An Experimental Analysis of Group Size, Endowment Uncertainty and Risk Sharing

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Abstract

This paper uses laboratory experiments to examine the relationship between group size and the extent of risk sharing without commitment in an insurance game, where individuals face random idiosyncratic and aggregate shocks to income. We find that the extent of mutual insurance is significantly higher in smaller groups, though contributions to the pool are not close to the theoretical predictions for complete risk sharing. Conducting experiments with individuals in self selected groups leads to higher risk sharing, suggesting that social ties between participants could be a crucial aspect of insurance mechanisms.

Key Words: Risk Sharing, Group Size, Insurance Game, Endowment Uncertainty, Experiments, Self-selected Groups

JEL Classification: O12, C92, D81

1 Introduction

Income risk is a pervasive fact of life in developing countries, where the majority of the population is employed in the agricultural sector and agricultural output is still at the mercy of the vagaries of nature. As most individuals are averse to large fluctuations in income they use a variety of formal and informal mechanisms to insure themselves. Voluntary and informal arrangements between members of community groups through mutual provision of credit, gifts and transfers at the time of need, is the most common mechanism used for insurance. Evidence suggests that such risk sharing arrangements provide partial insurance in poor communities (see Deaton, 1992; Townsend, 1994; Udry, 1994; Townsend, 1995; Grimard, 1997; Gertler and Gruber, 1997; Jalan and Ravallion, 1999; Foster and Rosenzweig, 2001). Given the importance of community groups in providing insurance against income fluctuations, it is crucial to examine the characteristics of these groups.

The literature on consumption insurance at the village/community level in developing countries finds that the null hypothesis of complete risk-sharing at the level of the community, is rejected. Possible explanations include the difficulty community wide insurance groups face in monitoring members and enforcing rules, thereby leading to problems in designing incentive compatible and implementable contracts that yield full insurance. There is, however, evidence that risk sharing actually occurs within smaller sub-groups rather than at the level of the community as a whole. Grimard (1997) and Morduch (2003) find risk sharing within people of the same ethnicity in Cote D'Ivoire and people of the same caste in India. 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 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.

The empirical observation that smaller groups are better at providing insurance against income fluctuations contradicts economic theory, which suggests that in a homogeneous population with risk averse individuals, the larger the population the higher is the per capita utility from risk sharing (see Ray, 1998). The intuition for this is that the larger the number of individuals in the group, the more likely it is that the positive and the negative fluctuations to income are balanced out.

Typically the argument that smaller groups perform better than larger groups in the field is based on comparisons across different institutions, leading to potential contamination of results. To isolate the impact of group size on risk sharing, we need to hold the institutional arrangement fixed and then vary the size of the group within that institution. This is often difficult to do using field data. Economic experiments, on the other hand, provide us with a unique opportunity 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 risk sharing would then no longer be contaminated by variations in institutions.

In this paper, we design an insurance game to compare the behaviour of small groups (with 5 members) with that of large groups (with 25 members). The insurance game is implemented as a multi-period game, where in each period, subjects in both small and large groups face uncertainty in terms of whether they receive a high or a low endowment. In addition to this individual level uncertainty, subjects also experience an aggregate uncertainty with the number of individuals in the group who get a high or a low endowment varying from one period to the next. Subjects can fully insure their earnings against individual level 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]

Our results show that contributions to the group account are significantly higher in small groups compared to large groups. However, contribution levels, even in the small groups, are never close to what the complete risk sharing equilibrium in this insurance game predicts. To attain complete risk sharing, 100% of the endowment should be contributed to the group account. However, overall contribution levels are 21.1% in the baseline (small group) treatment, going down to 11.2% in the large group treatment.

Given that contributions to the group account fall short of what is necessary to attain

[1] They cannot insure against aggregate uncertainty: in a bad aggregate state, the total amount available for sharing is less. In our experiment individuals knew the total amount available, i.e., the number of group members with high and low draws, before deciding on the level of contribution to the group account.

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) increasing the probability of receiving a low endowment; (2) removing aggregate uncertainty by keeping the number of high and low endowment subjects constant in each period; (3) increasing the level of inequality so that the difference in endowments is higher between high and low endowment subjects; and (4) recruiting subjects in self-selected groups, allowing us to examine the impact of social ties. We find that while the first three treatments do not have a significant effect on behaviour, the extent of risk sharing and mutual insurance is significantly higher in self-selected groups, indicating that social ties of participants can be a critical element in the success of insurance mechanisms.

2 Methodology

2.1 Background

Consider a community of n identical agents engaged in the consumption of a perishable good at each time period t. There is no production: each agent receives a random endowment that takes one of two values h (with probability p) and l (with probability $1-p$) with $h > l > 0$. Endowment realizations are independent and identical over individuals and also over time periods. Each agent has the same utility function that is increasing, smooth and strictly concave in consumption. Mutual insurance requires that once the shock is realized, agents that receive a high endowment make transfers to agents that receive a low endowment and risk sharing is attained because of reciprocal behaviour on the part of agents.

Once they receive their endowment, agents can contribute a portion of it to a common pool. The pool is then distributed among members of the group according to a pre-determined transfer rule. The pre-determined transfer rule that we consider in this paper is equal sharing of the common pool. The lifetime expected utility of each agent is maximised when each agent contributes the entire endowment to the pool in every period and the aggregate amount is divided equally among all group members. Further, the expected utility in each period is also maximised when each of the agents contribute all of their endowment into the common pool. It is in this context that the size of the group is important. The larger the size of the group, the greater the possibilities of mutual insurance (Ray, 1998, pages $596 - 597$). To make this argument clearer, consider a community that is populated by a large number of identical agents. We could write the income of each agent in every period as $Y = A + \epsilon + \theta$, where Y is income, A is each agent's average income, ϵ is a random shock that has the same distribution across agents but affects each agent independently and is not correlated over time (idiosyncratic random shock) and finally θ captures all the common or aggregate variation in the community, which affects all agents in the community in the same way. Assume that both ϵ and θ have zero mean. In this case if the number of agents is "large enough", the idiosyncratic variation due to ϵ can be completely insured away. This can be done, for example, by every agent paying his realized Y into a common pool. Since ϵ is sometimes positive and sometimes negative, this essentially means that some agents contribute to the pool and some draw from the pool. Hence all variation in ϵ is ironed out and a typical agent's insured income $\bar{Y}$ is given by $\bar{Y} = A + \theta$. The insured income $\bar{Y}$ carries less risk than the original income Y and the larger the number of agents, the more likely it is that the idiosyncratic component of income is fully insured away.[2] Hence large groups can potentially provide more insurance than smaller groups.

The type of risk sharing mechanism that is being implemented in this paper is based on mutual obligation and reciprocity, given that there is no commitment or enforceability. 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 contributing anything into the group account in the future.

2.2 Experimental Design

185 subjects participated in the experiment. They were either under-graduate or post-graduate students at the University of Melbourne and Monash University. Each session

[2]It is not the case however that under the perfect insurance scheme incomes do not fluctuate. Indeed they do, but the source of the fluctuation is the aggregate uncertainty that cannot be insured away (for example if the village or the community faces a bad state of nature like a drought or a flood, which affects all farmers in the same way).

consisted of two parts.[3] In the first part the subjects were required to fill out a questionnaire designed to elicit their risk preferences. Subjects were presented with 10 lotteries, referred to as choice games in the instructions given to the subjects. Each lottery involved a choice between two options: Option A always yielded \$5.00; Option B was risky and yielded either \$10.00 or \$0.00 with the probability of winning \$10.00 changing in increments of 10%, from 10% in the first lottery to 100% in the 10^{th} lottery.[4] The subjects were told that only one of the 10 lotteries would be used to determine their earnings for this part of the experiment and the relevant lottery will be determined by drawing a numbered ball from a bingo cage after all subjects had completed their choices.[5] Once the lottery had been determined, the actual payment for Option B was determined by drawing another ball from the bingo cage (the ball was replaced after the first draw). Additionally the subjects were also told that their choices in this part of the experiment would have no bearing on their earnings and decisions in the second part of the experiment.

The subjects' pattern of choices from the lottery game provides us an ordinal measure of their risk attitude. Risk aversion is represented by the convexity or concavity of an individual's utility function when faced with the choice between an uncertain pay-off 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 risky and the safe option. In the context of the lottery choice experiment that we report here, this is represented by the lottery at which the participant switches from choosing Option A to Option B. Individuals who switched after Game 5 are coded as being risk averse, those that switched before Game 5 as risk lovers and those who switch at Game 5 as risk neutral. 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.

Once the lottery choice had been made, subjects moved on to the insurance game, which was conducted using the Z-Tree software (see Fischbacher, 2007). Each group played the game for at least 20 periods and the end period was randomly determined by throwing a

[3]See Appendix A for a sample of the instructions.

[4]Lottery 10, (where Option B paid \$10.00 with certainty) was included to ensure consistency. Lotteries have often been used to 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.

[5]This was done at the end of the session, after the insurance game had also been played.

6-sided die. After the 20^{th} period, the experiment continued for an additional period with a probability of $\frac{5}{6}$ and the experiment stopped as soon as a 6 was rolled. The random determination of the last period was included to replicate an infinite horizon framework in the laboratory. At the beginning of each period, the subjects were informed about their endowment for that period, which could be either high or low.[6] This was however private information for each subject. A high endowment was 100 tokens and a low endowment was 20 tokens in all treatments except the increased inequality treatment (see section 3.2) where the high endowment was 200 tokens. Subjects did not know the exact endowment of the other members of their group, but were told the number of group members receiving a high endowment in that period. The subjects then had to decide how many tokens to contribute to the group account (common pool) and tokens placed in the group account were added up and divided equally among the group members. At the end of each round they were told the total number of tokens placed in the group account and their earnings from the group account in that period. They were provided with a personal record sheet, which they could use to track their earnings.[7] Each session lasted around 45 minutes (including the lottery game) and the average pay-off for the experiment was approximately US$20.00. Table 1 presents the parameters in the different treatments.

Treatment 1 is the baseline with 5 subjects in each session and treatment 2 examines risk sharing in large groups with 25 subjects in each session. To ensure that the proportion of subjects with high and low endowment remained the same across the two treatments, the large group sessions were replications of the baseline sessions, in the sense that the randomly allocated $6^{th}, 11^{th}, 16^{th}$ and 21^{st} subjects had the same endowment stream as the 1^{st} subject, the $7^{th}, 12^{th}, 17^{th}$ and 22^{nd} subjects had the same endowment stream as the 2^{nd} subject and so on.

[6] The endowments were generated using a uniform distribution. If the number, drawn at random, was between 0 and 0.5 (inclusive), the subject received a low endowment and if it was between 0.5 and 1, the subject received a high endowment. This procedure was repeated for every subject for every period.

[7] The earnings depended on the total number of tokens accumulated over all periods of play. Alternatively we could have chosen to determine the earnings from this part of the experiment on the basis of a randomly chosen period. To examine whether the earnings scheme used was robust, we conducted 3 sessions in the baseline treatment where the earnings in the insurance game was determined on the basis of a randomly chosen period. Using a ranksum test with the session level averages (computed over all subjects and all periods) as the unit of observation, we are unable to reject the null hypothesis ($p-value = 0.2752$) that the earnings scheme had no effect on contributions to the pool. To maintain consistency with the other treatments, we do not use the data from the sessions where the earnings were determined on the basis of a randomly chosen period.

In sections 3.2 and 3.3 we describe additional treatments that examine ways to increase risk sharing. These include three treatments where we change some of the parameters and one treatment where we recruit subjects in self-selected groups. In these two sections we restrict ourselves to 5 person groups, leaving aside the issue of group size.

2.3 Previous Experimental Literature

Prior experimental work on risk sharing is quite limited. Charness and Genicot (2009), examine risk sharing without commitment in a set up where two individuals interact over an infinite horizon and suffer random income shocks. Risk averse individuals have incentives to smooth consumption by making transfers to each other. These transfers are voluntary and therefore only self-enforcing risk-sharing arrangements are possible. They find evidence of risk sharing in the laboratory. In particular they find that (1) beliefs matter, i.e., how actual transfers compare to expected transfers play an important role in later transfers; (2) reciprocity is important, i.e., 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 and (3) a longer time horizon of interaction between subjects leads to more risk sharing.

Bone, Hey, and Suckling (2004) test whether pairs of individuals are able to exploit the ex-ante efficiency gains in the sharing of a risky financial prospect and find that a majority of subjects choose equal division of the chosen prospect even though often it is ex-ante inefficient. They argue that this is not due to considerations of fairness, rather an equal division is chosen due to its simplicity.

Barr and Genicot (2008) conduct a field experiment in rural Zimbabwe to examine the effect of changes in the level of commitment and information available to agents when entering risk sharing arrangements. Subjects were first asked to take part in a gambling experiment and were then invited to form risk sharing groups and share the gains from the gamble before knowing the outcome of the gambling game. The treatments varied by the ease with which individuals could defect after the realization of their own gamble (commitment) and whether information on defection was public or private. They find that when individuals were not allowed to defect, they engage in substantial risk sharing. However when they are allowed to defect, the extent of risk sharing depends on whether or not information on defections is public or private. The results imply that exogenous commitment, in which individuals are not allowed to defect, is important and intrinsic motivations and commitment maintained through social sanctions is not sufficient to guarantee full risk sharing.

The insurance game that we examine in this paper has similarities to certain social dilemma games like the linear public goods game.[8] Hence the insurance game can be viewed as one of collective action and purely from the point of view of collective action, the optimal solution for increasing contributions would be for individuals to interact in smaller groups. Olson (1965, page 65) argues that *the larger a group is, the farther it will fall short of providing an optimal supply of any collective good... In short, the larger the group, the less it will further common interests.* In a similar vein Putnam (2000) suggests that a large community size is often negatively correlated with pro-social behaviour such as formal volunteering, working on public projects and providing informal help to friends and strangers.[9]

The impact of group size on behaviour has been examined using experiments and the results are mixed.[10] Isaac and Walker (1988) and Isaac, Walker, and Williams (1994) examine contribution patterns in public good games with groups of size 4, 10, 40 and 100. They find that contrary to the widely held view that a group's ability to provide the optimal level of a pure public good is inversely related to group size, groups of size 40

[8]There are of course several important distinctions between the linear public goods game and the insurance game: not all subjects get the same endowment, the pattern of endowments received by each agent is uncertain, and the per capita return of transferring an additional dollar from the private account to the group account is equal to one in the insurance game. There are also similarities between the insurance game and the solidarity game of 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.

[9]He argues that this could be because people residing in large communities simply spend less time socializing with each other, as a result have fewer friends on an average and their social networks support less cooperation.

[10]Theoretical research in this area has also provided mixed results. For example, Okuguchi (1984) and Weesie (1994) show that under specific conditions, increases in the group size may not increase free riding and may even enhance the probability of public good provision. On the other hand, Pecorino (2009) shows that increases in the group size would adversely affect public good provision because an increase in group size leads to an increase in the number of private goods available for consumption, raising the marginal utility of income and hence increasing the opportunity cost of contributing to the public good. Au and Ngai (2003) provide an extensive summary of the theoretical and empirical results relating to group size in social dilemma problems.

and 100 provided the public good more efficiently than groups of size 4 and 10. In a more recent experiment Carpenter (2007) finds that when punishment is allowed, large groups contribute at rates no less than small groups as punishment rates do not fall as the size of the group increases.

On the other hand Abbink, Irlenbusch, and Renner (2006) use an investment game to examine the effect of group size on repayment performance in a microfinance like institution. Each group member invests in an individually risky project whose outcome is known only to the individual investor. Members of the group decide whether to contribute to group repayment or not. Only those with successful projects can contribute. The experiment ends if too few repay. They find weak support for the group size effect, with contributions to the group account decreasing as the size of the group increases.

The insurance game that we design and analyze in this paper can contribute to our understanding of how the size of the group can affect risk sharing arrangements, in the presence of endowment uncertainty. It brings together two separate strands of the literature, one that focuses on risk sharing and mutual insurance and the other that examines the effect of group size in social dilemma games. While our paper complements the existing literature, our design has some distinct features. For example, unlike Charness and Genicot (2009), we have a multi-person game, where reciprocity between individuals may have a different impact on behaviour. Reciprocal motivations are often triggered more in two person games, where a subject may feel more responsible for helping her partner; less so in the multi-person game that we consider in this paper. Further, our design allows us to examine the impact of individual as well as aggregate level uncertainty on risk sharing behaviour, both of which could be potentially severe in the context of developing economies. Also, unlike in the public goods literature the total amount contributed to the pool is not multiplied by an efficiency factor hence contributions to the pool cannot be attributed to efficiency concerns. In addition to the issue of group size, our paper also examines ways to improve risk sharing. In particular we examine the extent of risk sharing and mutual insurance in self-selected groups and compare the outcomes to those in randomly formed groups.

3 Results

We now turn to the results. Section 3.1 discusses the effects of group size while sections 3.2 and 3.3 consider the effects of changing the environment. In all our empirical analysis the sample is restricted to the first 20 periods. The continuation probability is less than 1 after the 20^{th} period and there is significant variation in the actual number of periods across sessions.

3.1 Effect of Group Size

Our first aim is to examine whether the size of the group has an impact on risk sharing behaviour. The group insurance problem predicts that if individuals are risk averse then the extent of risk sharing (through contributions to the pool) should be greater in larger groups compared to smaller groups.

Panel A in Figure 1 presents the average proportion contributed to the pool and the average amount contributed to the pool, in four period ranges, in the two treatments (baseline and large group). To enable clearer comparisons the data has been summarized in period ranges, where period range 1 includes data from periods 1 to 4, period range 2 comprises of data from periods $5-8$ and so on. Two observations are worth noting. First in both treatments, the average proportion placed in the pool and the absolute amount (in tokens) placed in the pool falls over time: average proportion placed in the pool is approximately 32% in periods $1-4$ in the baseline treatment and it goes down to 12% in periods $17-20$. This kind of a decline is observed for the large group treatment as well. This decline in contributions to the pool is similar to the findings in the public goods literature where contributions typically start between 40% and 60% in period 1 and then decay over time. Second, contributions to the pool (both in terms of proportions and in terms of contribution amounts) are higher in the baseline treatment compared to the large group treatment, though the differences are not statistically significant using ranksum tests (compare T1 and T2 in Table 2). The unit of observations for these tests are the session level averages, computed over all subjects and all periods, so we have 6 independent observations for the baseline treatment and 3 for the large group treatments.[11] Contributions in the 1^{st} period both in terms of proportion contributed and also the contribution amount are however significantly higher in the baseline treatment.

We now turn to the formal regression analysis. The Random Effect Tobit regression for proportion contributed and the Random Effect GLS regression for the absolute level of contribution are presented in Table 3. We have 105 subjects across the two treatments, each participating in the game for 20 periods. We estimate the proportion of their endowment that subjects place in the group account and the absolute amount placed in the group account. We also present the Tobit and OLS results for proportion contributed and the amount contributed to the pool in Period 1.

The explanatory variables in the two regressions include: a set of period range dummies (reference category period range $1-4$); a treatment dummy for large group; a dummy for whether the subject received a low endowment in that period; the aggregate state in the period, captured by including 3 dummies to control for the fraction of low types in the group in that period: 0.4, 0.6 or 0.8. The reference category is that the fraction of the group receiving a low endowment is 0.2. There were no groups with all high or all low types.

Using the data on risk preferences from the first part of the experiment, we defined a dummy for risk averse subjects. Figure 2 presents the histogram of the choice where the participants switched from the risk free Option A to the risky Option B. A majority (74.05%) of the subjects are risk averse. 18.35% of the subjects are risk neutral and the remaining(7.59%) subjects are risk lovers.[12] A priori we cannot say how risk preferences

[11] The large group sessions have 25 subjects and conducting many sessions in this treatment would have been very resource intensive. In addition, when we conduct regression analysis, the number of individual data points would be very different across treatments if we had conducted the same number of sessions for the baseline and the large group treatments.

[12] 27 of the 185 subjects either did not switch or kept switching between Option A and B. In computing the histogram in Figure 2, we dropped these 27 subjects from the sample. If we include these 27 subjects and define their switch as the game where they switched from Option A to Option B for the first time, the percentage of risk averse and risk neutral subjects fall (to 67.03% and 16.76% respectively) but the percentage of risk loving subjects increases to 16.22%. While this way of assessing risk attitudes has the advantage of being simple to administer and easy for subjects to understand, it is not clear to what extent people exhibit similar degree of risk aversion in different domains and it is also unclear to what extent risk assessments are sensitive to the ordering in which the lottery games are presented. Since risk attitudes were used here only as a co-variate in the regressions and not as an absolute measure of the riskiness of the population, we do not elaborate on these issues.

would affect contributions. On the one hand, sharing of endowment, through higher contributions to the pool, is essentially a means of insuring against fluctuations in income and one would expect risk averse subjects to contribute more to the pool. This could be regarded as the endowment uncertainty effect. On the other hand, risk averse subjects might contribute less because they view it risky to contribute as there is no guarantee that other members would reciprocate in future periods. This could be regarded as the strategic uncertainty effect. Which of the two effects would dominate is an empirical question.

The other variables in the regression are: a dummy for male subject; and a dummy for Economics/Commerce major and finally a variable (different across the two regressions), which captures the dynamics of contribution: in the proportion regressions we include a variable that captures the difference between the average contribution in the group and the contribution of the subject as a proportion of the endowment, in period $t-1$: $\pi_{i,t-1} = \frac{(\sum_i C_{i,t-1}) - C_{i,t-1}}{(\sum_i w_{i,t-1}) - w_{i,t-1}}$ where $C_{i,t-1}$ is the amount placed in the pool by subject i in period $t-1$, $w_{i,t-1}$ is the endowment of subject i in period $t-1$. In the regressions relating to the absolute amount placed in the group account we instead include $\Psi_{i,t-1} = \frac{1}{n-1}((\sum_i C_{i,t-1}) - C_{i,t-1}); n = 5, 25$, which is the average contribution to the pool in the previous period by the other members of the group. The variables $\pi_{i,t-1}$ and $\Psi_{i,t-1}$ could be viewed as indicators of the reciprocity of other members of the group and it is possible that subjects will use this information to determine their contribution levels. A positive and statistically significant coefficient associated with $\pi_{i,t-1}$ or $\Psi_{i,t-1}$ would imply that a higher contribution to the pool by the other members in the group in the previous period results in a higher contribution to the pool by individual i in period t.

3.1.1 Results on Group Size

We find that group size matters: both the proportion contributed and the actual amount contributed to the pool are significantly lower in the large groups. However even though we observe more risk sharing in the small group sessions, in absolute terms contributions in these sessions are nowhere near what ensures complete risk sharing. To be more specific, in order to attain the complete risk sharing equilibrium, members of the group must contribute their entire endowment to the group account, which is then divided equally among all members of the group. So $\frac{\sum_i C_{it}}{\sum_i w_{it}}$, or the proportion of total endowment actually contributed to the group account, could be viewed as a measure of the deviation from the complete risk sharing equilibrium. In the baseline sessions, on an average 21.1% of the endowment is contributed to the group account and this average goes down to 11.2% for the large group sessions.

The Olson (1965) and Putnam (2000) argument of larger groups performing poorly (less pro-socially) compared to smaller groups therefore holds. What explains this behaviour? One explanation is along the following lines. In the insurance game since contributions are not multiplied (unlike in a standard public goods game, where there is an efficiency factor associated with contributions to the public good), an increase in group size leads to a decrease in the per capita return. In the short run, i.e., in every period, any amount placed in the group account yields a return of $\frac{1}{n}$ where n is the group size, while any amount placed in the private account yields a return of 1. Hence, as the size of the group increases the marginal return from the pool declines (due to crowding).

A second possible explanation is that subjects in our experiment are myopic and do no appreciate the benefits of risk sharing. They fail to realize 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). This myopia effect is magnified in larger groups because as mentioned above the per capita return is lower in larger groups.

A third possibility is that subjects in the large groups appear to be hiding behind the veil of anonymity more than those in the small groups. This veil of anonymity arises from the fact that if an individual is one of 25 players in the group, then she is a part of a crowd, not so when she is a part of a group of 5 and that coordination failures are more likely in larger groups. This is similar to the *bystander* effect. Starting with Latane and Darley (1970), psychologists have shown that, bystanders are less likely to help a stranger when more people have the opportunity to help.

3.1.2 Other Results

In this section we briefly discuss the other results. Contributions (both in terms of proportion or in absolute amount) fall over time.

Subjects receiving a high endowment contribute to the pool significantly more in absolute terms but less in terms of the proportion of their endowment. This could be explained by the fair-share hypothesis, which suggests that individuals must contribute their fair-share to the pool (see Sugden, 1984). In groups of size 5 this fair-share might be interpreted as a fifth of the amount the entire group contributes to the pool, independent of income. Disutility from not contributing one's fair-share could induce low income individuals to contribute more as a percentage of their income compared to those with high income. To test this hypothesis we examine the subject's change in contribution pattern from one period to the next. If the hypothesis is correct, then in periods where individuals contribute less than their fair-share, they should increase their contributions in the next period and in periods they contributed more than their fair-share they should decrease their contribution in the next period. We define $\Lambda_{it} = \frac{1}{n}\sum_{i=1}^{n} C_{it} - C_{it}$, where n is the size of the group. Λ_{it} can be interpreted as the deviation from the fair-share: if subjects contribute less than the fair-share then $\Lambda_{it} > 0$, if not $\Lambda_{it} < 0$. We then regress the change in contribution from period $t-1$ to period $t(\Delta C_{it} = C_{it} - C_{i,t-1})$ on the same set of controls and include Λ_{it} as an additional explanatory variable. For the fair-share hypothesis to hold, the coefficient estimate of Λ_{it} should be positive and statistically significant. Indeed in such a regression (presented in column 5 of Table 3) we find that there exists a significant and positive relationship between Λ_{it} and ΔC_{it}. The Sugden (1984) fair-share hypothesis therefore provides a possible explanation for the low endowment individuals in the group contributing more in proportional terms. Our results are similar to prior experimental and empirical results. Buckley and Croson (2006) find in a public good experiment that those receiving a low endowment contribute more to the pool (as a proportion of their endowment) compared to those receiving a high endowment and the fair share hypothesis seems to fit their data as well.[13] Additionally, they report that this kind of behaviour is

[13] In Buckley and Croson (2006) 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.

also observed in the field.

Does the aggregate state in the period affect risk sharing behaviour? The results presented in Table 3 show that the proportion contributed to the pool and the absolute contribution levels to the pool are both significantly lower if 80% of the subjects in that period receive a low endowment.

The risk averse dummy is always negative though statistically significant only in the proportion contributed regressions. It appears therefore that the strategic uncertainty effect is stronger than the endowment uncertainty effect in terms of how it influences subject behaviour.[14] Recall that individuals are defined to be risk averse if they switched after Game 5 in the lottery choice game. To examine the robustness of our results to this definition of risk aversion, we re-estimated the regressions using alternative definitions of risk aversion and find that the results are consistent across the different measures of risk aversion used − the coefficient estimates and the standard errors of the other explanatory variables are similar across the different specifications.[15]

Contribution levels and the proportion contributed are both significantly lower for Economics/Commerce/Business majors. The male dummy is never statistically significant.

Individuals care where they stand relative to the rest of their group in terms of their contribution decisions. The coefficient estimate of $\pi_{i,t-1}$ is positive and statistically significant, while the coefficient estimate of $\Psi_{i,t-1}$, though positive is not statistically significant. These results imply that individuals increase or decrease their contributions as a proportion of their endowment, depending on the group contributions in the previous period. In terms of the actual contribution level, this result is however weaker.

[14] In an environment where strategic uncertainty is less important (for example in a two person game as in Charness and Genicot (2009)), risk averse individuals could exhibit more risk sharing.

[15] We used the following alternative specifications: (1) the first switching point is taken to be the relevant explanatory variable. The switching point is a continuous variable and is coded 0 for those that did not switch at all; (2) we use the number of choices of Option B as the relevant measure of risk aversion. The greater the number of choices of Option B, the less risk averse a participant is expected to be; (3) to examine whether the risk aversion of the other members of the group matters, we include an additional explanatory variable that captures the proportion of others in the group that are risk averse. Risk aversion is again defined using a dummy variable and individuals who switched after Game 5 in the lottery choice are coded as being risk averse. We do not present the results from all these different specifications in the paper, but they are available on request. The coefficient estimate of risk aversion is generally negative, but not always statistically significant.

3.2 Effect of Changing the Environment 1: Changing the Parameters

Our goal, in this section and the next, is to examine whether we can modify the "environment" to encourage more contributions to the pool and hence create incentives for greater mutual insurance and risk sharing. We suggest four alternative ways of modifying the environment (3 in this section and 1 in the next) and in the new treatments we keep the group size constant at 5.

One reason for the low contribution to the pool might be that subjects suffer from an optimism bias leading the ones who get a high endowment to expect more high draws in the future, and those who get a low draw think they will get a high draw next. One way of getting subjects to appreciate the independent nature of the income fluctuations is to increase the probability of receiving a low endowment and examine its effect on contributions. In Treatment 3 (high probability of low endowment treatment) we increase the probability of receiving a low endowment to 0.7. The endowments remain the same, i.e., a subject who receives a high endowment gets 100 tokens and a subject who receives a low endowment gets 20 tokens. One would expect that in such a scenario mutual insurance becomes more important and this should result in greater contributions to the pool.

What happens if there is no aggregate uncertainty? 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. Hence reciprocal arrangements might not be considered to be necessary, since an important determinant of insurance is the relative significance of idiosyncratic to aggregate risk (see Ray, 1998, page 597). In Treatment 4 (the no aggregate uncertainty treatment) we remove aggregate uncertainty: all subjects know that in every period there are exactly 3 subjects with low endowments.

What is the effect of increasing the level of inequality between subjects? If subjects exhibit inequity aversion (Fehr and Schmidt, 2003; 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. In Treatment 5 (increased inequality treatment) we increase the high endowment to 200, leaving the rest of the parameters unchanged.

Panel B in Figure 1 presents the average contribution levels in the different periods, by treatment (both in terms of proportion and in absolute amounts). As before average contribution levels fall over time. Treatment differences are not statistically significant using the non-parametric ranksum tests (compare T1 to T3, T4 and T5 in Table 2). Table 4 presents the regression results. Columns 1 presents the Random Effects Tobit regressions for the proportion contributed and column 2 presents the Random Effect GLS regressions for contribution amounts. 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 reference category is the baseline small group treatment). With one exception (no aggregate uncertainty in the proportion contributed regression), none of the treatment dummies have a statistically significant effect on contribution decisions. Even in the one exception, the effect is rather weak, significant only at the 10% level. Hence modifying the environment by changing the parameters has little systematic impact on subject behaviour in our experiment.[16]

3.3 Effect of Changing the Environment 2: Self-Selection

The change in the environment that we consider in section 3.2 relates to changes in the parameters of the experiment. An alternative would be to change the institutional structure of the game. In this section, we examine the effect of social ties on risk sharing behaviour, by focusing on self-selected groups. Potential participants are required to register for the experiment in groups of five. This recruitment technique ensures that groups are self-selected and imitates the self-selection process observed in risk-sharing groups in the field, where typically group members have known each other for some time before they form

[16] 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 them to not choose the optimal strategy. We implemented a communication mechanism which involved an announcement made by the experimenter to examine if explicitly stating the nature of the problem would change subject behaviour. See, for instance, Van Huyck, Gillette, and Battalio (1992), and Seely, Van Huyck, and Battalio (2003), who examine this issue in a coordination game and a public goods game respectively. We ran three additional sessions with 5 subjects in each session 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 current period, when you make your decision.* Overall and in the first period, giving them more information did not increase contributions to the pool.

a group to share risk.[17] We compare the results from this treatment, which we call the friendship treatment, to the baseline treatment, where subjects register individually for the experiment and are randomly allocated to groups, thus decreasing the possibility that they would know the other members of their group. To assess the degree of acquaintance between the group members in the friendship treatment, we requested the subjects to indicate the intensity of their contact to the other group members.[18]

All other aspects of the experiment remain the same, i.e., a subject who receives a low endowment receives 100 tokens and a low endowment subject receives 20 tokens and the probability of receiving a low endowment remains 0.5. The experimental procedures used are identical. The participants in the two treatments are comparable: a similar proportion of subjects were male (0.46 in the baseline sessions, compared to 0.45 in the friendship sessions, *p-value* = 0.9078), a similar proportion were risk averse (0.70 in the baseline sessions compared to 0.85 in the friendship sessions, *p-value* = 0.2237), had similar number of friends (6.11 in the baseline sessions compared to 5.19 in the friendship sessions, *p-value* = 0.2667), but the participants in the baseline sessions were slightly older (average age 24 years compared to 20.6 in the friendship sessions, *p-value* = 0.0046) and were less likely to be an Economics/Business/Commerce student (0.53 compared to 0.9 in the friendship sessions, *p-value* = 0.0065).

The non parametric ranksum tests (compare T1 and T6 in Table 2) show that even using session level averages (again computed over all subjects and periods) as the unit of observation, contribution levels, both in terms of proportion of endowment and in absolute amount, are significantly higher in the friendship treatment, compared to the baseline treatment. Table 5 presents the regression results. Column 1 presents the Random Effects

[17] See Abbink, Irlenbusch, and Renner (2006) for more on this kind of group recruitment mechanism, which they use to examine the role of social ties in a laboratory microfinance experiment.

[18] Subjects were asked to indicate how many of their group members they knew (very well, somewhat well or never met); how many of their group members do they meet (everyday, once every few days, once a week, once a month, seldom/very rarely); how many of their group members have they known for (less than a month, more than a month but less than 6 months, more than 6 months but less than a year, more than a year but less than 5 years, more than 5 years); how many of their group members did they meet (today for the first time, at university, pre university). The groups were indeed self-selected: there are no reported cases that anyone met any other member of the group for the first time on the day of the experiment (today), no one reported not knowing any other member of the group prior to the experiment. Members of the group meet often (more than once a month) and the length of association is always more than six months.

Tobit regressions for the proportion contributed while column 2 present the Random Effect GLS regressions for contribution amounts. The explanatory variables are the same as those in Table 3, with one difference − here we have a different treatment dummy: Friendship. The regression results show that subjects in the friendship treatment contribute more to the pool both as a proportion of their endowment and in absolute amount, as compared to the baseline treatment: the treatment dummy is positive and statistically significant.

What appears to lead to more risk sharing in our experiment is self-selection. Self-selected groups perform much better in terms of their ability to share risk. Contributions to the pool are significantly higher in self-selected groups. On an average 37.8% of total endowment is contributed to the pool in the friendship treatment, compared to 21.1% in the baseline treatment. The threat of social sanctions could be significantly greater in the self-selected groups: group members are friends and would meet often, unlike in the randomly chosen groups. This indicates that understanding how social ties work could be important for designing successful insurance programs.

4 Discussion

In this paper we examine the relationship between group size and the extent of risk sharing without commitment in an insurance game played over a number of periods with random idiosyncratic and aggregate shocks to income in each period. Results from our experiments show that the extent of mutual insurance is higher in smaller groups, though contributions to the pool are often not close to what efficiency requires.

We also find that social ties can influence risk sharing behavior. While it is generally accepted that greater social ties between members of the risk sharing group typically result in greater mutual insurance, it is difficult using field data to isolate the effect of being able to select one's group from other unobservables in the field. Our laboratory experiment can capture the impact of social connectedness more clearly.

Does this insurance game capture risk sharing? The game that we have analyzed in this paper indeed has parallels in the real world. There are instances of these kinds of insurance funds being set up in response to income fluctuations. One example, is the Koran study groups (*Pengajian*) established in many parts of Indonesia. Individuals receive an income shock and after the realization of the shock they choose a fraction of their income to put in the *Pengajian*. The *Pengajian* budget is immediately divided according to a predetermined transfer rule.[19] Chen (2008) argues that the *Pengajians* played an important role in insuring households at the time of the Indonesian financial crisis. The Kibbutz in Israel, which are based on the principle of income equality, are also an example of a risk sharing group, as the provision of insurance is an important role performed by them (see Abramizky, 2008).

Why do subjects contribute to the pool? As there is no efficiency factor associated with contributions to the group account the pure efficiency motive for contributing can be ruled out. An alternative motivation for contributing could be due to social (other regarding) preferences. However, we do not observe increased contribution in the increased inequality treatment (Treatment 5), relative to the baseline treatment, suggesting that pure inequality aversion is not the only motive. While our results are also consistent with the fair-share hypothesis, the fact that we can rule out both the pure inequality aversion and the pure efficiency motive strengthens the case for a risk-sharing motive for contributing to the pool. It could well be that risk-sharing is not the only motive for contributing to the pool, but it clearly is an important one.

Our analysis contributes to the understanding of the impact of group size in different contexts. One interesting implication relates to the effect of the size of borrowing groups on repayment performance in the context of group lending (microfinance). In practice it is unclear as to how group size affects repayment rates in microfinance institutions. In Peru, FINCA, lends to large borrower groups of between 10 and 50 members and continues to maintain perfect repayment rates on its loans to the group (Karlan, 2007). On the other hand the success of the Grameen Bank in Bangladesh is based on smaller groups with typically only 5 members, designed to keep free riding and within group coordination problems under control. Theoretically as well there is no consensus. Impavido (1998) and Armendariz de Aghion (1999) argue that the optimal group size cannot be too large

[19] The transfer rule employed in these *Pengajians* is different from the one we use in this paper. The size of the *Pengajian* varies depending on the size of the village, the number of Muslims and the number of Imams in the village. Chen (2008) finds that in 1998, on an average 61% of the village population participated in a *Pengajian*.

or too small in order to balance the commitment and the free riding effects. Ghatak and Guinnane (1999) argue that despite the potentially positive insurance effects of larger groups, smaller groups are preferred for their better within group coordination and reduced level of free riding. Our results do not support the positive insurance effect of large groups as smaller groups are observed to engage in more risk sharing, strengthening Ghatak and Guinnane (1999)'s argument for smaller groups.

Our paper also re-emphasizes the importance of social ties in eliciting more pro-social behaviour and in determining whether institutions work or not. Consider for example an environment where the outcome of an individual project is not costlessly observed by the other members of the group (a situation that is common in the context of group lending in developing countries). The dominant strategy for each individual would then be to shirk and hold others responsible for default. One solution to this problem and one that has been successfully used by microfinance organizations is to ensure that groups are self-selected: the idea being that close social ties increases peer pressure not to default and increases group solidarity (see Besley and Coate, 1995). We find a similar result in the context of risk sharing arrangements. By reducing the likelihood of free riding, self-selected groups appear to significantly increase the extent of mutual insurance in our context. However whether this kind of pro-social behaviour persists in larger self-selected groups is yet to be examined and 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)	3	75	100	20	0.5	$0-25$
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	$0-5$
Friendship (Group Recruitment) (size = 5)	4	20	100	20	0.5	$0-5$

Table 2: Selected Descriptive Statistics on Proportion Contributed and Contribution Levels.

	Baseline	**Large Group**	**High Probability of Low Endowment**	**No Aggregate Uncertainty**	**Increased Inequality**	**Friendship**
	T1	T2	T3	T4	T5	T6
Proportion Contributed						
All Periods	0.211	0.112	0.150	0.162	0.195	0.378
Ranksum Test^a		1.291	0.640	0.213	-1.066	-1.919**
Period 1	0.398	0.211	0.225	0.268	0.335	0.49
t-test^b		2.717***	1.690*	1.257	0.623	-1.009
Contribution Amount						
All Periods	10.285	5.226	5.733	6.943	15.343	21.778
Ranksum Test^a		1.291	1.066	0.213	-1.066	-1.919**
Period 1	17.167	7.427	6.5	7.75	28.3	27
t-test^b		2.89***	1.923*	1.699*	-1.216	-1.441

***: Significant at 1% level.
**: Significant at 5% level.
*: Significant at 10% level.
Treatment Differences Relative to Baseline Treatment
^{a}: Unit of observation is session level average (defined over all subjects in the session over all periods)
^{b}: Each individual's behaviour in period 1 is independent

Table 3: Effect of Group Size

	Proportion Contributed		Contribution Amount		Change in Contribution
	All Periods	**Period = 1**	**All Periods**	**Period = 1**	
	RE Tobit	Tobit	RE GLS	OLS	RE GLS
Period 5 - 8	-0.098**		-1.986**		2.171**
	(0.039)		(0.967)		(1.097)
Period 9 - 12	-0.213***		-4.253***		1.207
	(0.041)		(0.972)		(1.080)
Period 13 - 16	-0.271***		-5.249***		0.286
	(0.045)		(1.039)		(1.160)
Period 17 - 20	-0.354***		-6.648***		0.731
	(0.046)		(0.997)		(1.064)
Group Size	-0.247**	-0.377***	-4.099**	-9.310***	0.453
	(0.097)	(0.134)	(1.871)	(3.245)	(0.708)
Low Endowment	0.129***	0.329**	-6.114***	-7.786**	-6.206***
	(0.026)	(0.127)	(0.606)	(3.003)	(0.699)
Fraction of Low Endowment	0.012		0.148		0.904
Group Members = 0.4	(0.039)		(0.900)		(1.049)
Fraction of Low Endowment	-0.011		-0.112		-0.241
Group Members = 0.6	(0.037)		(0.854)		(0.996)
Fraction of Low Endowment	-0.111**		-1.947*		-0.704
Group Members = 0.8	(0.044)		(1.009)		(1.174)
$\pi_{i,t-1}$	0.481***				
	(0.131)				
$\Psi_{i,t-1}$			0.064		
			(0.051)		
$\Lambda_{i,t-1}$					0.673***
					(0.023)
Risk Averse	-0.164*	-0.015	-1.251	-0.422	-1.594**
	(0.092)	(0.127)	(1.760)	(3.082)	(0.674)
Male	-0.106	-0.044	-1.648	1.449	-0.030
	(0.088)	(0.122)	(1.672)	(2.931)	(0.637)
Economics/Commerce/	-0.178**	-0.186	-4.481***	-6.481**	-1.675**
Business Major	(0.090)	(0.125)	(1.715)	(3.017)	(0.657)
Constant	0.311**	0.312*	20.622***	24.914***	3.583**
	(0.131)	(0.178)	(2.625)	(4.376)	(1.449)
Number of Observations	1995	105	1995	105	1995
Number of Individuals	105		105		105

Standard Errors in Parenthesis
***: Significant at 1% level.
**: Significant at 5% level.
*: Significant at 10% level.

Table 4: Effect of Changing the Environment

	Proportion Contributed	**Contribution Amount**
	RE Tobit	RE GLS
Period 5 - 8	-0.060	-2.377*
	(0.037)	(1.375)
Period 9 - 12	-0.121***	-4.866***
	(0.038)	(1.380)
Period 13 - 16	-0.176***	-6.110***
	(0.040)	(1.419)
Period 17 - 20	-0.311***	-8.039***
	(0.042)	(1.413)
High Probability of	-0.073	-1.133
Low Endowment	(0.110)	(2.991)
No Aggregate Uncertainty	-0.193*	-1.243
	(0.111)	(3.002)
Increased Inequality	0.024	4.736
	(0.108)	(2.940)
Low Endowment	0.125***	-10.708***
	(0.024)	(0.873)
Fraction of Low Endowment	0.043	0.492
Group Members = 0.4	(0.041)	(1.505)
Fraction of Low Endowment	0.025	-1.689
Group Members = 0.6	(0.037)	(1.372)
Fraction of Low Endowment	-0.053	-3.094**
Group Members = 0.8	(0.040)	(1.446)
$\pi_{i,t-1}$	0.339***	
	(0.089)	
$\Psi_{i,t-1}$		0.100**
		(0.043)
Risk Averse	-0.064	-1.898
	(0.086)	(2.315)
Male	-0.091	-1.769
	(0.081)	(2.187)
Economics/Commerce/	-0.108	-1.518
Business Major	(0.081)	(2.178)
Constant	0.151	22.867***
	(0.120)	(3.384)
Number of Observations	1710	1710
Number of Individuals	90	90

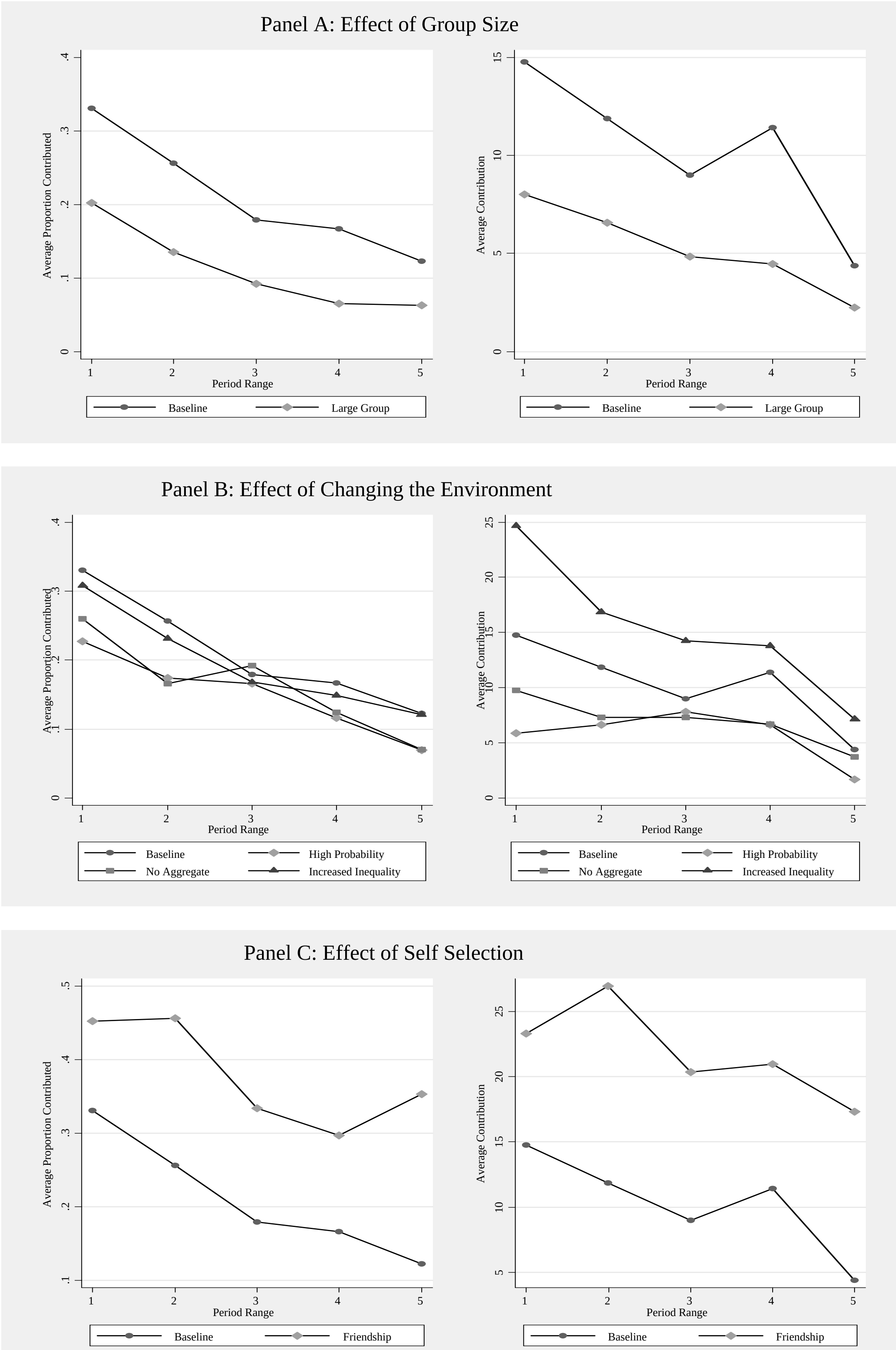
Standard Errors in Parenthesis
$***$: Significant at 1% level.
$**$: Significant at 5% level.
$*$: Significant at 10% level.

Table 5: Effect of Self Selection

	Proportion Contributed	**Contribution Amount**
	RE Tobit	RE GLS
Period 5 - 8	-0.002	-0.293
	(0.062)	(1.949)
Period 9 - 12	-0.151**	-4.649**
	(0.065)	(1.972)
Period 13 - 16	-0.178**	-6.147***
	(0.071)	(2.103)
Period 17 - 20	-0.243***	-6.791***
	(0.067)	(1.971)
Friendship	0.325***	10.817***
	(0.099)	(2.529)
Low Endowment	0.089**	-16.652***
	(0.042)	(1.257)
Fraction of Low Endowment	0.042	0.074
Group Members = 0.4	(0.059)	(1.818)
Fraction of Low Endowment	0.014	0.017
Group Members = 0.6	(0.059)	(1.796)
Fraction of Low Endowment	-0.049	-2.139
Group Members = 0.8	(0.069)	(2.097)
$\pi_{i,t-1}$	0.439***	
	(0.126)	
$\Psi_{i,t-1}$		0.111**
		(0.057)
Risk Averse	0.078	3.962
	(0.102)	(2.598)
Male	0.015	-2.257
	(0.086)	(2.191)
Economics/Commerce/	-0.172*	-3.081
Business Major	(0.100)	(2.531)
Constant	-0.032	21.330***
	(0.136)	(3.634)
Number of Observations	950	950
Number of Individuals	50	50

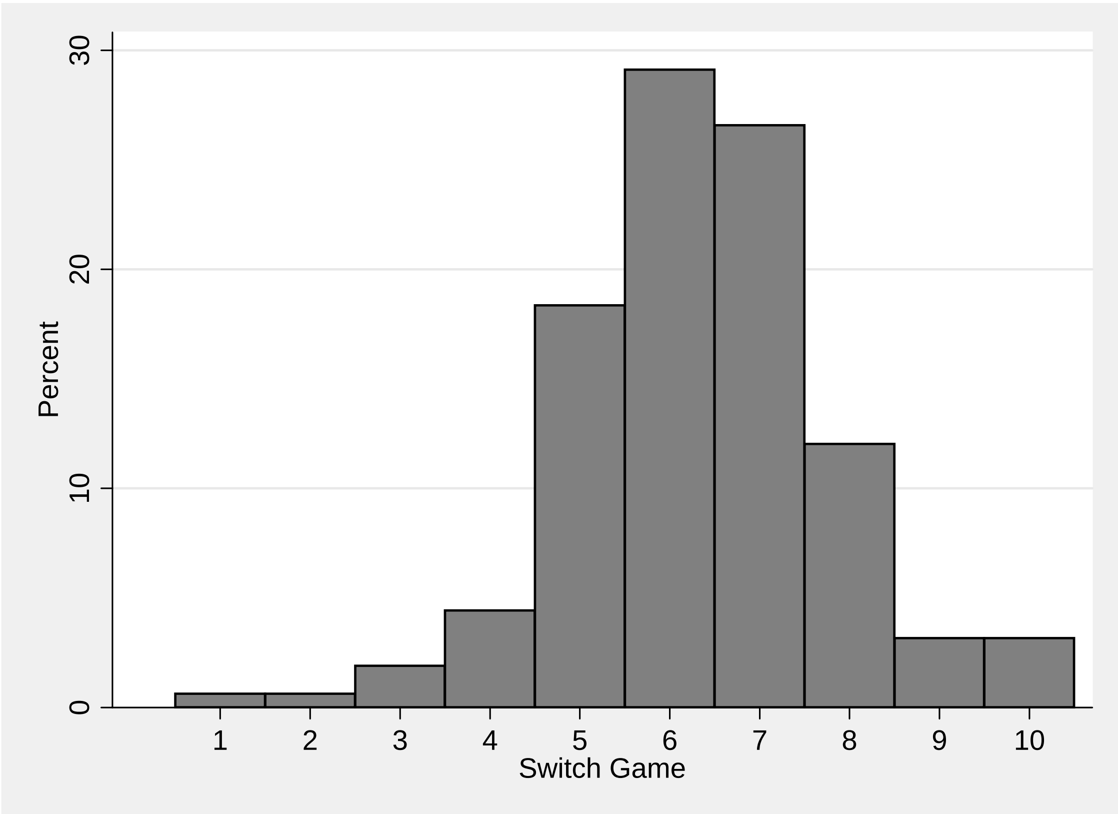
Standard Errors in Parenthesis
$***$: Significant at 1% level.
$**$: Significant at 5% level.
$*$: Significant at 10% level.

Figure 1: Average Proportion/Amount Contributed to the Pool in Each Period



Period Range 1: Periods 1 - 4; Period Range 2: Periods 5 - 8; Period Range 3: Periods 9 - 12; Period Range 4: Periods 13 - 16; Period Range 5: Periods 17 - 20

Figure 2: Histogram of Choice in Risk Assessment Game



<u>Appendix A</u>: Instructions for the Baseline Sessions

<u>Instructions</u>

Welcome.

This is an experiment in the economics of decision-making. The instructions are simple and if you follow them carefully and make good decisions you will earn money that will be paid to you privately in cash at the end of the session.

The experiment will consist of two separate decision tasks. The first task (Task 1) will require you to choose between two alternatives a number of times. Once this task is completed the experimenter will read aloud the instructions for the second task (Task 2). This will require you to interact with the rest of the players in this room.

Your total earnings will be the sum of what you earn from each experiment, and will be paid to you in cash at the end of the experiment.

Your decision and earnings in Task 1 will not affect your earnings in Task 2.

<u>Task 1:</u>

<u>Choice Between Two Alternatives</u>

In this task you will be asked to make a choice between two options - Option A or Option B – 10 times. The options differ in the following way:

OPTION A:

Option A pays $5.00 in cash always.

OPTION B:

There are two possible payoffs associated with Option B:

HIGH Payoff = $10.00

LOW Payoff = $0.00

Whether Option B pays the HIGH or LOW Payoff will be randomly determined in the following way:

- After all players have made their choices, the experimenter will pick a ball from the number cage located at the front of the room.
- If the number on the ball is associated with a HIGH Payoff, then the payoff is $10.00. If it is associated with the LOW Payoff, then the payoff is $0.00

For example, you might be shown the following two options:

Game 0: Example			
	OPTION A	**OPTION B**	
Payoff	$5.00	$0.00	$10.00
	Numbers: 1,2,3,4,5,6,7,8,9,10	Numbers: 1,2,3,4,5	Numbers: 6,7,8,9,10
Circle your Choice	**OPTION A**	**OPTION B**	

In the above example, choosing OPTION A pays you $5.00 no matter what numbered ball is chosen. Choosing OPTION B will pay $0.00 if the number selected is either 1, 2, 3, 4, or 5, and $10.00 if the number selected is either 6, 7, 8, 9, or 10.

Actual Choices to be made in Task 1

This experiment will begin with your making choices between OPTION A and OPTION B on 10 different games (numbered Game 1 to Game 10). The games are presented in the attached sheet. Even though you will be asked to make a choice between Option A and Option B for 10 different games, your actual earnings in Task 1 will depend on your choice in only ONE of those games. After both Task 1 and Task 2 are over the actual game that is played will be determined by choosing a ball from the number cage. The number on this ball will be announced and then this ball will be put back in the cage. The experimenter will then choose another ball from the number cage. The number on that second ball will determine whether the payoff from Option B is HIGH or LOW.

Hence your earnings from this part of the experiment will be determined by the game that is played and your choice of A or B. For instance suppose the first time the experimenter chooses a ball, which has a 5 on it. This means that Game 5 will be used to determine your earnings for Task 1. Now suppose in Game 5 you chose Option B. Next the experimenter will draw a ball from the number cage again. If this ball turns out to be 1,2,3,4 or 5 then you earn $0.00 while if the ball turns out to be 6,7,8,9 or 10

then you get $10.00. On the other hand if you chose Option A then you will get $5.00 for sure.
Are there any questions?
Please proceed to Task 1.

Task 1: For each of the 10 games below, circle the option you would like.

Game 1:			
	OPTION A	**OPTION B**	
Payoff	$5.00	$0.00	$10.00
	Numbers: 1,2,3,4,5,6,7,8,9,10	Numbers: 1,2,3,4,5,6,7,8,9	Numbers: 10
Circle your Choice	**OPTION A**	**OPTION B**	

Game 2:			
	OPTION A	**OPTION B**	
Payoff	$5.00	$0.00	$10.00
	Numbers: 1,2,3,4,5,6,7,8,9,10	Numbers: 1,2,3,4,5,6,7,8	Numbers: 9,10
Circle your Choice	**OPTION A**	**OPTION B**	

Game 3:			
	OPTION A	**OPTION B**	
Payoff	$5.00	$0.00	$10.00
	Numbers: 1,2,3,4,5,6,7,8,9,10	Numbers: 1,2,3,4,5,6,7	Numbers: 8,9,10
Circle your Choice	**OPTION A**	**OPTION B**	

Game 4:			
	OPTION A	**OPTION B**	
Payoff	$5.00	$0.00	$10.00
	Numbers: 1,2,3,4,5,6,7,8,9,10	Numbers: 1,2,3,4,5,6	Numbers: 7,8,9,10
Circle your Choice	**OPTION A**	**OPTION B**	

Game 5:			
	OPTION A	**OPTION B**	
Payoff	$5.00	$0.00	$10.00
	Numbers: 1,2,3,4,5,6,7,8,9,10	Numbers: 1,2,3,4,5	Numbers: 6,7,8,9,10
Circle your Choice	**OPTION A**	**OPTION B**	

Game 6:			
	OPTION A	**OPTION B**	
Payoff	$5.00	$0.00	$10.00
	Numbers: 1,2,3,4,5,6,7,8,9,10	Numbers: 1,2,3,4	Numbers: 5,6,7,8,9,10
Circle your Choice	**OPTION A**	**OPTION B**	

Game 7:			
	OPTION A	**OPTION B**	
Payoff	$5.00	$0.00	$10.00
	Numbers: 1,2,3,4,5,6,7,8,9,10	Numbers: 1,2,3	Numbers: 4,5,6,7,8,9,10
Circle your Choice	**OPTION A**	**OPTION B**	

Game 8:			
	OPTION A	**OPTION B**	
Payoff	$5.00	$0.00	$10.00
	Numbers: 1,2,3,4,5,6,7,8,9,10	Numbers: 1,2	Numbers: 3,4,5,6,7,8,9,10
Circle your Choice	**OPTION A**	**OPTION B**	

Game 9:			
	OPTION A	**OPTION B**	
Payoff	$5.00 Numbers: 1,2,3,4,5,6,7,8,9,10	$0.00 Numbers: 1	$10.00 Numbers: 2,3,4,5,6,7,8,9,10
Circle your Choice	**OPTION A**	**OPTION B**	

Game 10:			
	OPTION A	**OPTION B**	
Payoff	$5.00 Numbers: 1,2,3,4,5,6,7,8,9,10	$0.00	$10.00 Numbers: 1,2,3,4,5,6,7,8,9,10
Circle your Choice	**OPTION A**	**OPTION B**	

Actual Game Played:
Your Choice in this game:
Your earnings:

<u>Task 2: Interacting with other players in the room.</u>

In the second experiment you will use the computer screen to interact with the other players in this room. All earnings on your computer screens are in terms of Tokens. These Tokens will be converted to Australian Dollars at the end of the experiment, at a rate of 1 Token = 0.01 Australian Dollars. Notice that the more Tokens you earn, the more cash that you receive at the end of the experiment.

In this task you will be in a group with 4 others. So your group will have five members. You will not know the identity of the other members of your group at any time. The task will have a number of periods. You will not know the actual number of periods until the end of the experiment. We will definitely conduct 20 periods. Whether the game continues after 20 periods will depend on the roll of a 6-sided die. If this die roll comes up "6" then the experiment ends immediately; otherwise, we will continue for another period. The die is rolled again in each subsequent period, and the experiment will not end until we roll a 6 at the end of some period. These die rolls already occurred in our office before the experiment. The experimenter will reveal the outcome of each single roll at the end of each period, beginning after the 20th period.

In each period you are given an endowment of Tokens. This endowment can be high (equal to 100 tokens) or low (equal to 20 tokens) and this is randomly determined. For each player we generated a random number between 0 and 1 for each period that the game will be played. Every time the number turned out to be between 0 and 0.5 you received a low endowment (= 20) for that period. Otherwise (if the number turned out to be greater than 0.5) you received a high endowment. This random number generation was done in our office. You will not know the individual endowments of other players in your group but you will know the total number of players who have received the high endowment. Note that the total number of players with high and low draws can vary across periods, however high draws are always 100 and low draws are always 20.

You have to decide in every period how to divide these Tokens into either or both of the following two accounts: a Private account and a Group account. Tokens placed in the group account are divided equally amongst all the players (irrespective of whether they place anything in the group account or not and irrespective of whether they receive a high or a low endowment). This divided amount is your RETURN from the group account for that period. So in each period your return is the total tokens in the group account divided by 5.

Attached to these instructions you will find a sheet labeled Personal Record Sheet, which will help you keep track of your earnings based on the decisions you might make. Please do not reveal this information to anyone. It is your own private information.

Decision Periods

Each period proceeds as follows: You will learn the endowment at the beginning of the period: it will be indicated on your computer screen. You will also learn the number of high endowment members in your group. Then the number of low endowment members is 5 minus the number of high endowment members. You have to decide how many tokens (a whole number) you want to place in the group account. Remember that the minimum number of token you can choose to place in the group account is 0 and the maximum number is determined by your endowment in that period (either 100 or 20). Once everybody in your group has made this decision, the computer screen will show you the total amount placed in the group account by all players and your income in this period.

Your Income = Tokens in your private account + the average of the tokens placed in the group account.

Please record all this information in your personal record sheet. Column 1 shows the period number. In Column 2 write what your endowment for that period is. This is either 100 or 20. In Column 3 write down the total number of people in your group with HIGH endowments. This will be a number between 1 and 5 and will be visible on your computer screen. In Column 4 write down the number of tokens you want to place in your private account. In Column 5 write the number of tokens you want to place in the group account. You will also enter the number of tokens you want to place in the group account in the relevant box on your computer screen using your keyboard. Make sure that the two numbers in columns 4 and 5 add to your total endowment – which is either 100 or 20. After every subject has made the decision about how many tokens to place in the group account, on your computer screen you will be able to see (1) the total tokens in the group account based on the contributions of all five members of your group including you and (2) your return from the group account. Write down the total tokens in the group account in Column 6. This way you can track the total amount placed in the group account in each period for future reference. Write down your return from the group account in Column 7. Add the number in column 4 (tokens in private account) and the number in column 7 (returns from the group account) and write this in Column 8. This is your income for that period. This is the end of the period and then we move on to the next period. Tokens do not carry over from one period to the next. Each period starts with you getting a new endowment of either 100 or 20 tokens. Each subsequent period proceeds in the same way. At the beginning of the period you will learn your endowment for that period (100 or 20) and then you have to decide how many tokens to put in the private account and how many in the group account.

After calculating your income for the last period (once the experiment ends) calculate your total earnings for the entire session by summing up all the entries in Column 8. Write this sum next to the Total Earnings entry on your Personal Record Sheet. Multiply this number by the exchange rate (1 Token = _____ Australian Dollars) rounded to nearest whole number to get your actual earnings for this part of the experiment.

Remember that your total earnings for the session will be the sum of your earnings from the first and the second task.

Please complete the questionnaire attached to this set of instructions after the experiment is complete and hand it over to us when you receive your payment in cash.

Are there any questions before we start the experiment?

Personal Record Sheet

Player Number:

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Period	**YOUR Endowment for this period [This is either 100 (High) or 20 (Low)]**	**Total number of subjects with HIGH endowment [Between 1 and 5]**	**Tokens YOU wish to place in your Private Account**	**Tokens YOU wish to place in the Group Account**	**TOTAL tokens in the Group Account**	**YOUR Returns from the Group Account**	**YOUR Income for the Period (Add numbers in Columns 4 and 7)**
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**

Period	YOUR Endowment for this period [This is either 100 (High) or 20 (Low)]	Total number of subjects with HIGH endowment [Between 1 and 5]	Tokens YOU wish to place in your Private Account	Tokens YOU wish to place in the Group Account	TOTAL tokens in the Group Account	YOUR Returns from the Group Account	YOUR Income for the Period (Add numbers in Columns 4 and 7)
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							

Total Earnings: ___________________________

Questionnaire

1. Age in years:

2. Sex: Male Female

3. Year: 1st 2nd 3rd 4th Post-Graduate

4. Faculty: Business/Commerce/Economics
   Engineering
   Education
   Law
   Arts
   Architecture
   Science
   Information Technology
   Medicine, Nursing and Health Sciences

   Other

5. Country of Birth: Australia
   New Zealand
   Other Pacific Nation
   South-East Asia
   South Asia
   Other Asia
   Eastern Europe
   Western Europe
   Africa
   North America
   South America

6. If not born in Australia, how long have you lived in Australia?
   More than 5 years
   2 – 5 years
   1 – 2 years
   less than one year

7. Did you go to school in Australia? Yes No

8. Do your parents live in Australia? Yes No

9. Are you the eldest Child? Yes No

10. Are you the only Child? Yes No

11. Where did you live when you were 15 years old:
    - In open country but not on a farm
    - On a farm
    - In a small city or town (under 50,000)
    - In a medium-size city (50,000-250,000)
    - In a suburb near a large city
    - In a large city (over 250,000)

12. Generally speaking, would you say that most people can be trusted or that you can't be too careful in dealing with people?
    - Most people can be trusted
    - Can't be too careful
    - Don't know

13. Do you think most people would try to take advantage of you if they got a chance, or would they try to be fair?
    - Would take advantage of you
    - Would try to be fair
    - Don't know

14. Would you say that most of the time people try to be helpful, or that they are mostly just looking out for themselves?
    - Try to be helpful
    - Just look out for themselves
    - Don't know

15. When dealing with strangers, one is better off using caution before trusting them.
    - Disagree Strongly
    - Disagree Mildly
    - Neutral
    - Agree Mildly
    - Agree Strongly

16. Most people are basically honest.
    - Disagree Strongly
    - Disagree Mildly
    - Neutral
    - Agree Mildly
    - Agree Strongly

17. I don't mind giving money to others if they need the money more than I do.
    - Disagree Strongly
    - Disagree Mildly
    - Neutral
    - Agree Mildly
    - Agree Strongly

18. Have you ever spontaneously benefited from the generosity of someone you never knew before?

Yes No

19. You can't count on strangers anymore.
    More or less agree
    More or less disagree

20. I am trustworthy.
    Disagree Strongly
    Disagree Mildly
    Neutral
    Agree Mildly
    Agree Strongly

21. How often do you leave the door to your house unlocked?
    Very Often
    Often
    Sometimes
    Rarely
    Never

22. Do you ever lend money to strangers? Yes No

23. How often do you lend money to friends?
    More than once a week
    About once a week
    About once a month
    Once a year or less

24. How often do you lend personal possessions (such as books or CDs) to friends?
    More than once a week
    About once a week
    About once a month
    Once a year or less

25. Have you ever been a victim of crime? Yes No

26. How often do you lie to your parents?
    Very Often
    Often
    Sometimes
    Rarely
    Never
    Not applicable

27. How often do you lie to your roommates?
Very Often
Often
Sometimes
Rarely
Never
Not applicable

28. How often do you lie to your close friends?
Very Often
Often
Sometimes
Rarely
Never

29. How often do you lie to your partner?
Very Often
Often
Sometimes
Rarely
Never
Not applicable

30. Are you a member of a Political Club? Yes No

31. Number of hours spent volunteering per week.

32. Number of hours spent studying alone per week.

33. Do you subscribe to any Newspaper or Magazine? Yes No

34. Member of Sports Organizations: Yes No

35. Member of Religious Organizations: Yes No

36. How often do you attend religious services?
Never
Less than once a year
About once or twice a year
Several times a year
About once a month
2-3 times a month
Nearly every week
Every week
Several times a week

37. Most students do not cheat on exams.

Disagree Strongly
Disagree Mildly
Neutral
Agree Mildly
Agree Strongly

38. Amount of money donated in the past year:

39. Have you ever volunteered for a political campaign? Yes No

40. Did you vote in the last student elections at your university? Yes No

41. How many close friends do you have?