfaction with the preceding decision.

Overall therefore, there have been a few experiments which have found turn-taking in some form or other. The lack of incentives, subject monitoring and other design issues means that in none of them is there a clear cut test of no-turn-taking when real choices are involved. As a result we design an experiment to avoid these possible weaknesses. The experiment takes place under our gaze with subjects separated for the first stage. The second stage of the experiment follows on immediately from the first to avoid attrition in the sample. Third, the tasks in the second stage were exactly the same as in the first stage. Fourth, all the tasks were simple

dichotomous choices, so it would be apparent when couples differed in preferences and when one person won. Finally we used a random lottery device to incentivize the decisions from all parts of the experiment. In other words, out of all the choices made by the couple one was picked at random to be executed at the end of the experiment. More details about the experimental procedure follow in the next section.

Method.

Subjects were recruited at two community events hosted by Royal Holloway, University of London, U.K. during the summer of 2007. The first was a garden party – a fair for the local community with craft stalls, food and entertainment; the second event was part of a nationwide heritage day in which buildings of architectural interest were opened to the public. Fifty couples took part in the first event and 32 in the second. On each day we set up a stall with advertising material and with posters listing prizes. We also handed out fliers around the event.

Couples passing the stall run by the experiments were invited to take part in the experiment. At this stage we did not know whether individuals were part of a couple, so we simply asked any passing adults if 'they were with their partner today'. If they answered positively, we probed further to see if they satisfied the criteria for the sample: were they both 21 or over, were they living together as a couple and had they been together for over one year. If they met the criteria and agreed to take part, they were given introductory instructions and descriptions of the prizes by the experimenters. Each individual was then asked to fill in separately the first part of the experiment which consisted of the individual choice questions (followed by a brief socio-demographic questionnaire). In order to keep the process gender neutral,[6] one member of each couple was labelled 'Triangle' and 'Wave' at random at the start of the experiment. On the questionnaire in section 2, their answers were labelled as such. Tables and chairs were set out to allow participants to sit down well apart from one another and the subjects were monitored by the researchers to prevent collaboration. If children were present, the subjects were monitored and reminded to answer the questions without their influence. Some toys were also provided to keep the children occupied.

Appendix A lists the full set of goods used and appendix B provides a sample pair of questions. The goods were initially selected on the basis of answers given by couples taking part in a previous experiment (Bateman, McNally and Munro, 2007). They mix some low value goods with vouchers for popular retailers, some personal and household goods and vouchers for dating 'experiences' such as a meal and show in London's West End theatre district. This last class were bought from leading internet-based suppliers and are well-known gift purchases in the UK. They are flexible and can typically be enjoyed at a variety of venues, within one year of purchase. Recipients cannot exchange them for cash. The prizes varied in face value from DVDs (retailing for around £10 or $20) up to some of the experiences which cost over £110 ($220).

In providing instructions for the first part of the experiment we did not tell the subjects the nature of the second part. We only specified that there was a second part and that one question chosen at random from their answers, their partner's answers or from the second part of the experiment would be chosen as the real question and their supplied responses would be binding.

We produced two versions of the questionnaire with the same tasks but in a different order. Each couple was randomly allocated to one version or the other (i.e. the partners in a couple always saw the same order).

After both partners had completed the first section we tallied their choices and transferred the information onto the questionnaire for section two of the experiment. In this section the subjects were jointly presented with the same set of questions from the first section and then asked to make a joint choice. So that there could be no issue of recall bias, the questionnaire included on it details of the choices made by both partners in the first section of the experiment. Appendix C provides one page of this section of the experiment. Once section 2 had been completed a random lottery device (bingo chips drawn from a bag) was used to select the question that would be for real. The couple was then notified of the relevant prize and the experiment ended.[7]

[6] In fact all the couples were heterosexual in this experiment.
[7] Prizes were ordered after the experiment and delivered to the participants in the following week.

After the first event two things became clear: first there was some scope for asking subjects to answer more than the 12 questions each of them faced; secondly and more seriously, for many questions there was a large level of agreement within couples (around 65% of all items).[8] This limited the value of the dataset. Consequently we ran focus groups to identify more goods with a reasonable probability of disagreement and then replaced some questions and added a few more. As a result, at the second event subjects were asked to answer 15 questions each and disagreement levels increased to around 45%. Apart from this the format remained the same.

Results

Figure Two sets out some descriptive data from the combined sample, based on individual responses from the questionnaire at the end of the first section. At the time of the experiment, on average, couples taking part had lived together for just over 19 years and their mean age was 49. The oldest person was 80 and the youngest 22. The modal length of time together was 1 year, but as the chart shows, this simply reflects the wide dispersion of the sample on this measure. The majority of couples were in long-established relationships with 55 years as the longest self-reported time as a couple. About 70% were married. As is common the pattern of children was bimodal with 0 as the most frequent answer and 2 as the other typical response. Around 75% of couples gave the same answer for living together, while just over 60% agreed on the description which matched most closely their financial arrangements. Matching the results of Bateman and Munro, 2005, 42% agreed on both questions. Sharing everything was the most common financial arrangement with the overwhelming majority of the other subjects stating that one partner had principle control while the other kept some money for personal use. The most commonly reported occupation was 'retired'. For those in work, a wide variety of occupations were reported including electrician, clerk, sales manager, reflexologist and driving instructor. Using the UK's Labour Force Survey occupation codes from after 2001 around 2/3 of the responses would be classified as professional/managerial or in other skilled and semi-skilled jobs.

[8] This should not be seen as evidence of assortative mating – when we test to see if the levels of agreement we find were higher than that obtainable if a random male from our sample were matched with a random female we find no significant difference.

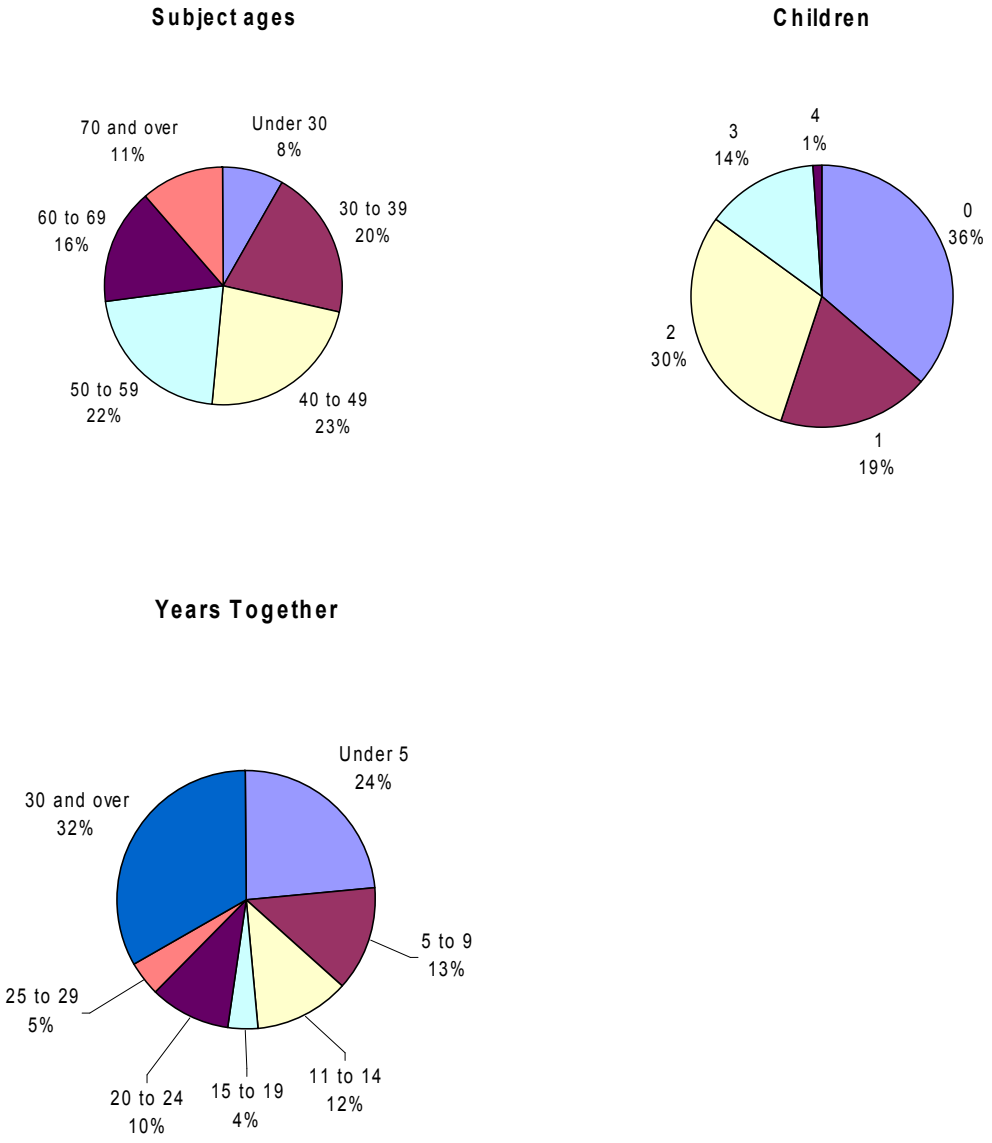

Figure 2 Descriptive Information on the full data set.

Before we set out the main results of the paper, we present some subsidiary evidence on transitivity and the Pareto principle. We have two pairs of three questions for the first of these tests. Out of 200 individual observations we have only 7 instances where individuals fail to make answers consistent with transitivity and out of 100 joint choices we have just one case where transitivity is rejected in joint choice. This compares favourably with experiments involving relatively abstract lotteries where inconsistency is relatively common (Starmer, 2000).

Similarly, Bateman and Munro, 2005, report an experiment involving choices between lotteries made by couples and find a much higher level of inconsistency than that found here.

For couples to be Pareto efficient, in instances where they have made the same choice in section one, they would need to choose the same option jointly in section two. Eight couples showed some evidence contrary to Pareto efficiency out of a total of 419 instances when both couples chose the same option (A or B) in section one of the experiment. Thus reversals of joint preference are rare, though not unknown and no couple reverses more than once. Again though, and perhaps because we are dealing with goods rather than lotteries, preference reversals are much rarer than the 15% incidence reported in Bateman and Munro, 2005 for instance. Overall therefore there is much coherence in the data.

Out of the 82 couples we have 380 disputed questions. The median number of disagreements per couple was 4 and the maximum number encountered was 10 (see figure 3).

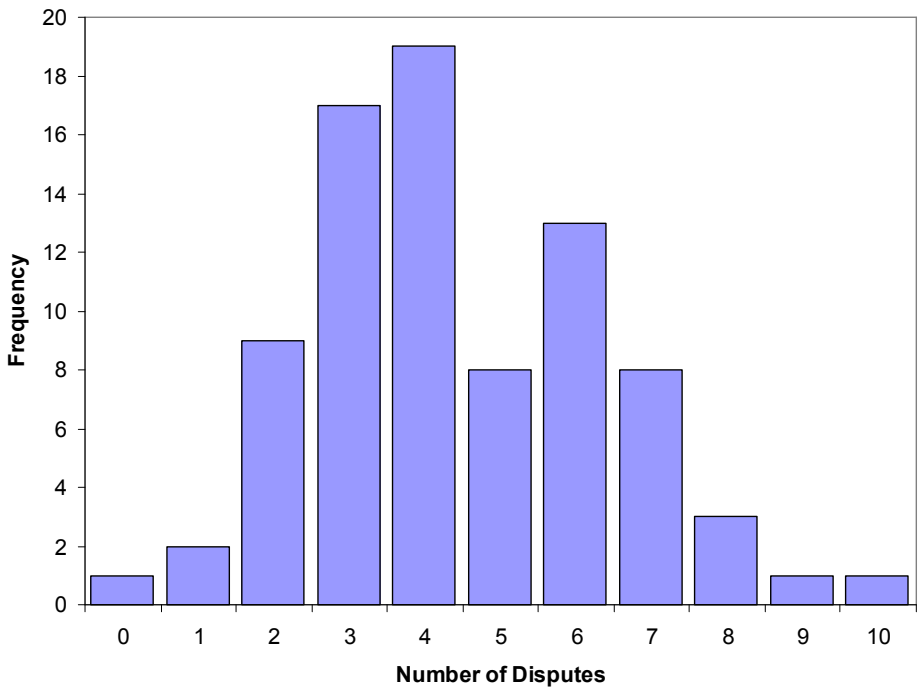

Figure 3 Dispute Frequency

Although as would be anticipated, Triangle wins near enough half of all disputes (51.9%), across couples we have a wide dispersion of win rates. Figure 4 summarises this information, which excludes the one couple who did not disagree on any answers. Twenty-two couples split the wins 50:50, but otherwise there is substantial variation including 13 cases where one partner won all disputes. In six of these cases the dominant partner was male. Overall, women won 51.4% of disputed decisions.

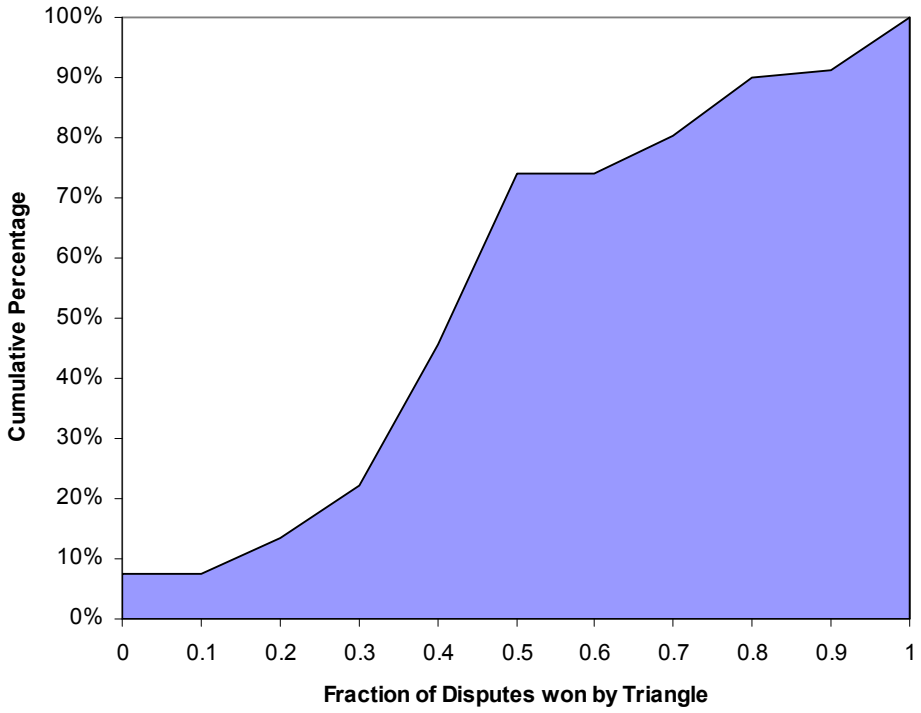

Figure 4. Cumulative Distribution of Win Rates.

As an illustration of our null hypothesis and test statistic consider the pattern of responses below for a sequence of eight questions. In the first question the couple give the same answers individually; in the second case they disagree and Wave gets their preferred option and so on.

Agree	T loses	T loses	T wins	Agree	T wins	T loses	Agree

In this example, there are five disputes and T loses on 3 occasions. Out of these three cases where T loses, there are two cases when there is at least one subsequent dispute. In the third

occasion that T loses, there is no subsequent dispute. So, given T loses a dispute, T loses the subsequent dispute 50% of the time, which is less than the 60% unconditional chance that T will lose a dispute. However, this is not the correct comparison. Once we know a dispute has been lost then given the total number of disputes lost by T, one degree of freedom about what can happen in other disputes is removed. This is most clearly seen in the case where there are only two disputes and T loses the first of these. The unconditional proportion of losses is 0.5, but the probability of two consecutive losses is zero. Essentially therefore we have to compare the conditional probability that the next dispute is lost, to the probability that another, randomly chosen dispute is lost.

More formally, let d = the number of disputed questions and let l = the number of disputes lost by Triangle and let k = the number of pairs of consecutive disputes lost by Triangle. For each of these couples we compute two proportions: P(L), the probability that the Triangle player loses a dispute, and the conditional proportion of disputes lost by Triangle, given that the previous dispute was also lost, P(L | L). Each of these calculated proportions includes a correction to allow for the nature for the sample.

$$P(L) = \frac{number\ of\ disputes\ lost - 1}{number\ of\ disputes - 1} = \frac{l-1}{d-1}$$

$$P(L \mid L) = \frac{number\ of\ pairs\ of\ consecutive\ disputes\ lost}{number\ of\ disputes\ lost - i} = \frac{k}{l-i}.$$

Here i is an indicator variable that takes the value 1 if the last disputed question is lost by Triangle and 0 otherwise. Our hypotheses are then:

H0: P(L) = P(L | L).
H1: P(L) > P(L | L).

If there is no negative serial correlation and the null hypothesis is true, then there is an equal chance that P(L | L) is higher or lower than the first proportion. We therefore conduct a sign test on the difference between P(Loss) and P(Loss | Loss), with a null hypothesis that P(Loss) is greater than P(Loss | Loss) for 50% of the sample. The alternative hypothesis is that P(Loss) is more frequently higher than P(Loss | Loss).

As could be seen from Figure Three, we have 1 couple with no disputes and 2 couples with 1 dispute. In addition we have 3 couples where the solitary dispute lost by Triangle is also the last dispute. We drop these 6 cases from our sample. In 54 out of the remaining 76 cases, (0.71) we find that the conditional probability of losing is strictly lower than the unconditional probability. A binomial test produces $z = 4.064$, $p = 0.000$ (to 3 significant figures). For the separate sub-samples the relevant z scores are 2.47 (event B, n=30) and 5.33 (part A, n=46). Both of these have p values below 0.01. Thus we reject the null in favour of the alternative hypothesis of negative serial correlation in the resolution of disputes.

For small levels of disagreement, negative serial correlation might simply reflect the desire amongst a couple to equalize some measure of gains. Thus with only two disagreements we might expect Triangle to win the second if she or he loses the first. To consider this possibility we repeat the binomial tests progressively eliminating couples with low levels of disagreement. Table 1 summarises the results. We can see that the proportion where P(Loss | Loss) is lower than P(L) falls slightly as we exclude more and more couples, but that the result remains robust until the sample falls to just 26 couples at which the p value for a one-tailed test is 0.9504. (There are 14 couples with 7 or more disagreements; the relevant proportion is 64% for this group.) Overall we conclude that the result is not an artefact caused by the inclusion of couples with only 2 disagreements.

Table 1. Losing and losing twice in a row

Couples included	Number of couples	Proportion where frequency falls	Z value
All	76	0.71	4.064***
4 or more disagreements	51	0.71	3.226***
5 or more disagreements	38	0.68	2.443***
6 or more disagreements	26	0.65	1.649

*** significant at 1% level.

One theoretical possibility is that our results are driven by particular pairs of questions. As we note above, we have three different question orders across the sample, which makes it unlikely

that our results are simply due to the sequence of questions. Perhaps more pertinent is the additional fact that there are a large number of agreements within our sample, so that in many cases disputes are not consecutive questions. Indeed the incidence of the next dispute is spread across subsequent questions. For example, the largest number of disputes for a single question is 40 (out of 82). Only 16 of these couples then disagree about the choice for the subsequent question and out of them, one member of the couple wins both questions on 14 occasions. In other words, for this particular pair of questions, the data is at variance with the general pattern of results. For the remaining 24 couples, the next task where they disagree is scattered across the rest of the questionnaire. More generally, for the sample as a whole, in 45% of the cases where consecutive disagreements involve consecutive questions, the partners alternate who wins. Where consecutive disputes are separated by one or more questions where the partners agree, 47% of cases involve alternation of the winning partner. So, in fact, taking it in turn is slightly more frequent for the pairs of disputes separated by some period of agreement, though the difference is not remotely significant. Overall, therefore we conclude that turn-taking is not an artefact of the particular order of the questions used in this experiment.

To analyse the data in a different way, we also run regressions, treating the dataset as a panel and using a random effects model to capture the idiosyncratic effects of households. The dependent variable in this regression is coded as 1 if the joint choice concurs with the preference expressed by the Triangle partner ('Triangle'). There is a corresponding variable for the Wave partner ('Wave'). Thus if both of these dummy variables are 1 then partners made the same choice individually and jointly. See below for the complete interpretation of these variables.

		Wave	
		Wave=1	Wave=0
Triangle	Triangle=1	Partners agree and stick to individual choices	Partners disagree and Triangle predominates
	Triangle=0	Partners disagree and Wave predominates	Partners agree but reverse individual choice

According to the null, the probability that the joint choice in task t agrees with the choice made by Triangle as an individual should be independent of how past decisions have been resolved. According to the alternative hypothesis, the probability of success for Triangle should increase when Wave has been successful in the past round, once we control for Triangle's overall success rate. Thus a regression of Triangle on lags of itself, on Triangle's overall success rate and on Wave and lags of Wave provides a framework for testing the hypothesis.

So, we estimate the random effects logit model: [9]

$$Triangle_{i,t} = a + b_0 Wave_{i,t} + b_1 Wave_{i,t-1} + b_2 Triangle_{i,t-1} + b_3 Agree_{i,t} + b_4 WinRate_{i,t} + \varepsilon_{i,t}$$

Where i refers to the subject, t refers to the question, Win Rate is the average number of disputes won by Triangle and Agree is a dummy that takes the value 1 if Triangle and Wave separately have given the same answer. We leave in Agree because of the possibility that individuals separately give the same answer but jointly reverse that decision. The error term, $\varepsilon_{it} = \varepsilon_i + u_{it}$ with ε_i normally distributed and u_{it} having an extreme value distribution. The null hypothesis is that $b_1=0$; the alternative is that $b_1>0$. We would also anticipate that $b_0 < 0$, $b_4 > 0$ and $b_3 > 0$.

Table 2 summaries the results (the terms in parentheses are standard errors). For all the models, a null hypothesis of no explanatory power is strongly rejected, but an assumption that there is no individual level heterogeneity is not rejected. In other words, it is as if there are no systematic differences between couples that are not picked up by the Win Rate variable. Not surprisingly the effect of overall Win Rate on whether an individual gets their preferred alternative is positive and highly significant within the pooled sample and separately in the two sub-samples. Similarly, when couples make the same choice separately, then this has a positive impact on the probability of that option being chosen. Again this is not a surprise, given that the marginal impact of the partner winning is negatively correlated with Triangle winning. Most pertinently

[9] Since WinRate is constant within a household, we cannot use a fixed effects model. When we omit the WinRate variable and compare the fixed and random effects models, a Hausman test does not reject the random effects model against the fixed effects alternative.

we see that if Wave wins in the previous round, then Triangle is more likely to win in the current round. The coefficient on $Wave_{t-1}$ is significant at the 5% level, two tailed test for the pooled sample and significant at the 1% level for the second sub-sample. For the first sub-sample, the coefficient is positive, but not significant.

Since the choice of who is Triangle is random it makes no sense to include demographic features directly into the equation when they do not differ between the household members. When we include Triangle's gender and the age gap between the partners, as we do in equation 4, the coefficient on $Wave_{t-1}$ is still significant, but the added variables have very low t values (i.e. the Win rate variable subsumes their explanatory power). Note that the sample is reduced for equations 4-6 because of incomplete demographic data from 5 couples.

It is possible that variables that are constant within a couple may affect the coefficients on the decision history variable. For instance, older couples might be more or less responsive to a win by their partners in the previous round. When we test for this we do not find any effect with age, children or years together as a couple. However, as shown in the final two columns, we find a difference between married and unmarried couples. For the latter, admittedly small group, there is no significant effect of decision history on outcomes. However, for married couples, there is a significant effect. Married couples take turns whereas the unmarried do not.[10]

[10] The rate of disputed questions is almost identical between married and unmarried questions.

Table 2. Random effects logit model of serially correlated outcomes.

Equation	1	2	3	4	5	6
	Entire sample	First event	Second event	Entire sample, demographics	Married	Unmarried
Constant	-0.059	-0.151	0.937	-0.288	-0.775	2.04
	(0.660)	(0.928)	(1.13)	(0.607)	(0.745)	(2.27)
$Wave_t$	-5.12***	-4.38***	-6.07***	-5.038***	-4.61***	-7.17***
	(0.447)	(0.541)	(0.815)	(0.455)	(0.486)	(1.531)
$Wave_{t-1}$	0.996**	0.736	1.80***	0.899**	1.27***	-1.374
	(0.452)	(0.615)	(0.775)	(0.451)	(0.486)	(1.824)
$Triangle_{t-1}$	0.553	0.322	0.919	0.593	0.540	0.901
	(0.424)	(0.538)	(0.766)	(0.426)	(0.451)	(1.24)
Agree	7.15***	6.77***	7.93***	7.044***	6.75***	9.18***
	(0.488)	(0.603)	(0.883)	(0.493)	(0.531)	(1.61)
Win Rate	3.55***	5.28***	3.92***	2.13***	3.97***	2.54
	(0.922)	(1.825)	(1.362)	(0.400)	(1.056)	(2.680)
Age difference				-0.035	-0.009	-0.158
				(0.046)	(0.051)	(0.167)
Male				0.465	0.272	1.21
				(0.381)	(0.428)	(1.31)
Rho	3.6e-07	6.1e-08	6.41e-07	3.2e-0.07	1.44e-07	2.48e-0.07
Observations	984	540	444	933	694	239
Couples	82	50	32	77	57	20
LL	-131.9	-83.03	-45.41	-128.3	-107.4	-16.6
LL test 1	234.4***	136.08***	91.46***	222.2***	173.4***	35.4***
LL test 2	3.8e-05	4e-06	1.8e-05	3.7e-0.05	0	0

Notes: Terms in parentheses are standard errors. *** indicates significant at 1% level, one tailed test; ** indicates significance at 5% level, two-tailed; * indicates significant at 5% level, one tailed test. The number of observations is not a simple multiple of the number of groups, because one or two couples did not express preferences for the questions involving alcohol. Demographic data is incomplete for 5 couples.

LL test 1 gives the χ^2 for the likelihood ratio test that the equation has no explanatory power.

LL test 2 gives the χ^2 for the likelihood ratio test that rho equals zero (i.e. there is no couple level heterogeneity).

Thus overall we conclude that, controlling for overall win rate and other factors, there is a serial correlation between Triangle winning and the history of how decisions have been resolved. When the previous decision is disputed and Triangle has lost the dispute, then Triangle is more likely to win in the current decision.

5. Discussion.

We have presented a novel experiment on household decision-making. Established couples face a series of choices separately and then jointly; they are asked to make decisions over the same sets of alternatives. Using a random lottery device we provide incentives for them to take each part of the experiment seriously. We find firm experimental support for the hypothesis that there is turn-taking in the resolution of disputed choices within our sample. In common with Corfman and Lehmann, 1987, we find that when one person in the couple has won in a particular dispute, then it is more likely that the other person will win the next disputed question. We do not find evidence that turn taking is simply a result of any attempt to equalise the gains from disputed questions and we do not find any evidence that age or length of time together affects the propensity to take turns. However, we do find that married couples take turns more than unmarried couples.

These results present something of a challenge to traditional models of household decision-making in that the order that subjects see the tasks is arbitrary. Traditional models, both from economics and from consumer psychology, do not predict this pattern of turn-taking. As we have emphasised, however, our results do not imply that our subjects were irrational. Rather it may be that the strategies employed to resolve disputes were more concerned with relationship maintenance than in bargaining over goods.

As others have indicated, preference intensity, expertise and raw power are all factors that play a part in household decisions and these elements may swamp relationship maintenance at times. As a result, the wider significance of our results is not clear. However, taken at face value, they suggest that models which attempt to predict household choices, but which are grounded only in preferences over goods may be inaccurate. Choices made by households may appear to be

capricious when viewed from without the relationship, when in fact they have a stable and predictable rationale when viewed from within.[11] Viewed alongside earlier work by Corfman and Lehman, 1987, Su et al, 2003 and Ward, 2006, these results also pose a challenge to the view that in close relationships individuals pay less attention to rules of fairness (Clarke and Grote, 2003).[12] Finally, we can only speculate about whether our results apply to other established small groups such as organizational teams and ongoing buyer-seller relationships. Certainly, much of the literature on on-going transactions within business (e.g. Dwyer et al, 1987) would be compatible with a relationship maintenance motive for turn-taking.

[11] Corfman, 1986, makes this point when examining test-retest reliability of group decisions.

[12] Following their experiments on fairness amongst primates, Brosnan et al, 2005, make a similar claim for chimpanzees. They suggest that "individuals in close relationships (marital, family or friendship) follow communal rules, which do not pay overt attention to fairness and switch to contingent rule-based behaviour such as equity or inequality only when there is stress in the relationship." P. 257. Our results suggest otherwise.

References.

Bateman, I. J. and A. Munro, 2003, Testing economic models of the household: an experiment, *CSERGE working paper, University of East Anglia.*

Bateman, I. J. and A. Munro, 2005, An experiment on risky choice amongst households, *Economic Journal, 115, 502, C176-C189.*

Baumeister, R.F., Stillwell, A.M. and Heatherton, T.F., 1995, Personal narratives about guilt: role in action control and interpersonal relationships, *Basic and Applied Social Psychology* **17**, 173–198.

Becker, G. S., 1974, A theory of social interactions, *Journal of Political Economy*, vol. 82 (6), 1063-1093.

Becker, G. S., 1981, *A Treatise on the Family*, Cambridge, Harvard University Press.

Belch, M. W., and L. A. Willis 2001, Family Decisions at the Turn of the Century: Has the Changing Structure of Households Impacted the Family Decision-Making Processes? *Journal of Consumer Behaviour*, 2 (2), 111-124.

Bohlmann, J. D. and W. J. Qualls, 2001, Household preference revisions and decision making: The role of disconfirmation, *International Journal of Research in Marketing,* 319–339.

Brosnan, S. F., H. C. Schiff and F. B. M. de Waal, 2005, Tolerance for inequity may increase with social closeness in chimpanzees, Proceedings of the Royal Society B, 272, 253–258

Browning, L., A. M. Colman, 2004, Evolution of coordinated alternating reciprocity in repeated dyadic games, *Journal of Theoretical Biology*, 229 (2004) 549–557

Browning, M., and P-A. Chiappori, 1998. Efficient intra-household allocations: a general characterisation and empirical tests. *Econometrica* 66 (6), 1241–1278.

Chen, Z. and F. Woolley, 2001, A Cournot-Nash Model of Family Decision-making, *Economic Journal,* 111, 722-748.

Clark, M. S. & Grote, N. K., 2003, Close relationships. In *Handbook of psychology: personality and social psychology,* (ed. T. Millon &M. J. Lerner), pp. 447–461. New York: Wiley.

Corfman K. P., 1986, Effects Of The Cooperative Group Decision-Making Context On The Test-Retest Reliability Of Preference Ratings, in *Advances in Consumer Research* Volume 13, ed. Richard J. Lutz, 554-557.

Corfman, K.. P. and D. R. Lehmann, 1987, Models of cooperative group decision-making and relative influence: An experimental investigation of family purchase decisions. *Journal*

of Consumer Research, 14: 1-13.

Corfman, K. P., D. R. Lehmann and J. H. Steckel, 1990, Longitudinal patterns of group decisions: an exploratory analysis, *Multivariate Behavioural Research*, 25, 249-273.

Corfman, Kim. P., and S. Gupta, 1992, Mathematical Models of Group Choice and Negotiations, Working paper, University of Michigan. School of Business Administration. Division of Research, 677.

Davis, H. L., 1976, Decision Making within the Household**,** *The Journal of Consumer Research*, Vol. 2, No. 4. (March), 241-260.

Davis, J. H., 1973, Group Decision and social interaction: a theory of social decision schemes, *Psychological Review*, 80, 97-125.

Dufwenberg, M., 2002, Marital investments, time consistency and emotions, *Journal of Economic Behavior and Organization,* Volume 48, Issue 1, 57-69.

Dufwenberg M. and G. Kirchsteiger, 2004, A theory of sequential reciprocity, *Games and Economic Behavior*, 47 268–298

Dufwenberg, M., S. Gächter and H. Hennig-Schmidt, 2006, The Framing of Games and the Psychology of Strategic Choice, University of Nottingham.

Dwyer, F. R., P. H. Schurr and S. Oh, 1987, Developing Buyer-Seller Relationships, *Journal of Marketing*, Vol. 51, No. 2, 11-27

Geanakoplos, J., Pearce, D. and Stacchetti, E., 1989, Psychological games and sequential rationality, *Games and Economic Behavior* **1**, pp. 60–79.

Lau, S.-H. P. and V.-L. Mui, 2003, Mitigating Conflict and Coordination Problems by Turn Taking in the Repeated Battle of the Sexes Game, Working Paper, University of Hong Kong and Monash University.

Lich-Tyler, S., Negotiations and love songs:The dynamics of bargained household decisions, University of Michigan.

Meeker, B. F. and C. A. Hornung, 1976, Strategies of interaction, *Social Science Research*, Volume 5, Issue 2, June, 153-172.

Messick, D., M., 1999, Alternative logics for decision making in social settings, *Journal of Economic Behavior and Organization*, Vol. 39 (1999) 11–28.

Morton, T. L., 1978, Intimacy and reciprocity of exchange: A comparison of spouses and strangers, *Journal of Personality and Social Psychology*, *Volume 36, Issue 1*, *January 1978*, *Pages 72-81*

Nock, S. L. (1998). Turn-Taking as Rational Behavior. *Social Science Research* 27: 235-244.

Ostrom, E. (1990), *Governing the Commons: The Evolution of Institutions for Collective Action*, New York: Cambridge University Press.

Park, J-H., P Tansuhaj, E. R. Spangenberg and J. McCullough, 1995, An Emotion-Based Perspective Of Family Purchase Decisions, in *Advances in Consumer Research,* Volume 22, eds. F. R. Kardes and M. Sujan, Provo, UT : Association for Consumer Research, 723-728.

Park, J-H, P. S. Tansuhaj, and R. A. Kolbe, 1991, The Role of Love, Affection, and Intimacy in Family Decision Research." In *Advances in Consumer Research 18*. Eds. R. H. Holman and M. R. Solomon. Provo, UT: Association for Consumer Research, 651-656

Peters, H. E., A. Sinan Ünür, J. Clark and W. D. Schulze, 2004, Free-Riding and the Provision of Public Goods in the Family: An Experimental Test of the Rotten Kid Theorem, *International Economic Review*,

Pollay, R., 1968, A model of family decision making, *British Journal of Marketing*, 3, 206-216.

Prisbrey, J., 1992, An experimental analysis of two-person reciprocity games, Social Science Working Paper 787, California Institute of Technology.

Qualls, W. J. and F. Jaffe, 1992, Measuring Conflict in Household Decision Behavior: Read My Lips and Read My Mind, In *Advances in Consumer Research 19*. Eds. J. F. Sherry, Jr. and B. Sternthal. Provo, UT: Association for Consumer Research, 522-531.

Rubin, Z., 1970, *Liking and Loving*, New York, Holt, Rhinehart and Winston.

Sobel, J., 2005, Interdependent Preferences and Reciprocity, *Journal of Economic Literature,* Vol. XLIII 392–436

Sonsino, D. and J. Sirota, 2003, Strategic pattern recognition—experimental evidence, *Games and Economic Behavior* Volume 44, Issue 2, August 2003, Pages 390-411.

Su, C., E. F. Fern, and K. Ye, 2003, A Temporal Dynamic Model of Spousal Family Purchase-Decision Behavior, *Journal of Marketing Research*, 40, 3, 268-281

Gupta, S and J. H. Steckel, 1993, Preference Aggregation And Repeat Buying In Households**,** *Marketing Letters* 4, 321-336.

Ward, C. B., 2006, He Wants, She Wants: Gender, Category, and Disagreement in Spouse's Joint Decisions, *Advances in Consumer Research*, 33, 117-123.

Ward C. B., 2007, Spouse's Joint Decision-Making: Is Level Of Initial Disagreement Important? *Academy of Marketing Studies Journal, Volume 11, Number 1,, 113-124.*

Appendix A. The Goods.

6 bottles of red wine from Oddbins.
6 bottles of white wine from Oddbins
12 bottles of red wine from Oddbins.
12 bottles of white wine from Oddbins
£30 Theatre Voucher
£30 Shoe shop voucher
DVD of The Last King of Scotland.
DVD of Amazing Grace
DVD of Hot Fuzz
DVD of The Painted Veil (2007)
Dancing experience for two
Grand Prix karting experience for two
Do something voucher for Him
Do something voucher for Her
£60 Voucher from Marks and Spencer.
Voucher for Day Spa for 2 people
Man's watch (choice of 3)
Constellation luggage set.
Voucher for Meal at the Ritz for two.
Ipod Nano 2GB
Voucher for dinner for 2 and West End Theatre.
Kodak Digital Photo viewer
Cookworks Signature whole fruit juicer.
£25 Gardening Voucher
£20 Itunes Voucher
£20 Gardening Voucher
£20 Voucher from Marks and Spencer
DVD of The Bourne Supremacy.
DVD of Casino Royale.
DVD of Miss Potter
DVD of The Queen.

Appendix B. A typical page of questions from Section One.

Question 4

DVD of The Last King of Scotland.
Powerful drama starring Forrest Whitaker as Idi Amin and James McEvoy as a naïve doctor caught up in the dictator's reign of terror in 1970s Uganda.

I prefer (***tick one***): Option A ☐

DVD of Amazing Grace
Inspirational 2007 historical drama telling the story of William Wilberforce and his efforts to end the slave trade in Britain. Stars Ioan Gruffud, Michael Gambon and Albert Finney.

Option B ☐

Question 5

DVD of Hot Fuzz
Top British comedy of 2007 from Simon Pegg and Edgar Wright who after the success of Shaun of the Dead tackle the Hollywood action movie in this well-regarded spoof.

I prefer (***tick one***): Option A ☐

DVD of The Painted Veil (2007)
Sumptuous adaptation of Somerset Maugham's love story set against a backdrop of cholera in 1920's China and starring Naomi Watts as the unfaithful wife who comes to love husband Edward Norton.

Option B ☐

TICK ONE OPTION FOR EACH QUESTION

[PLEASE TURN OVER]

Appendix C. A Page from the Section 2 questionnaire.

- In this section for each question tick the option you jointly prefer.
- Each question also first shows what you each preferred separately.
- At the end of the experiment one question number from 1-36 will be chosen for your household.
- If it is one of the questions from this section (25-36) you will get the prize you say you jointly prefer.

25	**Voucher for Meal at the Ritz for two.**		**Ipod Nano 2GB, Silver**
	Triangle preferred	☐	☐
	Wave preferred	☐	☐
	We prefer	☐	☐
26	**Voucher for dinner for 2 and West End Theatre tickets.**		**Digital Photo viewer**
	Triangle preferred	☐	☐
	Wave preferred	☐	☐
	We prefer	☐	☐
27	**Karting experience for 2 people**		**Voucher for dinner for 2 and West End Theatre**
	Triangle preferred	☐	☐
	Wave preferred	☐	☐
	We prefer	☐	☐
28	**£20 Marks and Spencer Voucher.**		**£25 Gardening Voucher**
	Triangle preferred	☐	☐
	Wave preferred	☐	☐
	We prefer	☐	☐
29	**£60 Marks and Spencer Voucher**		**Voucher for Day Spa for 2 people**
	Triangle preferred	☐	☐
	Wave preferred	☐	☐
	We prefer	☐	☐
30	**Man's watch (choice of 3)**		**'Constellation' 3 piece trolley case luggage set.**
	Triangle preferred	☐	☐
	Wave preferred	☐	☐
	We prefer	☐	☐