ISSN 0819-2642
ISBN 0 7340 2612 9

THE UNIVERSITY OF MELBOURNE

DEPARTMENT OF ECONOMICS

RESEARCH PAPER NUMBER 955

NOVEMBER 2005

An Experimental Analysis of Group Size and Risk Sharing

by

Ananish Chaudhuri
&
Lata Gangadharan
&
Pushkar Maitra

Department of Economics
The University of Melbourne
Melbourne Victoria 3010
Australia.

An Experimental Analysis of Group Size and Risk Sharing*

Ananish Chaudhuri♣, Lata Gangadharan♠ and Pushkar Maitraℵ

November 2005

Abstract

We study the relationship between group size and the extent of risk sharing in an insurance game played over a number of periods with random idiosyncratic and aggregate shocks to income in each period. Risk sharing is attained via agents that receive a high endowment in one period making unilateral transfers to agents that receive a low endowment in that period. The complete risk sharing allocation is for all agents to place their endowments in a common pool, which is then shared equally among members of the group in every period. Theoretically, the larger the group size, the smaller the per capita dispersion in consumption and greater is the potential value of insurance. Field evidence however suggests that smaller groups do better than larger groups as far as risk sharing is concerned. Results from our experiments show that the extent of mutual insurance is significantly higher in smaller groups, though contributions to the pool are never close to what complete risk sharing requires.

Key Words: Reciprocity, Risk Sharing, Group Size, Experiments

JEL Classification: O12, C92, D81

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* Funding provided by the Monash Small Grant Scheme, Monash University and the Faculty Research Grant Scheme, University of Melbourne. We would like to thank Mark Harris, Brett Inder, Vai-lam Mui, Charles Noussair, Marie-Claire Villeval, seminar participants at Monash University and participants at the ESA North American Annual Meetings at Tuscon for comments and suggestions. We would like to thank Mark Harris for providing us with Gauss codes. Ratbek Djumashev, Jonathan Payne and Emma Waller provided excellent research assistance.

♣ Ananish Chaudhuri, Department of Economics, University of Auckland, Commerce A Building Room 124, Private Bag 92019, Auckland, New Zealand. E-mail: a.chaudhuri@auckland.ac.nz

♠ Lata Gangadharan, Department of Economics, University of Melbourne, VIC 3010, Australia. E-mail: latag@unimelb.edu.au. Corresponding Author.

ℵ Pushkar Maitra, Department of Economics, Monash University, Clayton Campus, VIC 3800, Australia. E-mail: Pushkar.Maitra@Buseco.monash.edu.au.

1: Introduction

Economic theory suggests that in a homogeneous population, the larger the population the higher is the per capita utility from risk sharing (see for example Genicot and Ray, 2003 and other references cited there). This implies that in the absence of any other impediments to group formation, a Pareto optimal solution to risk sharing, for risk averse agents, would be to form as large a group as possible.

On the other hand, field evidence has shown that smaller groups do better than larger groups with respect to risk sharing. For example, there are a large number of papers that test for full consumption insurance at the village (community) level in developing countries. All of these papers reject complete risk-sharing at the level of the community and find evidence of only partial insurance. However there is evidence suggesting that risk sharing actually occurs within smaller groups rather than at the level of the community as a whole. For example Morduch (1991) and Grimard (1997) find risk sharing within people of the same caste in India and people of the same ethnicity in CoteD'Ivoire. Fafchamps and Lund (2003) find evidence of gifts and transfers among a network of friends and relatives in response to income shocks in rural Philippines. Murgai, Winters, Sadoulet and De Janvry (2002) investigate water transfers among households along a water-course in the Punjab province in Pakistan and find that reciprocal exchanges are localized in units smaller than the entire water course community. It therefore appears that while the larger groups are unable to fully insure households against income fluctuations, smaller sub-groups are doing a better job of it.

How do we reconcile the theoretical predictions relating to risk sharing and the evidence from the field? One way is to take into account other considerations like informational decay or costs to group formation that increase with the size of the group that ultimately affect large groups. However in arguing that smaller groups perform better than larger groups in the field, we are comparing across groups, and in a sense comparing apples and oranges. When we compare a group of size n_1 in community X to a group of size n_2 in community Y with $n_1 < n_2$ we are essentially comparing across different institutions and that might be contaminating the results. To be able to conclude that the extent of risk sharing is greater in smaller groups we need to hold the institutional arrangement fixed and then vary the size of the group within that institution. This is difficult, if not impossible, to do using data from the field. Economic experiments, on the other hand, provide us with a unique opportunity to examine the impact of group size on risk-sharing. Experiments allow us to control for the institution (defined by the experimental design and the parameters) and then vary the size of the group. The relationship between group size and the extent of insurance would then no longer be contaminated by variations in institutions.

In this paper, we use an *insurance game* to compare the behaviour of small groups (with 5 members) with that of large groups (with 25 members). We implement a multi-period game, where in each period subjects in both small and large groups get either a high or a low endowment with equal probability. Apart from this individual level risk, subjects also experience an aggregate uncertainty with the number of people who get a high or a low endowment varying from one period to the next depending on a random draw. Subjects can fully insure their earnings against individual uncertainty by placing their entire endowment into a group account in each period with the total amount in the group account being distributed equally among all group members.[1] Note that here subjects face two different kinds of uncertainty – the endowment uncertainty arising from the random nature of the endowment stream over their lifetime and the strategic uncertainty arising from uncertainty regarding the behaviour of the other members of the group (in terms of contributions to the pool) once the shock has been realized.

While this kind of a common insurance fund is a nice theoretical construct, how "real" is it? There are instances of this kind of insurance funds being set up in response to shocks. An example is the Koran study groups (*Pengajian*) in many parts of Indonesia. Agents choose the amount (as a proportion of their income) to contribute to the *Pengajian* and the pool is then divided among the contributors. Chen (2005) argues that the *Pengajians* played an important role in insuring households at the time of the Indonesian financial crisis. The mutual insurance scheme in this case is designed as follows: agents receive a shock and after the realization of the shock they choose a fraction of their income to put in the *Pengajian* (and keep the rest for themselves). The *Pengajian* budget is immediately divided according to a pre-determined transfer rule. The transfer rule employed in these *Pengajians* is however different from the one we use in this paper.[2]

Our results show that contributions to the group account are significantly lower in the large groups compared to the small groups. However contribution levels are never close to what the complete risk sharing equilibrium in this insurance game predicts. One

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[1] They cannot insure against aggregate uncertainty: in a bad aggregate state, the total amount available for sharing is less.

[2] The typical size of the *Pengajian* varies depending on the size of the village, the number of Muslims and the number of Imams. Chen (2005) finds that in 1998, the average *Pengajian* participation in the village was 61%.

possible explanation is that agents are myopic and fail to fully realize the benefits of contributing to the pool when they receive a high endowment. While the long run benefits of contributing to the pool can be substantial, the short run returns less so and more importantly the short term returns are lower in large groups.

Given that contributions to the pool fall short of the complete risk sharing outcome, we next explore alternative environments that might encourage more contributions to the pool and hence result in greater mutual insurance and risk sharing. We examine this issue by focusing exclusively on groups of size 5 and introducing the following treatment variations: (1) we increase the probability of receiving a low endowment; (2) we remove the aggregate uncertainty by guaranteeing that in each period there will be a fixed number of high and low endowment subjects; and (3) we increase the level of inequality so that the difference in endowments is higher between high and low endowment subjects. These treatments improve our understanding of the behaviour of subjects, with respect to risk sharing, when they face different parameters.

We proceed as follows. Section 2 discusses the theoretical framework which forms the basis of our experiment. Section 3 presents an overview of the experimental design. Section 4 contains our main results. Section 5 has a discussion of the results and makes some concluding remarks.

2: Theoretical Framework

Consider a community of n identical agents engaged in the production and consumption of a perishable good at each time period t. Each agent receives a random income that takes on two values h (with probability p) and l (with probability $1-p$) with

$h > l > 0$. Income realizations are independent and identical both over individuals and also over time periods. There is full information – all agents know the realization of the shock. Each agent has the same utility function that is increasing, smooth and strictly concave in consumption. This is a classical group insurance problem. Mutual insurance requires that once the shock is realized, agents that receive a high endowment make unilateral transfers to agents that receive a low endowment. Risk sharing is obtained because of reciprocal behaviour on the part of agents. The framework that we use here follows Genicot and Ray (2003).

Since each agent draws independently, the aggregate resource in the economy is given by

$$Z = (p)^n h + (1-p)^n l + \sum_{k=1}^{n-1} p(n,k)\left[k*h + (n-k)*l\right]$$

where $p(n,k)$ is the probability of k high draws out of n (i.e., there are k individuals in the community who have a high draw) and $p(n,k) = \frac{n!}{k!(n-k)!} p^k (1-p)^{n-k}$.

Expected utility (in any given period) under complete risk sharing outcome[3], attained by dividing the aggregate resource available at each period equally among all members of the community, is

$$EU^{PO} \equiv \left(\frac{1}{n}\right)\left[(p)^n u(h) + (1-p)^n u(l) + \sum_{k=1}^{n-1} p(n,k) u\left(k*h + (n-k)*l\right)\right]. \qquad (1)$$

[3] This is also the symmetric Pareto optimal outcome.

It follows immediately that the larger the group size the smaller the dispersion of per capita output and the larger the potential value of insurance. The expected utility under autarky (where each agent consumes what he/she draws in each period) is given by

$$EU^{A} \equiv pu(h)+(1-p)u(l). \tag{2}$$

How does risk sharing work within the group? Once the shock is realized agents contribute a share of their income to a common pool. The pool is then distributed among members of the group according to a pre-determined transfer rule. The transfer scheme is implemented as follows: suppose that an agent k with a good draw contributes t_k^h and each agent with a bad draw contributes t_k^l; $t_k^i \in \left[0, w_k^i\right], i = h, l$ where w_k^i denotes the endowment of agent k in state i. Total contribution then is $kt_k^h + (n-k)t_k^l$ and this is divided equally among all agents, irrespective of whether the agent receives a high endowment or not and whether she contributed or not. So the utility of an agent with a good draw (conditional on k good draws) is $u\left(h - t_k^h + \frac{kt_k^h + (n-k)t_k^l}{n}\right)$ while the utility of an agent with a bad draw (again conditional on k good draws) is $u\left(l - t_k^l + \frac{kt_k^h + (n-k)t_k^l}{n}\right)$. The expected utility from this transfer scheme is given by:

$$\begin{aligned} EU^{TT} &\equiv p^n u(h) + (1-p)^n u(l) + \\ &\sum_{k=1}^{n-1} p(n,k)\left[\frac{k}{n}u\left(h - t_k^h + \frac{kt_k^h + (n-k)t_k^l}{n}\right) + \frac{n-k}{n}u\left(l - t_k^l + \frac{kt_k^h + (n-k)t_k^l}{n}\right)\right] \end{aligned} \tag{3}$$

where: $p(n,k) = \frac{n!}{k!(n-k)!} p^k (1-p)^{n-k}$. Note that once the shock is realized, there is always an incentive for the individuals with a high draw to deviate (and contribute 0), since $u(h) > u\left(h - t_k^h + \frac{kt_k^h + (n-k)t_k^l}{n}\right), \forall t_k^h > t_k^l > 0$. But the expected utility from contributing, assuming that agents are risk averse, is always higher than the expected utility under autarky.

Each player knows her own endowment and the total number of high (or low) draws in the community. We can then compare the actual extent of risk sharing with what should happen under complete risk sharing. The type of risk sharing mechanism being implemented here (and by extension those in many field situations) is essentially based on mutual obligation and reciprocity, given that there is no commitment or enforceability.[4] There is no punishment for "cheating" via non-contribution in the event of receiving a high draw. The only potential consequence is the loss of faith by other group members who in turn might respond by not putting anything into the group account when they get high draws in turn.

2.1: Hypotheses

We test several hypotheses relating to individual behaviour in terms of risk sharing. The first hypothesis examines group size and contributions to the pool and attempts to reconcile the differences between theoretical predictions relating to the size of the group and empirical observations. Hypothesis 1: *Agents in large groups contribute more to the pool (as a proportion of their endowment in the period) compared to agents in small groups.*

[4] These models have been categorized under the broad heading of models of risk sharing without commitment. Coate and Ravallion (1993) originally coined this term and there has since been a large volume of work that examines various aspects of this issue, both theoretically and empirically. See for example Genicot and Ray (2003).

Mutual obligation and reciprocity implies that agents with a high endowment would voluntarily transfer some of their resources to those who are less fortunate (agents that receive low endowment). Of course it must be noted that while this reciprocal behaviour is consistent with risk sharing and risk aversion on the part of economic agents (endowments are uncertain and those with high endowment contribute more to the pool today, hoping that they would in turn be the beneficiary of voluntary contribution by some others when they have a low endowment), it could also be the result of altruistic behaviour or inequality aversion on the part of agents. Becker (1974) models a utility function that is comprised of two elements: the agent's own wealth and the wealth of other members of the group. Utility increases as the agent's wealth increases and as the wealth of the other group members increases. This model predicts that individuals with a high endowment will contribute more, in an absolute sense, to the pool than individuals with a low endowment. The second type of model is inequity-aversion. Fehr and Schmidt (1999) use a utility function where utility decreases (asymmetrically) when an agent earns either more or less than the average group payoff. Bolton and Ockenfels (2000) use a utility function that combines self-interest with a concern for relative standing. These models have the same predictions in our setting. Hence irrespective of which behavioural pattern (reciprocity, altruism or inequity aversion) motivates them, individuals with higher income or wealth should contribute a larger share of their income to the pool (i.e., do more risk sharing) than those with lower income or wealth. So the second hypothesis we test is: Hypothesis 2: *Agents with high endowment contribute more to the pool compared to agents with low endowments.*

2.2: Previous Experimental Literature

Prior experimental work on risk sharing is quite limited. Charness and Genicot (2004) in a paper that is closest to the spirit of this paper (in that they also test for risk sharing, but do so in a different game) examine the issue of risk sharing without commitment by choosing a simple framework in which one of the two paired agents, selected at random in each period, receives an amount of money h in addition to his or her fixed income. After observing the interim incomes, this player chooses a non-negative transfer to his or her partner. Participants face the same variance in income but do not necessarily have the same mean income. They find strong evidence of risk sharing in the laboratory. In particular they find that (1) beliefs matter, in the sense that how actual transfers compare to expected transfers plays an important role in later transfers; and (2) reciprocity is important: the higher the first transfer made by an individual's partner within a match, the higher the individual's transfer, particularly upon receiving a good shock.

Bone, Hey and Suckling (2004) conduct an experiment to test whether pairs of individuals are able to exploit the ex ante efficiency gains in the sharing of a risky financial prospect. They argue that fairness is not a significant consideration and find that having to choose between different prospects diverts partners from allocating the chosen prospect efficiently.

Barr (2003) conducted one shot risk sharing games among villagers in rural Zimbabwe who were observed to share risk with each other. She finds that more extrinsic commitment is associated with more risk pooling but more information is actually associated with less risk pooling.

The structure of our insurance game is similar to a linear public goods game with the distinctions that not all subjects get the same endowment, the endowments are uncertain from one period to the next and contributions to the common pool are not increased by a multiplicative factor greater than one as in a voluntary contributions mechanism. There are also similarities between our insurance game and the "solidarity game" studied by Selten and Ockenfels (1998). The solidarity game is played by three-person groups where each player could earn DM 10.00 with 2/3 probability. Before the outcome of the game is known each subject has to decide how much he is willing to give to either one or two losers in the group in the event of winning the lottery.[5]

3: Experimental Design

160 subjects participated in the experiment. These are undergraduate and post-graduate students from Monash University and the University of Melbourne.

Each session consists of two parts. In the first part subjects fill out a questionnaire designed to elicit their risk preferences. For this part, participants were presented with ten lotteries (referred to as choice games in the instructions given to the subjects).[6] Each lottery involved a choice between two options. Option A always yielded $5.00 with

[5] Selten and Ockenfels (1998, p. 518) comment: "Solidarity means a willingness to help people in need who are similar to oneself but victims of outside influences such as unforeseen illness, natural catastrophes, etc. To some extent solidarity is similar to reciprocity, a motivation which urges you to give something in exchange for something you have received, even if you are not compelled to give anything. However, solidarity is different. Gifts are made but not reciprocated. They are made to recipients who presumably, if one were in need oneself, would have made a gift to oneself. Solidarity aims at a reciprocal relationship, but a more subtle one than giving after one has received."

[6] Lotteries have been often used to experimentally elicit risk preferences from subjects. The choice between a risky and a safe choice that we have used in this paper follows Brown and Stewart (1999). Holt and Laury (2002) use two lotteries, one more risky than the other. The advantage of Holt and Laury (2002) is that it provides a "finer grid" of risk preferences but it has the disadvantage of being more complicated and time consuming, particularly given that this was not the main focus of our paper.

certainty. Option B was risky and paid either $10.00 or $0.00 (see Appendix A) with the probability of winning $10.00 changing (in 10% increments) from 10% on the first lottery to 100% on the tenth lottery. Lottery 10 (where Option B paid $10.00 with certainty) was included to ensure consistency (ideally every agent should choose Option B in the 10^{th} game). The participants were told that only one of the ten lotteries would actually be played. The chosen lottery would be determined by drawing a numbered ball from a cage after all participants had completed their choices.[7] The number on the ball would signify which one of the ten games would be played. Once the lottery had been determined, the actual payment for Option B (either $10.00 or $0.00) was obtained by drawing a ball numbered between 1 and 10 from the number cage. For example, in the first lottery, Option B would pay $10.00 if the number on the ball was 1 and $0 if any other number was chosen. In the ninth lottery Option B paid $10.00 if any number between 1 and 9 was chosen and $0 if the number on the ball was 10. Thus, choosing Option B was considerably more risky in the first lottery than in the ninth. The experimenter collected the responses after all participants finished. The participants were told that their earnings from this game would be determined after the completion of the second game (the insurance game, which was the primary focus of our analysis). They were also told that their decisions in this experiment would have no bearing on the second experiment.

[7] The choice of the lottery was done after the insurance game was played. The participants of course had to make their choices before the insurance game.

The participant's pattern of choices provided an ordinal measure of their risk attitude in this context.[8] Risk aversion is represented by the convexity or concavity of an individual's utility function when faced with the choice between an uncertain payoff and a safe bet. One way to assess the convexity or concavity of this function is to find the bet at which the participant is indifferent between the safe and risky option. In the present context this point is represented by the lottery at which the participant switches from choosing Option A to Option B. Individuals who switched from Option A to Option B after Game 5 are coded as being risk averse, those that switched before Game 5 are risk lovers and those who switch at Game 5 are risk neutral.[9]

Once the lottery choices had been made subjects moved on to the insurance game which was conducted using the ZTREE software (Fischbacher, 1999). Each group played the game for at least 20 periods and the end period was randomly determined by throwing a six sided die. After the 20th period, the experiment continued for an additional period with a probability of $5/6$ and the experiment stopped as soon as a "6" was rolled. At the beginning of each period the subjects were informed about their endowment for that period, which could be either high or low.[10] A high endowment was 100 tokens and a low endowment was 20 tokens in all treatments except the increased inequality

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8 While this way of assessing risk attitudes has the advantage of being simple to administer and easy for subjects to understand, one needs to remember that it is not clear to what extent people are more risk-seeking in one domain yet more risk-averse in another, relative to other participants. Furthermore, it is unclear to what extent risk assessments are sensitive to the ordering in which the games are presented. Since risk attitudes were used here only as a covariate (and not as an absolute measure of the riskiness of the population), we ignore those issues.

9 In Game 5, lottery B pays $10.00 if the number picked is 1, 2, 3, 4 or 5 and $0.00 if the number picked is 6, 7, 8, 9 or 10.

10 The endowments were generated using a uniform distribution. If the number (drawn at random) was greater than 0.5, the subject received a high endowment and if less than 0.5 the subject received a low endowment.

treatment where the high endowment was 200 tokens. Subjects did not know the exact endowments of the other members of the group but they were told how many players in the group received a high endowment in that period. The subjects then had to decide how many tokens to contribute to the pool. The language used in the instructions did not use the term contribution – rather the subjects were asked to allocate tokens to either a group account or a private account (see Appendix A for a sample of the instructions). Tokens placed in the group account were added up and divided equally among the group members. At the end of each round the players received the following feedback: the total number of tokens contributed to the group account and their earnings for that round. The subjects could track their earnings on a personal record sheet. Table 1 presents the parameters in the different treatments. Each session lasted around 45 minutes (including the lottery game) and the average payoff for the experiment was AUD 24.

The large group sessions (with 25 subjects) were essentially replications of the baseline sessions (with 5 subjects), in the sense that the (randomly allocated) 6th, 11th, 16th and 21st subjects were clones of the 1st subject in terms of the endowment stream, the 7th, 12th, 17th and 22nd subjects were clones of the 2nd subject and so on. The reason we did this was to ensure that the proportion of subjects who had high endowments did not change across treatments. The subjects were however not informed of this pattern of endowments.

4: Results

We begin with an overview of the risk attitudes of the subjects. Figure 1 presents the histogram of the choice where the participants switched from the risk free Option A to the risky Option B. It is clear that the majority (62.5%) of the subjects are risk averse in the sense that they switch from Option A to Option B in Game 6 or later, 20% of the subjects are risk neutral (switch from Option A to Option B in Game 5) and the remaining (17.5%) of the subjects are risk lovers (switch prior to Game 5).[11]

Next we look at the behaviour in the insurance game. We start by examining some descriptive statistics. Panel A in Table 2 presents the average proportion contributed and the absolute amount contributed to the pool in each of the treatments. Panel B in Table 2 presents the average behaviour over time. It shows that, not surprisingly, in every treatment the average proportion contributed falls over time. Average proportion contributed is nearly 40% in period 1 in the baseline sessions and it goes down to 15% in the 20th period and down to around 3% after the 20th period. A similar pattern is obtained for all of the other treatments.[12]

Figure 2 presents the histogram of proportion contributed to the pool for the different treatments. The majority of the subjects contribute 0 and the percentage contributing 0 varies from 73 percent in the large group sessions to 49 percent in the increased inequality sessions. Likewise the proportion contributing the maximum (10) varies from 9 percent in the baseline sessions to around 2 percent in the high probability of low endowment sessions. In Figure 3 we present the average proportion contributed (Panel A) and average contribution (in absolute terms, in Panel B) in each treatment by endowment type. While subjects with high endowment contribute less to the pool as a

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[11] 21 of the 160 subjects either did not switch or kept switching between Options A and B. We defined their switch as the game where they switched from Option A to B for the first time. For those that always chose Option A, we coded their switch at Game 10.

[12] In the Selten and Ockenfels (1998) solidarity game, members of three-person groups promise, that in the event of winning the lottery, they would give on average 24.6% of the $10.00 prize to the loser if there is only one loser in the group or 15.6% to each of two losers in the group.

proportion of their endowment, in terms of absolute contributions high endowment subjects contribute more.

4.1: Econometric Analysis

The first issue that we wish to examine in this paper is whether the size of the group matters. Accordingly we start by analysing the baseline sessions (with 5 subjects in each) and the large group sessions (with 25 subjects in each). We have 80 players across the two treatments, each playing the game for at least 20 periods (in most cases more) giving us a total of 1685 observations. We estimate the proportion of their endowment that individuals contribute to the group account using a random effects Tobit regression (to take into account the unobserved player specific heterogeneity and the upper and lower censoring) and the actual contribution to the group account using a random effects GLS regression (to take into account the unobserved player specific heterogeneity).[13]

Table 3 presents the regression results to examine the group size effects: column 2 presents the random effects Tobit regression results for proportion contributed to the group account and column 3 presents the random effects GLS regression for contribution to the group account.[14] The explanatory variables included are: (1) the inverse of time $\left(1/t\right)$ that allows us to capture the non-linearity in the effect of time on contributions and also allows us to distinguish between the effects of early and later rounds on

[13] When we try to estimate the absolute contribution using a random effect Tobit regression, we face a problem with the upper censoring, which is endowment specific. We did estimate the random effect Tobit model for absolute contribution where we account only for lower censoring. These estimates are available on request.

[14] We also computed the pooled Tobit regressions with player fixed effects and the random effect GLS regression for proportion contributed to the group account. These results are similar and available on request.

contributions; (2) a treatment dummy for the large group; (3) a dummy for whether the player received a high or low endowment in that period; (4) the aggregate state in the period, which is captured by three dummies to control for the fraction of low types in that period: fraction of the group receiving low endowment = 0.4 (i.e., 2 out of the 5 members receive low endowments), fraction of the group receiving low endowment = 0.6 (i.e., 3 out of the 5 members receive low endowments) and fraction of the group receiving low endowment = 0.8 (i.e., 4 out of the 5 members receive low endowments);[15] (5) two variables that capture the dynamics of contribution: proportion contributed by player i in period $t-1$ $\left(p_{i,t-1}\right)$ and the proportion of total endowment placed in the public pool by the group in period $t-1$, $\pi_{t-1} = \sum_i c_{i,t-1} \Big/ \sum_i w_{i,t-1}$, where $c_{i,t-1}$ is the contribution of player i in period t and $w_{i,t-1}$ is the endowment of player i in period t. Remember that contributing to the pool is essentially based on the notion of reciprocity and mutual obligation. In each period, players know the number of high types in the group, so they know the total endowment for the group as a whole. So the proportion of the total endowment placed in the pool could therefore be viewed as an indicator of the reciprocity of the other members of the group and it is quite likely that players will use this information to determine their contributions. (6) A dummy for risk averse agents (which takes the value of one if the player switched from Option A to Option B in Game 6 or later and zero otherwise) obtained from the choice of gambles by each agent; (7) Finally we also collected demographic information on the subjects and we include two

[15] The reference category is that the fraction of the group receiving low endowment = 0.2. Also there were no groups with 0 low types or all low types.

dummies: male and Economics/Commerce/Business major. For the regressions for contribution to the group account we account for dynamics in the behaviour of agents by including in the set of explanatory variables the contribution by the particular player to the group account in the previous period $\left(c_{i,t-1}\right)$ and the total contributions to the group in the previous period by the group as a whole.[16]

The following results are worth noting. First, contributions fall over time. As t increases $1/t$ decreases and this is associated with a reduction in contributions and hence the positive (and statistically significant) coefficient associated with $1/t$.

Second, both the proportion contributed and the actual amount contributed to the public pool is significantly lower in the larger groups. *Hypothesis 1* is therefore not supported by the data. The question is why are contributions lower in larger groups? Typically it has been argued that costs to group formation and other informational problems result in less cohesive behaviour in larger groups. In this laboratory set-up there are no costs to group formation and also there are no informational asymmetries per se. Does it then mean that subjects in the large groups are less reciprocal? That would be an unsatisfactory explanation because subjects were randomly allocated into one of the two groups.

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[16] A problem with including the lagged dependent variable $p_{i,t\text{-}1}$ or $c_{i,t\text{-}1}$, in the set of explanatory variables is that it could be correlated with the unobserved component of the error term. Statistically the consistency of the corresponding random effects GLS estimator depends on the size of t (the time component): for large t, it is consistent but might be biased, though the bias decreases with t (see for example Baltagi, 2001). To obtain unbiased and consistent estimates, we computed the non-linear Generalized Method of Moments (Arellano and Bond, 1991) estimator, though we were not able to account for censoring. Given that t is at least 20 in our sample, we present and discuss the standard random effects regression results. The non-linear Generalized Method of Moments estimation results are similar and are available on request.

One explanation for the relative lack of success of the larger groups might be along the following lines. In each period, once the income shock has been realized, each player faces the choice of making a contribution $c_j \in \{0, \bar{c}\}$ to the common pool where a contribution of $c_j = \bar{c}$ (the endowment for that period) will lead to a Pareto optimal outcome. However there is considerable uncertainty about the contributions of the other $n-1$ players. Let us define the cumulative distribution function for player j's action as $F\left(c_j\right)$. In the Pareto optimal outcome $F(\bar{c}) = 1$ and $F\left(c_j\right) = 0$ for $c_j < \bar{c}$. If $\left\{c_1, \ldots, c_n\right\}$ are independently and identically distributed with common cumulative distribution function $F\left(c_i\right)$, then the cumulative distribution function for the minimum contribution $F_{\min}(c) = 1 - [1 - F(c_j)]^n$. In the Pareto optimal outcome $F_{\min}(c)$ equals 0 for $c_j < \bar{c}$. But suppose that a player is uncertain that the other $n-1$ players will choose the action $\left(\bar{c}\right)$ commensurate with the Pareto optimal outcome. Specifically, let $F(0)$ be small but greater than zero, then as n goes to infinity $F_{\min}(0)$ goes to 1. When the number of players is large, it only takes a remote possibility that an individual player will not choose to contribute $\bar{c}$ to motivate defection from the Pareto optimal outcome. Van Huyck, Battalio and Beil (1990) use a similar explanation in discussing the issue of equilibrium selection from a set of Pareto ranked equilibria.

We have noted above that there are similarities in the structure of our insurance game and a linear public goods game. As far as the latter game is concerned, Isaac and Walker (1988), using groups of 4 and 10, find that holding group size constant contributions to the public account are lower when the per capita return (the return to an individual from transferring an additional \$1 from his private account to the public account holding the contributions of other group members constant) from the public good is lower. However they also find that holding the per capita return constant, increasing the group size does not lead to lower contributions. The latter finding about group size is reinforced by Isaac, Walker and Williams (1994) who look at groups of 4, 10, 40 and 100. They find that with a per capita return of 0.30, groups of 40 and 100 contribute more to the public account than groups of 4 and 10 and when the per capita return is 0.75 there is no difference in contributions across the various group sizes. It is not straight-forward to extrapolate from these linear public goods game results to our insurance game results. In our game, since contributions are not multiplied, an increase in group size leads to a decrease in the per capita return. In the short run, any amount placed in the group account yields a return of $1/n$ where n is the group size, while amount placed in the private account yields a return of 1 and it is possible that this reduction in the per capita return is driving the result that contributions to the pool are significantly lower in the larger groups. But contrary to the Isaac, Walker and Williams (1994) result that larger groups are more cooperative and actually achieve greater efficiency for some values of the per capita return, we find that the larger groups in our insurance game are consistently less cooperative and less efficient than the smaller groups.[17]

[17] Yet another reason for the low levels of contribution to the pool could be because the subjects did not fully "understand" the game and this led to them not choosing the optimal strategy. We implemented a communication mechanism which involved an announcement made by the experimenter to examine if clarifying the nature of the problem would change subject behaviour. (See, for instance, Van Huyck, Gillette and Battalio, 1992, who study a coordination game and Seely, Van Huyck and Battalio, 2003, who look at a public goods game). We ran three additional sessions with 5 subjects in each where we added the following sentences to the instructions: *Remember that your endowments are uncertain. You may get a high or a low endowment in a particular period followed by a high or a low endowment in the period after that and so on. So think of your income over the different time periods in the experiments and not just the*

Third, players receiving high endowment contribute to the pool significantly more in absolute terms but less in terms of the proportion of their endowment. *Hypothesis 2* is therefore supported by the data. Our results however do not support the strong version of the inequity aversion model (Fehr and Schmidt, 1999 and Bolton and Ockenfels, 2000) where agents are concerned with relative standing and predict that individuals with higher income or wealth should contribute a larger share of their income to the public good than those with lower income or wealth. Our results show that the opposite is true – individuals with lower income actually place a larger share of their income to the pool.[18] The weak version of the inequity aversion hypothesis is accepted since the absolute contributions of the high endowment subjects are significantly higher (column 5) and do lead to an increase of the income of the low endowment subjects, hence the behaviour of the rich helps in reducing inequality. The fact that absolute levels of contributions to the pool are significantly higher for agents with high endowment suggests that Becker's model of altruism can explain part of the behaviour of the subjects.

Does the aggregate state in the period have an effect? The Random Effects Tobit regression results show that the proportion contributed is significantly lower when there are a larger number of subjects with low endowment in the group but the aggregate state in the period does not have a statistically significant effect on actual contributions.

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current period, when you make your decision. We compared the contributions in the first period in this treatment to those in the baseline sessions and found that, making this announcement did not increase contributions to the pool even in the first period. We do not include this data from these three sessions in any of the econometric analyses carried out above.

[18] Buckley and Croson (2003) in a public good experiment find that those receiving a low endowment contribute more to the pool (as a proportion of their endowment) compared to those receiving a high endowment. In their paper subjects within the same group had different endowments, but there was no uncertainty regarding the endowment: some members of the group received a low endowment every period while the others received a high endowment every period.

The proportion contributed by player i in the previous period $\left(p_{i,t-1}\right)$ does not have a statistically significant effect on proportion contributed to the pool in the index period. However when we look at absolute contributions, we find that there is a statistically significant lagged effect. The proportion of total endowment contributed to the pool in the previous period by the whole group $\left(\pi_{t-1}\right)$ on the other hand has a statistically significant effect on proportion contributed to the pool in the index period.

It is interesting to note that proportion contributed (but not the absolute amount) is significantly lower for risk-averse agents. A priori we cannot be sure what the effect of individual level risk aversion on contributions to the group account will be. On the one hand, sharing of the endowment (through higher contributions to the pool) is essentially a means of insuring against fluctuations in income and one would expect risk averse agents to contribute more to the pool (the endowment uncertainty effect). On the other hand risk-averse agents may contribute less as they might think that contributing is risky as the other members may not reciprocate in future periods and they would be more averse to be taken advantage of (the strategic uncertainty effect). It therefore appears that the strategic uncertainty is stronger than the endowment uncertainty in terms of its effects on contributions to the pool. Finally, contribution levels are significantly lower for Business/Economics/Commerce majors.[19]

[19] We also collected data on a number of other demographic characteristics of the subjects and it is worth examining the effect of these additional demographic characteristics on contribution levels. We included the following additional demographic controls (dummies): eldest child, only child, whether born in Australia, whether went to high school in Australia, whether parents live in Australia and whether the subject resided in a big city or a suburb near a big city when aged 15. The results are robust to the addition of these demographic controls (the regression results are available on request): only the risk aversion dummy now loses its statistical significance. Turning to these new demographic controls, we see that contributions to the pool are lower if parents live in Australia and if the subject is the eldest child while contributions to the pool are higher if the subject was born in Australia and went to school in Australia.

We further explore the observation that contributions are low in large groups (evidence that does not support Hypothesis 1) by suggesting that in a large group subjects feel that they can hide behind the veil of anonymity more easily compared to subjects in a small group since the actual contribution levels of each player is never made public. Subjects could perceive that the strategic uncertainty is greater in large groups compared to that in small groups, given the endowment risk, which is constant across the two groups. To examine this issue we re-estimated the contribution regressions (both in terms of proportion and in terms of absolute amounts) by stratifying the sample by group size. The random effects Tobit regression results show that the coefficient of π_{t-1} is positive and statistically significant for the baseline treatment and is positive but not statistically significant for the large group treatment (this regression result is not presented in the paper but is available on request). So it is clear that in the small groups, subjects respond much more to increased contributions to the group as a whole. To pursue this line of argument further, we re-estimated these same set of regressions but now instead of using π_{t-1} as an explanatory variable, we used $\Delta_{it-1} = \pi_{t-1} - p_{it-1}$. So Δ_{it-1} measures the deviation of subject i's contribution from the group average. $\Delta_{it-1} \leq 0$ implies that the proportion of his/her endowment contributed to the pool in period $t-1$ by subject i is at least equal to the proportion of the total endowment contributed to the pool by the group as a whole and $\Delta_{it-1} > 0$ implies that the proportion of his/her endowment contributed to the pool in period $t-1$ by subject i is less than the proportion of the total endowment contributed to the pool by the group as a whole. The random effects Tobit regression results (see Table 4) show that while the coefficient estimate of Δ_{it-1} is positive and statistically significant for the baseline treatment sessions, it is not statistically significant for the large group sessions. One way of interpreting these results is that the subjects care about where they stand, relative to the group as a whole, in the small group sessions but not in the large group sessions. [20]

How do the results from the experiment compare to the complete risk sharing prediction? The complete risk sharing outcome is attained when all agents share the total resources in every period. Let us define V_i^{CR} as the life time discounted utility of agent i under complete risk sharing, V_i^A as the life time discounted utility of agent i under autarky (where each agent consumes his/her endowment in every period) and finally V_i^T as the observed lifetime utility of agent i from the experiment, where

$$V_i^{CR} = \sum_{t=1}^{T} \beta^t u\left(\frac{1}{n}\sum_i w_{it}\right); V_i^A = \sum_{t=1}^{T} \beta^t u\left(w_{it}\right); V_i^T = \sum_{t=1}^{T} \beta^t u\left(\left(w_{it} - c_{it}\right) + \frac{1}{n}\sum_i c_{it}\right)$$

Figure 4 presents the average value of $V_i = \frac{V_i^T - V_i^A}{V_i^{CR} - V_i^A}$, which is the actual gain (in terms of lifetime utility) over that under autarky, as a proportion of the best that they can do, which is the gain from complete risk sharing over autarky. These have been computed assuming a constant relative risk aversion (CRRA) utility function of the form

[20] The data allows us to examine a number of other related issues. First, we looked at the pattern of contributions separately for the high and the low endowment subjects. We find that high endowment subjects in large groups contribute less to the pool in terms of proportion of their endowment. Additionally males receiving low endowment contribute a significantly larger proportion of their endowment to the pool, compared to males receiving high endowment. Second, one could argue that it is not the endowment received in the particular period rather the pattern of endowment over the lifetime that matters. For example, a large number of low endowments over the lifetime can be thought of as an indicator of bad luck and that might influence the pattern of contribution. To examine this issue we include in the set of explanatory variables the number of low endowments received up to and including the current period. The regression results show that an increase in the number of bad draws over the lifetime significantly reduces contribution (both in absolute and in terms of proportion) to the pool. These regression results are available on request.

$u(x) = \frac{x^{1-\sigma}}{1-\sigma}$ with $\sigma = 2$ (most agents are risk averse, see figure 1) and a discount rate $\beta = 0.99$. Contribution levels are nowhere near what we would obtain under complete risk sharing. For the baseline sessions, the actual gain in utility is less than 5% of the maximum potential (the benchmark case of complete risk sharing outcome). For the large group sessions, for the median subject the observed discounted lifetime utility with the transfer scheme is actually lower than that under autarky.

4.2: Effect of Changing the Environment:

Given that contributions to the pool are nowhere close to what is required to attain a Pareto optimal allocation, how could we modify the "environment" to encourage more contributions to the pool and hence create incentives for greater mutual insurance and risk sharing? First, one reason for the low contribution might be that subjects do not really understand the independent nature of the shocks and therefore those who get a high draw suffer from an optimism bias and those who get a low draw think they will get a high draw next. One way of getting people to appreciate the downside is to increase the probability of receiving a low endowment and examine if that increases contributions. In Treatment 3 we increase the probability of receiving a low endowment to 0.7. The endowments remain the same, i.e., a subject who receives a low endowment receives 100 tokens and a low endowment subject receives 20 tokens. The reciprocity argument would suggest that contributions in this treatment would be higher, leading to the following hypothesis: Hypothesis 3: *Contributions to the pool (as a proportion of the endowment) will increase when we increase the probability of a low shock.*

What should happen if there is no aggregate uncertainty? It is not clear what the impact of this change would be. We expect contributions to the pool (and mutual insurance) to decrease in the absence of aggregate uncertainty. Aggregate uncertainty determines in every period how many subjects in the group would get a low endowment. If that number is constant across periods, one component of uncertainty is resolved and then subjects have to deal with just individual uncertainty and reciprocal arrangements might not be considered as necessary and an important determinant of insurance is the relative significance of idiosyncratic to aggregate risk (see Ray, 1998). In Treatment 4 we have no aggregate uncertainty. All subjects know that in every period there are exactly 3 subjects with low endowment.[21] Hypothesis 4: *Contributions to the pool, as a proportion of the endowment, will decrease in the absence of aggregate uncertainty.*

What is the effect of increasing the level of inequality between subjects? If subjects exhibit inequity aversion (Fehr and Schmidt, 1999, Bolton and Ockenfels, 2000) then we expect contributions to the pool, as a proportion of the endowment, to increase as the level of inequality increases.[22] In Treatment 5 we increase the high endowment to 200, leaving the rest of the parameters unchanged. Specifically we examine the following hypothesis: Hypothesis 5: *Contributions to the pool, as a proportion of the endowment, will increase as the level of inequality increases.*

In Table 5 we present the regression results for individual behaviour. Note that in conducting our regressions we restrict our sample to the small (5 subject) groups as here

[21] There is one other problem here. It so happens that compared to the baseline case, two of the parameters change: on one hand there is no variation in the aggregate state and second the probability of receiving a bad endowment is now 0.6 (greater than 0.5 as in the baseline session). We will need to be careful in interpreting the results in this case.

[22] Genicot (2004) shows that for a large range of utility functions a spread-preserving inequality between the agents increases the transfers agents make within the constrained optimal agreement.

our focus is not on group size effects but on the effect of changing the environment. Column 2 presents the Random Effects Tobit regressions for the proportion contributed and column 3 presents the Random Effect GLS regressions for (absolute) contributions by player i in period t. The explanatory variables are the same as those in Table 3, with one difference – here we have three treatment dummies: High Probability of Shock, No Aggregate Uncertainty and Increased Inequality. The regression results show that relative to the baseline sessions, proportion contributed (but not the amount contributed) is significantly lower in sessions with a higher probability of receiving a low endowment and in sessions with no aggregate uncertainty, but contribution levels (both in absolute terms and in terms of proportions) are significantly higher in sessions with increased inequality. Hence *Hypothesis* 3 is rejected, whereas *Hypotheses* 4 and 5 receive support from the data. Finally it is worth noting that while contribution levels are no where near what we would obtain under complete risk sharing (see Figure 4), subjects always do better than under autarky: the actual gain in utility as a proportion of the maximum possible is positive. It is also worth noting that in two of the new treatments (no aggregate shock and increased inequality) the average actual gain in utility exceeds that in the baseline treatment session.

5: Conclusion

In this paper we examine the relationship between group size and the extent of risk sharing in an insurance game played over a number of periods with random idiosyncratic and aggregate shocks to income in each period. The complete risk sharing outcome is for all agents to place their endowments in a common pool which is then shared equally among members of the group in every period. Theoretically, the larger the group size, the smaller the per capita dispersion in income and greater is the potential value of insurance. Field evidence however suggests that smaller groups do better than larger groups as far as risk sharing is concerned. These often suffer from differences in institutions and risk sharing arrangements that hinder comparability across groups. Results from our experiments show that the extent of mutual insurance is significantly higher in smaller groups, though contributions to the pool are never close to what efficiency requires.

Costs to group formation and other informational problems are often argued to result in less cohesive behaviour in larger groups. In this laboratory set-up there are no costs to group formation and also there are no informational asymmetries per se. Agents are typically myopic in nature and they fail to realize the full benefits of risk sharing i.e., the fact that contributing to the pool when one receives a high endowment might not generate immediate returns but in the long run the benefits in terms of utility gain can be substantial (they essentially view the strategic uncertainty as being more than the endowment uncertainty). In the short run, any amount placed in the group account yields a return of $1/n$ where n is the group size, while amount placed in the private account yields a return of 1. The larger the size of the group, the lower is the short term return from contributing to the group account and therefore contributions to the pool are significantly lower in the larger groups. Additionally subjects in the large groups appear to be hiding behind the veil of anonymity more than those in the small groups.

Given that contributions to the pool are not close to what is required to attain Pareto Optimal Allocation, how could we change the "environment" to encourage more contributions to the pool and hence greater mutual insurance and risk sharing? We examine this issue by: (1) increasing the probability of receiving a low endowment; (2) removing aggregate uncertainty and (3) increasing the level of inequality. Our results are in line with the *a priori* theoretical predictions for (2) and (3), but goes in the opposite direction for (1). We find that relative to the baseline sessions, proportion contributed is significantly lower in sessions with a higher probability of receiving a low endowment and in sessions with no aggregate uncertainty but is significantly higher in sessions with increased inequality. However contributions to the pool continue to be low.

One could argue that the anonymous insurance game that we have implemented in this paper is not representative of real-life risk-sharing arrangements which rely on unilateral and/or multilateral communication, a variety of kinship ties, peer monitoring as well as formal and informal sanctions.[23] However before one can incorporate these complexities into the experimental design, one would first have to examine the treatments that we have done here by focusing exclusively on behaviour in the presence of individual-level and aggregate uncertainty under anonymity and abstracting from more complex factors in order to establish a relevant bench-mark. The next step in this research therefore, is to examine what kind of formal and informal sanctions or communication between participants can work in the insurance game that we have in this paper (remember, sanctions and exclusions have costs and must be traded against the benefits from not contributing today) and also to examine the properties of the best

[23] In the context of public goods experiments it is not clear whether dependence on social sanctions alone have a positive effect on contributions to the pool (see for example Noussair and Tucker, 2004 and Noussair and Tucker, 2005). On the other hand Charness, Rigotti and Rustichini (2003) argue that social facilitation (effect on performance due to the mere presence of others) can have significant effect on behaviour.

insurance that is consistent with the requirement that agents with high endowments contribute more. This is left for future research.

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Table 1: Summary of Treatments

Treatment	Number of Sessions	Number of Subjects	High Endowment	Low Endowment	Probability of low endowment	Number of High Endowment Subjects
Baseline (Size = 5)	6	30	100	20	0.5	0 – 5
Large Group (Size = 25)	2	50	100	20	0.5	0 – 5
High Probability of Low Endowment (Size = 5)	4	20	100	20	0.7	0 – 5
No Aggregate Uncertainty (Size = 5)	4	20	100	20	0.6	2
Increased Inequality (Size = 5)	4	20	200	20	0.5	0 – 5

Table 2: Selected Descriptive Statistics on Proportion Contributed

Panel A: Average Proportion Contributed by Treatment and Endowment Type (in tokens)

Treatment	Sample Size	Average Proportion Contributed	Average Contribution
Baseline	635	0.2009	9.8016
Large Group	1050	0.0730	3.2962
High Probability of Low Endowment	470	0.1362	5.1809
No Aggregate Uncertainty	470	0.1529	6.4426
Increased Inequality	465	0.1826	14.4774

Panel B: Average Proportion Contributed at Different Points in the Game, by Treatment (in tokens)

Treatment	Period 1	Period 20	Period 1 – 10	Period 11 – 20	Period 21 and Higher
Baseline	0.3983	0.1467	0.2765	0.1454	0.0289
Large Group	0.1542	0.0572	0.1007	0.0512	0.0134
High Probability of Low Endowment	0.2250	0.0405	0.2014	0.0991	0.0557
No Aggregate Uncertainty	0.2675	0.0600	0.2166	0.1083	0.0987
Increased Inequality	0.3350	0.0875	0.2513	0.1393	0.1046

Table 3: Regression Results. Examining the Effect of Group Size

	Proportion Contributed (RE Tobit)	Contribution (RE GLS)
1/t	0.9067***	11.3053***
	(0.1392)	(3.2507)
Large Group	-0.3952***	-3.7454***
	(0.0522)	(0.7618)
Low Endowment	0.1281***	-4.9595***
	(0.0308)	(0.7112)
Fraction of Low Endowment in the Group = 0.4	-0.0565	-0.8827
	(0.0442)	(1.0225)
Fraction of Low Endowment in the Group = 0.6	-0.0450	-0.3506
	(0.0413)	(0.9572)
Fraction of Low Endowment in the Group = 0.8	-0.1058**	-1.6057
	(0.0489)	(1.1255)
Proportion Contributed in Previous Period $\left(p_{i,t-1}\right)$	0.0335	
	(0.0670)	
Proportion of Total Endowment Contributed by the Group in the Previous Period $\left(\pi_{t-1}\right)$	0.4071**	
	(0.1874)	
Risk averse	-0.1176***	0.0104
	(0.0451)	(0.6919)
Male	0.0696	-0.9369
	(0.0520)	(0.6685)
Economics/Commerce/Business Major	-0.0046	-1.9200***
	(0.0503)	(0.6981)
Contribution in the Previous Period $\left(c_{i,t-1}\right)$		0.3378***
		(0.0238)
Total Contribution by the Group in the Previous Period		0.0056
		(0.0064)
Constant	-0.1675***	8.9162***
	(0.0614)	(1.1694)
σ_u	0.4218***	0
	(0.0292)	
σ_e	0.4096***	11.3065
	(0.0151)	
ρ	0.5147	
LR Test of $\sigma_u = 0$	292.45***	
τ		
Log Likelihood	-757.7217	
Wald $\chi^2(11)$	197.79***	456.80***
Number of Observations	1605	1605
Number Uncensored	468	
Number Lower Censored	1060	
Number Upper Censored	77	
Number of Subjects	80	80

Notes:
Standard errors in parentheses; ***: Significance at 1%; **: Significance at 5%; *: Significance at 10%

Table 4: Random Effect Tobit Regressions by Group Size

	Baseline	Large Group
1/t	0.7709***	0.6854***
	(0.2334)	(0.1627)
Low Endowment	0.1986***	0.0644*
	(0.0506)	(0.0342)
Fraction of Low Endowment in the Group = 0.4	-0.0579	-0.0344
	(0.0703)	(0.0511)
Fraction of Low Endowment in the Group = 0.6	-0.0514	-0.0279
	(0.0674)	(0.0465)
Fraction of Low Endowment in the Group = 0.8	-0.1522*	-0.0601
	(0.0800)	(0.0535)
Proportion Contributed in Previous Period $\left(p_{i,t-1}\right)$	0.6056***	0.8423*
	(0.1991)	(0.4688)
Deviation from Group Average in Previous Period $\left(\Delta_{i,t-1}\right)$	0.6637***	0.4869
	(0.2139)	(0.4825)
Risk averse	0.1641	-0.0819
	(0.1108)	(0.0592)
Male	-0.0085	-0.0813
	(0.0973)	(0.0861)
Economics/Commerce/Business Major	-0.2020**	-0.1218*
	(0.0949)	(0.0647)
Constant	-0.2780**	-0.1857
	(0.1416)	(0.1135)
σ_u	0.3149***	0.3342***
	(0.0517)	(0.0514)
σ_e	0.4680***	0.3257***
	(0.0244)	(0.0167)
ρ	0.3117	0.5130
LR Test of $\sigma_u = 0$	67.09***	145.24***
Log Likelihood	-396.3374	-351.5866
Wald $\chi^2(10)$	64.76***	78.06***
Number of Observations	605	1000
Number Uncensored	243	225
Number Lower Censored	317	743
Number Upper Censored	45	32
Number of Subjects	30	50

Notes:
Standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
Δ_{it-1} = Proportion of Total Endowment Contributed by the Group in the Previous Period - Proportion Contributed in Previous Period

Table 5: Regression Results. Examining the Effect of Changing the Environment

	Proportion Contributed (RE Tobit)	**Contribution (RE GLS)**
1/t	0.7063***	18.5880***
	(0.1012)	(3.8801)
High Probability of Low Endowment	-0.1454***	0.0689
	(0.0404)	(1.2424)
No Aggregate Uncertainty	-0.2815***	0.0150
	(0.0446)	(1.3279)
Increased Inequality	0.2089***	3.1102***
	(0.0406)	(1.1495)
Low Endowment	0.1048***	-10.4244***
	(0.0226)	(0.8768)
Fraction of Low Endowment in the Group = 0.4	-0.0144	-1.3548
	(0.0377)	(1.5126)
Fraction of Low Endowment in the Group = 0.6	0.0044	-2.0853
	(0.0345)	(1.3853)
Fraction of Low Endowment in the Group = 0.8	-0.0655*	-2.7523*
	(0.0359)	(1.4282)
Proportion Contributed in Previous Period $\left(p_{i,t-1}\right)$	-0.0487	
	(0.0458)	
Proportion of Total Endowment Contributed by the Group in the Previous Period $\left(\pi_{t-1}\right)$	0.4498***	
	(0.0884)	
Risk averse	-0.1717***	-1.4480
	(0.0289)	(0.8905)
Male	-0.1086***	-1.5404*
	(0.0299)	(0.8385)
Economics/Commerce/Business Major	-0.0182	-0.6533
	(0.0270)	(0.8387)
Contribution in the Previous Period $\left(c_{i,t-1}\right)$		0.2076***
		(0.0243)
Total Contribution by the Group in the Previous Period		0.0419***
		(0.0093)
Constant	-0.0755	11.7809***
	(0.0473)	(1.6129)
σ_u	0.3618***	
	(0.0217)	
σ_e	0.3792***	16.3846
	(0.0102)	
ρ	0.4766	
LR Test of $\sigma_u = 0$	370.08***	
Log Likelihood	-1056.3066	
Wald $\chi^2(13)$	304.86***	500.74***
Number of Observations	1950	1950
Number Uncensored	844	
Number Lower Censored	1015	
Number Upper Censored	91	
Number of Subjects	90	90

Notes:
Standard errors in parentheses
***: Significance at 1%; **: Significance at 5%; *: Significance at 10%

Figure 1: Histogram of Choice in the Risk Assessment Game

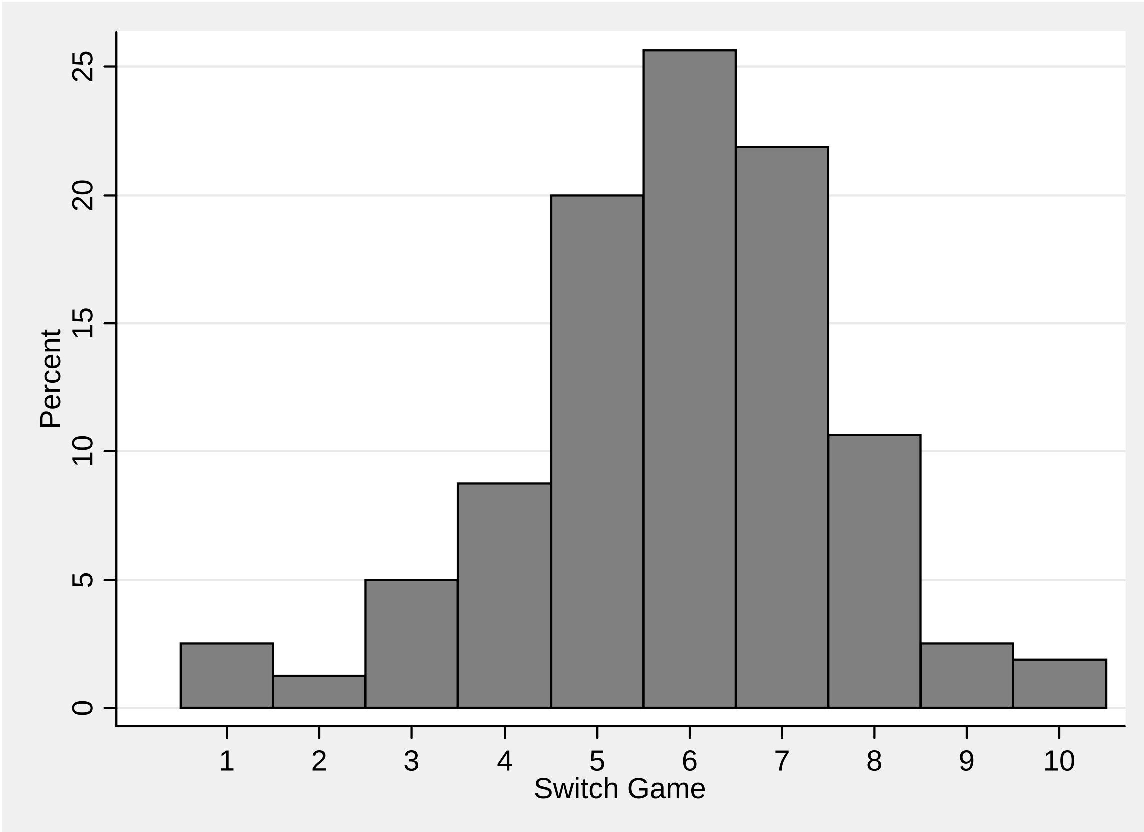


Figure 2: Histogram of Proportion Contributed by Treatment

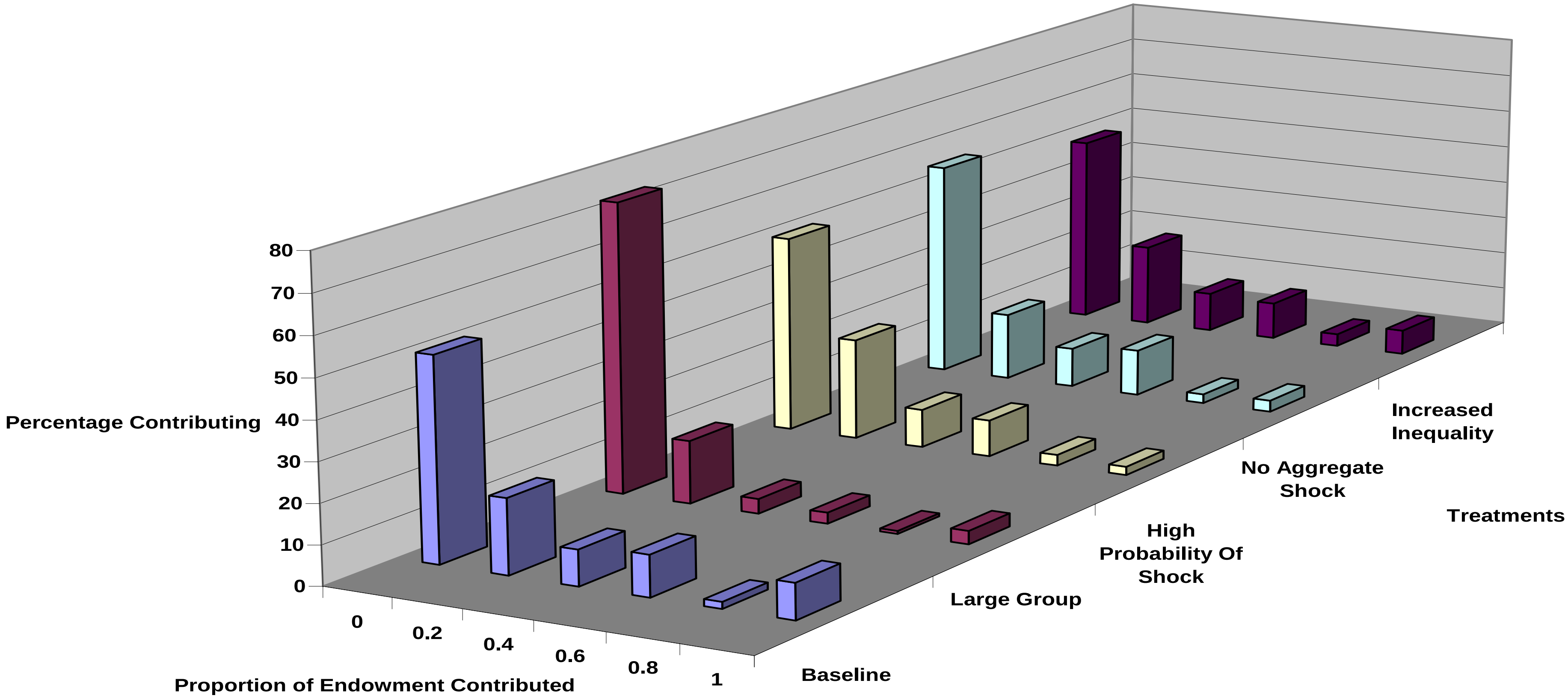
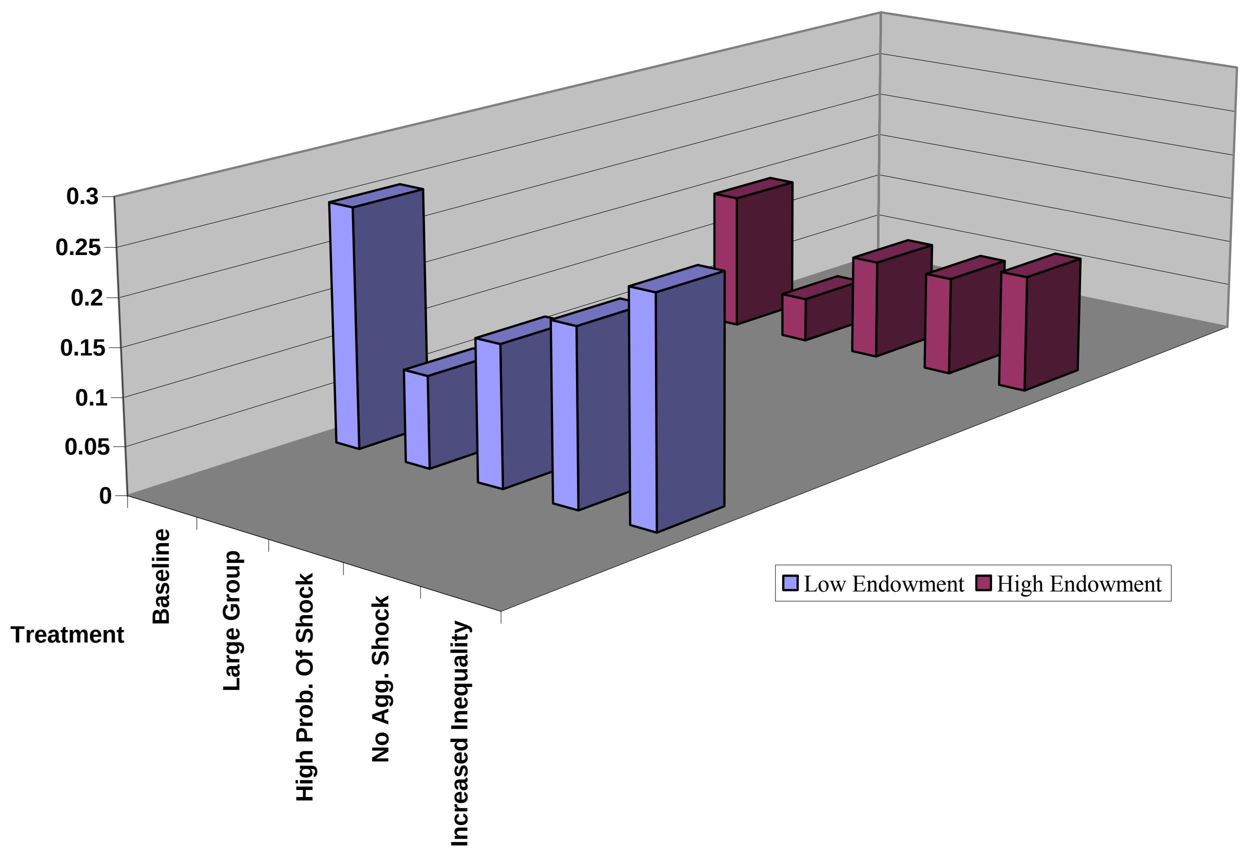


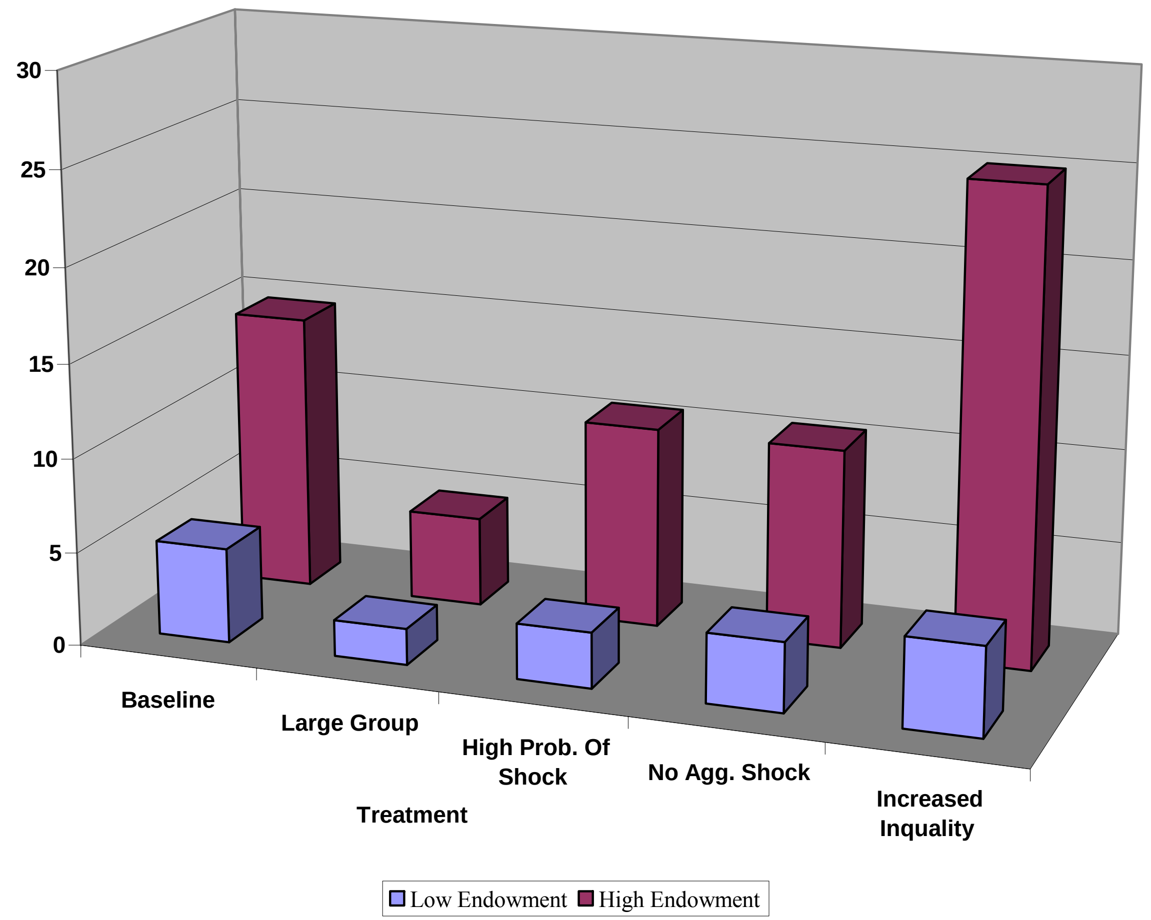
Figure 3: Mean Proportion Contributed and Contribution by Endowment in the Different Treatments.

Panel A: Mean Proportion Contributed in the Different Treatments



Treatment: 1=Baseline; 2=Large Group; 3=High Prob of Shock; 4=No Aggregate Shock; 5=Increased Inequality

Panel B: Mean Contribution in the Different Treatments



Treatment: 1=Baseline; 2=Large Group; 3=High Prob of Shock; 4=No Aggregate Shock; 5=Increased Inequality

Figure 4: Average Gain in Utility as a Proportion of Maximum Possible, by Treatment