

The Determinants of Trust: An Experimental Approach*

Alexander Smith[†]

May 2008

Abstract

The empirical literature on trust suggests trust positively affects growth rates and that population heterogeneity and trust are negatively correlated. However, research about the determinants of trust has found varying results regarding the effects of income inequality and group identity. We present an experiment designed to measure the effects of lab-induced heterogeneity on trust and trustworthiness and find that income inequality and group identity adversely affect trust. These results highlight the importance of considering population heterogeneity in the design of public policy.

1 Introduction

Trust is an important feature of any well-functioning economy. When people trust each other, transactions can occur smoothly while incurring lower costs. This has led a number of researchers to examine the determinants of trust, as well as the relationship between trust and growth rates. The general findings are that population heterogeneity, such as income inequality and ethnic diversity, is negatively correlated with trust, and that trust positively affects growth rates. However, the predictive power of the measure of trust commonly used in these studies is questionable. For this reason, the approach here is to study the determinants of trust using an experiment designed to measure demonstrated trust and trustworthiness. The

*I thank my advisor, Robert J. Oxoby, and Ana Ferrer for helpful comments and suggestions. I thank Collin Goodlet for his help in the lab and Kendra N. McLeish for her insights regarding identity.

[†]PhD Candidate, Department of Economics, University of Calgary, 2500 University Drive NW, Calgary AB Canada T2N 1N4; smithad@ucalgary.ca.

aim is to determine the relationship between heterogeneity and trust in order to develop a better understanding of the mechanisms by which heterogeneity affects economic activity and development.

The economic activities that require trust include the exchange of goods and services for payments to be made at a future date, employment contracts when managers cannot fully observe the effort of employees, and investment decisions that rely on the promises of governments not to expropriate private assets (Knack and Keefer, 1997). This gives a distinct advantage to economies in which people trust each other. When trust is high, contracting costs are lower because contracts are not required for small transactions and contracts for large transactions need not cover every possible contingency. Also, people can rely on each other, instead of institutions, for everything from small loans to keeping the peace. This means fewer resources are used creating contracts and supporting the institutions that enforce them, and more can be devoted to consumption and investment in productive capacity. Another benefit of trust is that governments can be more effective because policy announcements are credible, allowing monetary and fiscal policies to have their desired effects.

Knack and Keefer (1997) find empirical support for the hypothesis that trust positively affects growth rates. Their measure of trust is the percentage of a nation's citizens who answered that "most people can be trusted" in response to the following question from the World Values Survey (WVS): "Generally speaking, would you say that most people can be trusted or that you can't be too careful in dealing with people?" The use of this question has become common practice in the literature in spite of the ambiguity regarding which people are being referred to or what they might be trusted with. Alesina and La Ferrara (2002) use the question in their study of the determinants of trust, and find that living in heterogeneous communities, either in terms of income or race, reduces trust. Zak and Knack (2001) use the same measure and find income inequality and ethnic diversity affect trust on a national level.

Unfortunately, the trust question from the WVS is a poor predictor of demonstrated trust. Glaeser et al. (2000) test the predictive power of the question using the trust experiment of Berg et al. (1995) and find that answers to the trust question have no significant predictive

power over the amount of trust implied by subjects' choices and only a low correlation with demonstrated trustworthiness. In addition to this, Buchan and Croson (2002) find that trust does not imply trustworthiness and vice versa, making it impossible for a single indicator to reliably predict both traits.

The advantage of using experimental methods to study the determinants of trust is that salient monetary rewards can be attached to the decisions subjects make, creating the incentive necessary to ensure their choices reflect the preferences of interest to the researcher. Decisions do not have the same salience in surveys, and this means survey data must be interpreted cautiously. For example, it is not clear how to interpret responses to the trust question from the WVS because people may answer that "most people can be trusted" in order to appear trusting. The tendency to do this may vary across the groups being studied, and this complicates empirical work.

We present the results of an experiment designed to measure the effects of income inequality and group identity on demonstrated trust and trustworthiness. We find that both income inequality and group identity adversely affect trust. However, though all subjects demonstrate reduced trust when there is income inequality, group identity creates both positive and negative effects. Subjects who share a common group identity show more trust, while those who do not show less.

Section 2 of this paper reviews a selection of the empirical and experimental literature related to trust. Section 3 outlines our experimental design and discusses hypotheses motivated by existing theories in the literature. Section 4 presents the results of the experiment and section 5 concludes.

2 Related Literature

Much of the literature regarding trust is either empirical or experimental. Empirical works have examined the determinants of trust and trust as a factor affecting growth rates. Experimental research involves the measurement of trust and trustworthiness, the relationship between the two traits and the effects of heterogeneity.

2.1 Empirical Literature

Development economists have long believed trust is important for economic growth. The common view is that economies in which people trust each other will grow faster due to higher investment and general economic activity. Knack and Keefer (1997) test this hypothesis using data from a sample of 29 countries. Their measure of trust is the trust question from the WVS, which was conducted in 21 countries in 1981, 28 countries in 1991 and obtained data from a total of 29 different countries across the two survey years. Knack and Keefer note that the trust question can be interpreted in different ways by different people. For example, it is not clear which people should be considered when the question refers to "most people," so respondents are left to guess if they should consider their family, friends, public figures or strangers. Furthermore, it is not clear what these people might be trusted with, the possibilities include personal property, friendship and the welfare of their children (if, for example, caregivers are being considered). The drawbacks associated with the trust question make using an experiment to measure trust an attractive alternative.

Knack and Keefer regress average annual growth rates (1970-1982) on GDP in 1980, per capita income in 1980, variables to control for average educational attainment and trust. The economic variables are to control for level of economic development and may approximate the effects of institutions; however, the influence of institutions is not captured explicitly. Also, there is potentially an endogeneity bias because in addition to trust affecting growth, growth may affect trust. To mitigate this effect, the authors use growth subsequent to the measurement of trust wherever possible. However, if trust changes slowly over time, using lagged values of trust will not correct the bias.

The estimates suggest trust positively affects growth rates. The estimated coefficient for trust is 0.082 and is significant at 1%. The interpretation of this finding is that a ten percentage point increase in trust is associated with a 0.8 percentage point increase in a country's growth rate. This result highlights the significance of trust in determining growth rates and suggests the determinants and formation of trust are important topics for further research.

Alesina and La Ferrara (2002) conduct work of this nature in their examination of the

determinants of trust using individual level data from US localities. They identify individual experiences and community characteristics that influence trust and find the factors associated with low trust include (1) a recent history of traumatic experiences (e.g. divorce, disease, accidents or financial misfortune), (2) belonging to a group historically felt discriminated against, (3) being economically unsuccessful in terms of income or education, and (4) living in a heterogeneous community, either in terms of income or race. Alesina and La Ferrara's primary source of data was the General Social Survey (GSS) from the years 1974-1994. Each year, the survey interviews a sample of 1500 Americans intended to be representative of the nation. One of the questions on the GSS is the same trust question that appears on the WVS, and this is the measure of trust used by the authors.

Alesina and La Ferrara conduct a probit regression of trust on a variety of individual characteristics. They find having experienced a traumatic event in the last 12 months, being female, being black and having less than 12 years of education are all associated with being less trusting at the 5% level of significance. Real income is found to have a significant positive effect on trust. In other probit regressions of trust on community characteristics, it is found that the Gini coefficient and an index of racial fragmentation both have significant negative effects on trust when included individually in separate regressions. However, when the Gini coefficient and the index of racial fragmentation are included in the same regression, racial fragmentation is significant and the Gini coefficient is not. This suggests studying the effects of income inequality without controlling for group identity may give misleading results. In light of this finding, we include both types of population heterogeneity in our experiment.

Zak and Knack (2001) study how various determinants of trust are related to growth rates, and consider many of the same factors as those identified by Alesina and La Ferrara (such as income inequality and ethnic diversity). Consistent with previous authors, Zak and Knack use the trust question from the WVS as their measure of trust. They use data on 41 different countries (from the WVSs of 1981, 1991 and 1996), begin by replicating the results of Knack and Keefer using the larger data set, and proceed by focusing on the "correlates" of trust.

In a regression of trust on GDP per capita, a measure of average education, an index of

property rights, the Gini coefficient and a measure of ethnic homogeneity, they find income inequality and ethnic homogeneity are associated with lower levels of trust. However, they acknowledge a potential endogeneity bias. The regression specifies income inequality is an independent variable affecting trust, but there may be reverse causation. Trusting and cohesive societies might support policies that promote income equality. Zak and Knack are unable to correct for the endogeneity due to the lack of a good instrument and present their estimates as "preliminary." The endogeneity is a recurring issue in the empirical literature on trust and provides another reason for using experimental methods as an alternative to conducting traditional empirical work.

Bjornskov (2006) attempts to control for the endogeneity identified by Zak and Knack (2001) using an Instrumental Variables (IV) regression. Though Bjornskov uses the same measure of trust, he notes the ambiguity of the trust question means it might pick up specific cultural perceptions regarding the context in which the question is asked, or reflect transitory phenomena such as recent media reports.

In an Ordinary Least Squares (OLS) regression of trust on income inequality, ethnic diversity and measures of institutional development, income inequality is found to have a negative affect on trust, but the other variables are not significant. Bjornskov conducts an IV regression using GDP per capita as an instrument for income inequality and confirms the OLS results. However, the validity of the IV procedure rests on the assumption that trust does not affect GDP per capita, which contradicts Knack and Keefer (1997). It seems the lack of good instruments for the determinants of trust may limit the usefulness of IV methods in this context.

2.2 Experimental Literature

The experimental literature on trust is based largely on the trust game of Berg et al. (1995), a mechanism for measuring trust and trustworthiness. The game proceeds in the following manner. Two players are each endowed with an amount of money and one of them (the investor) is given the opportunity to send part of their endowment to the other (the trustee).

The amount sent to the trustee is multiplied by a factor of three before it is received by the trustee, and the trustee then decides how much of what they have received they would like to return to the investor. The payoff of the investor is the portion of their endowment they decide to keep (rather than invest) plus the amount the trustee returns to them. The payoff of the trustee is their endowment plus what they receive less the amount they return to the investor. The amount investors send to trustees is the measure of trust and the ratio of the amount trustees return to investors relative to the amount they receive is the measure of trustworthiness.

In Berg et al., 30 out of 32 investors sent positive amounts to their trustee and the average was \$5.16 (out of \$10). Trustees (who received an average of \$15.48) returned an average of \$4.66. Significant trust and trustworthiness was demonstrated by investors and trustees, and the experimental design has been the basis for many subsequent trust experiments. The experiment we present draws closely on the mechanism of Berg et al. because their design measures trust and trustworthiness using observed behaviour, and this appears to be the best way to study trust.

Glaeser et al. (2000) use the trust game of Berg et al. to study how well answers to standard attitudinal survey questions predict trust. The authors asked subjects the trust question and a set of three questions regarding past trusting behaviour along the lines of "How often do you lend money to your friends?" The subjects came back a few weeks later to play the trust game, preceded by the chance to meet the other subjects in the experiment. The average amount invested was \$12.41 (out of \$15) and the average amount returned was \$12.30. In a regression of the amount invested on demographic variables and each subject's answer to the trust question, the coefficient of the trust question is insignificant. However, an equivalent regression that replaces the trust question with a behavioural index based on the three questions composed by the authors estimates a coefficient for the behavioural index that is significant at 5%. The trust question is a better measure of trustworthiness. In a regression of trustworthiness, the coefficient of the trust question is significant at 5%, but this still compares poorly to a parallel regression that finds a coefficient for the behavioural

index significant at 1%. Glaeser et al. conclude that the trust question is a poor indicator of trust, but a better predictor of trustworthiness. Even so, the weakness of the trust question is evident and the results suggest empirical work using the trust question should be interpreted carefully.

Buchan and Croson (2002) also find evidence that use of the trust question may give misleading results. They conducted the trust game in the United States, China, Korea and Japan, and the mean amounts invested were 60%, 52%, 44% and 44%. This leads them to conclude people in the United States and China are trusting and those in Korea and Japan are not. The mean amounts returned in the four countries were 32%, 65%, 74% and 34% of the amounts invested, suggesting the Chinese and Koreans are trustworthy, but that the Americans and Japanese are not. The lack of correspondence between trust and trustworthiness is problematic as it makes it impossible for one variable, such as the trust question, to reliably predict both traits. This provides further support for using experimental methods that can measure the two traits independently.

In light of the difficulties associated with the trust question, Anderson et al. (2006) study the effects of income inequality on trust and trustworthiness using the trust game. They incorporate heterogeneity by providing subjects with unequal show-up payments. In the control treatment, each of eight subjects receive a show-up payment of \$7.50. In the symmetric treatment, three subjects get \$5, two get \$7.50 and three get \$10. In the skewed treatment, three subjects get \$4, four get \$7 and one gets \$20. Show-up payments are awarded either privately or publicly, giving the experiment a 3x2 design. In all six treatments, investors are given \$10 to allocate between them self and their trustee. Thus, there is no heterogeneity in the amount available to be invested. It is in this respect that the experiment fails to capture a potentially important feature of reality; namely, that different people have different amounts available to invest. Our experimental design incorporates this element.

With private show-up payments, the mean amounts invested in the control, symmetric and skewed treatments were \$4.99, \$4.04 and \$4.19. None of the distributions of investments are statistically different from one another. With public show-up payments, the mean amounts

invested were \$5.41, \$5.27 and \$5.92, and again, the differences are not statistically significant. There are no significant differences between the six treatments in the amounts returned either. The results indicate subjects are unaffected by heterogeneous show-up payments.

The finding that heterogeneity does not affect trust in experimental settings is inconsistent with the empirical literature. Our results make an important contribution toward resolving the conflict. Natural choices for the types of heterogeneity to study in experimental contexts include income inequality and group identity. The hypothesis that income inequality affects trust is consistent with the empirical work of Zak and Knack (2001). Though it may seem the stakes commonly used in economic experiments are not sufficient to create income inequality large enough to affect the decisions of subjects, asymmetric endowments have been found to have important effects in previous experiments such as public goods games (Cherry et al., 2005) and ultimatum bargaining (Armantier, 2006). The hypothesis that group identity will affect trust is consistent with the empirical work of Alesina and La Ferrara (2002).

The ways in which group identity affects behaviour have just begun to be explored in the literature. Akerlof and Kranton (2000) develop a model that predicts identity will affect behaviour because the utility people receive from the actions they choose depends on their identity. McLeish and Oxoby (2007) find that after a challenge designed to encourage group identity, subjects are more generous toward members of their own group in an allocation game.

In McLeish and Oxoby's experiment on identity, subjects are divided into two teams and each team is asked to complete a quiz of 20 questions. Following the quiz, subjects are randomly matched with a partner to play an allocation game and told of their partner's team affiliation. A randomly chosen sender in each pair must decide how much of an endowment of 24 lab dollars (ld) to keep for themselves and how much to pass on to their receiver. Upon learning the amount allocated to them by their sender, receivers have the opportunity to punish senders using the following mechanism. Every ld spent on punishment by the receiver reduces the payoff of the sender by 1.5 ld.

The results indicate that being a receiver from the same team as the sender is associated with receiving an allocation 3.95 ld higher than a receiver from the other team. It is also found

that unfair allocations (allocations of less than 50%) are punished more significantly when the sender and receiver are from the same team. The results indicate cooperation is higher when people share the same affiliation, and also that the desire to punish unfair treatment is higher when one is treated unfairly by someone of the same affiliation. The implication of this finding that heterogeneity in the form of group identity is an important determinant of behaviour in experimental situations. With this in mind, we include group identity in our experiment.

3 The Experiment

This section presents an experiment designed to identify the effects of lab-induced heterogeneity (income inequality and group identity) on observed trust and trustworthiness.

3.1 Experimental Design

The experiment consists of three treatments constructed to isolate the effects of income inequality and group identity. Treatment 1 is a control treatment and does not involve either income inequality or group identity. Treatment 2 incorporates income inequality and Treatment 3 involves group identity. In each of the three treatments, all subjects are paid a show-up fee of \$5 and provided with an endowment to use in the trust game. This differs from some experimental protocols which provide the First Mover with an endowment and the Second Mover with nothing. Giving both the First and Second Movers an endowment is intended to eliminate investment motivated by inequity aversion (Fehr and Schmidt, 1999).

Treatment 1

Treatment 1 closely follows the experiment of Berg et al. (1995). The primary difference is that the trust game is repeated for multiple rounds to measure the effects of repetition. After the consent form and instructions are explained and all questions are answered, each subject is provided with an endowment of \$10 to use in eleven rounds of decision-making. Each round proceeds in the following manner. To begin, the subjects are randomly matched in pairs, and within each pair, one subject is randomly selected to be the “First Mover” and the other is

the “Second Mover.” The First Mover decides how much of their endowment they would like to pass on to the Second Mover, and that amount is multiplied by three before it is received by the Second Mover. The Second Mover then decides how much of the amount they have received they would like to pass back to the First Mover. In each round, the earnings of the First Mover are the sum of the portion of their endowment they keep and the amount passed back to them by the Second Mover. The earnings of the Second Mover are sum of their endowment and the portion of the amount they receive from the First Mover they choose to keep. Once the eleven rounds have been completed, one of the rounds is randomly selected to determine the final payoffs, which are the sum of the \$5 show-up fee and earnings in the randomly selected round. Note that earnings cannot be accumulated across rounds; subjects play each round using their initial endowment of \$10.

Conducting multiple rounds of the trust game measures the effects of repetition and adds to the amount of data obtained during each experimental session. The “learning” that may occur as the rounds progress should be controlled for when the data is analyzed. Also, it is possible that being treated unusually well or poorly in a given round will affect subjects’ decisions in the subsequent round. To account for these possibilities, a variable for the round and a variable reflecting how the subject was treated in the previous round can be included in all regressions (Anderson et al., 2006). Treatment in the previous round is captured by the amount passed to the subject if the subject was a Second Mover in the previous round and the ratio of the amount passed back to the subject to the amount the subject passed on to the Second Mover if the subject was a First Mover in the previous round.

Treatment 2

Treatment 2 differs from Treatment 1 in that subjects receive heterogeneous endowments to use in the eleven rounds of the trust game. Half of the subjects are randomly selected to receive an endowment of \$5 and the other half receive \$15. Note that the mean endowment is \$10, as in Treatment 1, which facilitates comparisons of aggregate investment across treatments. The second difference from Treatment 1 is that at the start of each round, subjects are told the

endowment of the other subject they are paired with. This makes the relative endowments within pairs common knowledge.

The trust game is played by three types of subject pairs: (1) two subjects with \$5, (2) two subjects with \$15, and (3) one subject with \$5 and one with \$15. Comparing the amounts invested in Treatment 1 to the amounts invested by pair-type (3) identifies the effect of income inequality on trust. Part of this effect is a wealth effect; that is, it is due to the fact subjects have different amounts to invest rather than their endowments being heterogeneous. This wealth effect can be identified by comparing the amounts invested in Treatment 1 to the amounts invested by pair-types (1) and (2). All other aspects of the treatment are as in Treatment 1.

Treatment 3

Treatment 3 differs from Treatment 1 by incorporating group identity. The treatment begins by dividing the subjects into two groups as they arrive at the experiment. Each group is placed in a separate room and is asked to answer a quiz consisting of 20 questions. The quizzes are casual in nature, one involves matching celebrity stage names to real names and the other asks subjects to match three-letter airport codes to the cities the airports serve. The two groups, or “teams” are allowed to submit only one answer sheet per team, so team members must interact while answering the quiz. The aim is for each team to develop a sense of group identity. This process is along the lines of the identity building activity used by McLeish and Oxoby (2007). If a team answers at least twelve of the 20 questions correctly, each member receives a payment of \$7, otherwise each member receives nothing.

Following the quizzes, the subjects play eleven rounds of the trust game using endowments of \$10 as in Treatment 1. At the start of each round, subjects are told the team affiliation of the subject they are paired with. There are two types of pairings: (1) two subjects from the same team, and (2) two subjects from different teams. Comparing the amounts invested in Treatment 1 to the amounts invested by pair-type (1) identifies the in-group effect. The amounts invested by pair-type (2) identify the out-group effect.

3.2 Hypotheses

We propose hypotheses based on theories of reciprocity (Rabin, 1993; Dufwenberg and Kirchsteiger, 2004), inequity aversion (Fehr and Schmidt, 1999) and identity (Akerlof and Kranton, 2000). Hypotheses **H1.1-1.4** relate to the effects of the income inequality in Treatment 2 and hypotheses **H2.1-2.2** relate to the group identity in Treatment 3.

H1.1: First Movers with high (low) endowments invest a lower (higher) share of their endowment.

Suppose First Movers believe Second Movers consider the inequity associated with final payoffs when they choose how much to return to their First Mover. First Movers with high (low) endowments will expect less (more) reciprocation of positive treatment by their Second Mover and will invest less (more).

H1.2: First Movers invest a higher (lower) share of their endowment in Second Movers with high (low) endowments.

If First Movers believe Second Movers consider the inequity associated with final payoffs, they expect more (less) positive reciprocity from Second Movers with high (low) endowments and invest more (less) in these situations.

H1.3: Second Movers with high (low) endowments return a higher (lower) share of the amount they receive.

This hypothesis follows from the theory that Second Movers are motivated by concerns regarding the inequity of final payoffs.

H1.4: Second Movers return a higher (lower) share of the amount they receive to First Movers with low (high) endowments.

This hypothesis also follows from Second Movers having preferences regarding the inequity of final payoffs.

H2.1 First Movers invest more (less) in Second Movers of the same (with the opposite) team affiliation.

Suppose First Movers believe Second Movers receive greater satisfaction from reciprocating positive treatment to those with whom they share the same group identity. First Movers will expect more positive reciprocity from Second Movers of the same team affiliation and invest more when the Second Mover is a member of the same team as them. The reverse argument can be made when the First and Second Mover are members of opposite teams.

H2.2 Second Movers return a higher (lower) share of the amount they receive to First Movers of the same (with the opposite) team affiliation.

This hypothesis follows from the theory that Second Movers receive greater satisfaction from engaging in positive treatment of those with whom they share the same group identity.

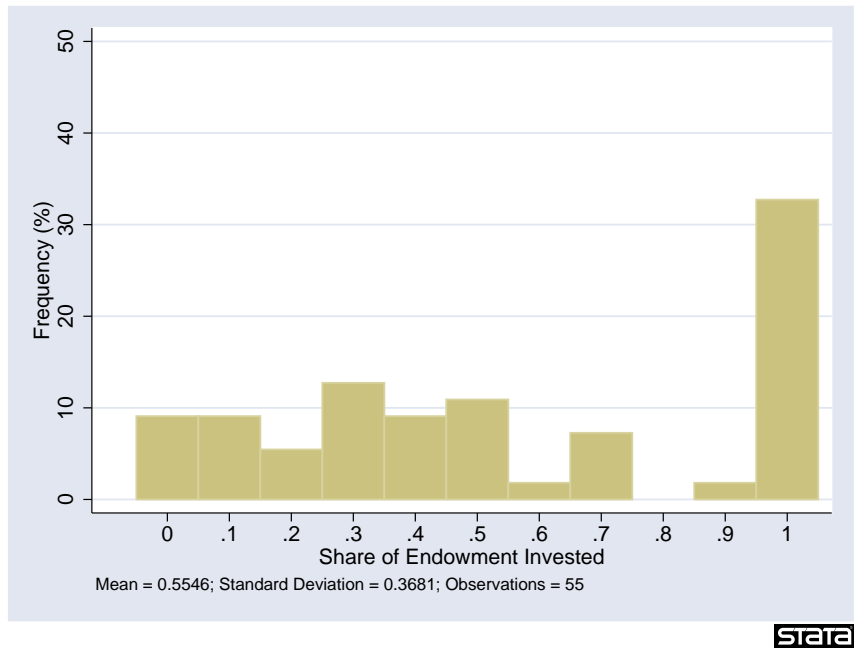
4 Results

The experiment was conducted at our University's experimental economics laboratory using subjects recruited from the undergraduate student body. The decision-making rounds were programmed using the software package z-Tree (Fischbacher, 2007) and occurred over a closed-circuit computer network. Ten subjects participated in Treatment 1, 14 in Treatment 2 and 14 in Treatment 3. Treatments 1 and 2 each lasted 45 minutes, while Treatment 3 took 75 minutes. The average total earnings in the three treatments were \$17.40, \$15.93 and \$27.50.

We will begin by considering investment by First Movers. Frequency distributions for the share of endowment invested in each of the three treatments are plotted in Figures 1-3.

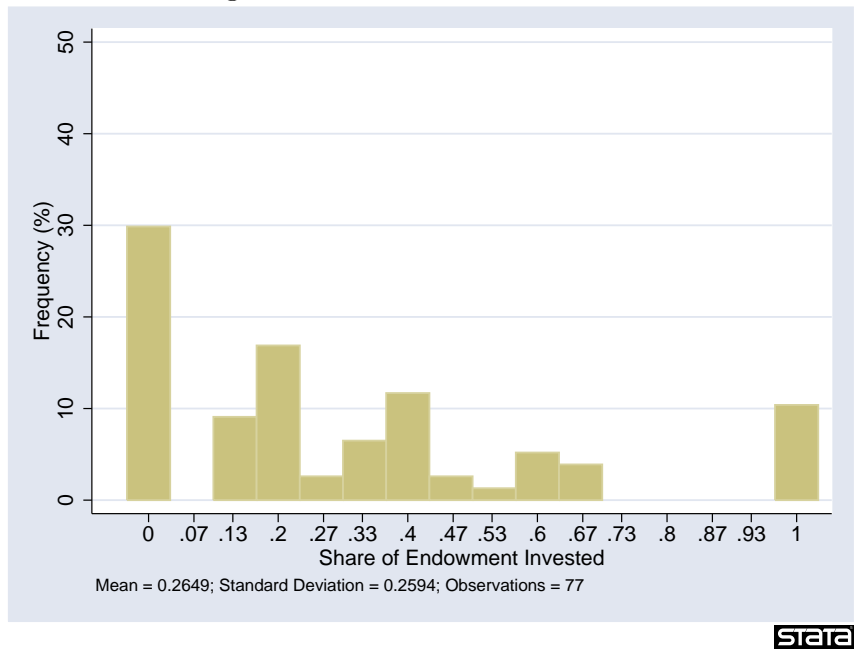
Investment shares are quite evenly distributed in Treatment 1, with the exception that First Movers invested their entire endowment approximately one third of the time. Investment shares were lower in Treatment 2, and First Movers invested nothing nearly a third of the time. A t-test for differences in means finds that the share of endowment invested in Treatment 2 is lower than in Treatment 1 at the 1% level of significance, providing strong evidence that income inequality decreases aggregate investment.

Figure 1: Investment in Treatment 1



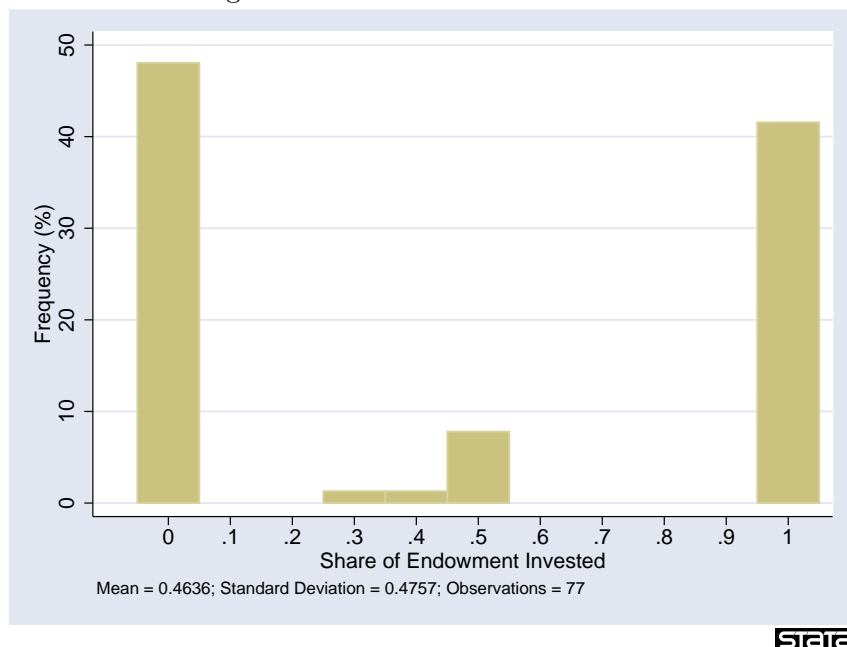
STATA

Figure 2: Investment in Treatment 2



STATA

Figure 3: Investment in Treatment 3



Investment shares are widely dispersed in Treatment 3. First Movers with the same team affiliation as the Second Mover tended to invest the maximum while those who were members of the other team often invested nothing. Overall, the out-group effect dominates the in-group effect and aggregate investment is lower in Treatment 3 than in Treatment 1. The statistical significance of this finding is not as strong ($p = 0.1189$) as between Treatments 1 and 2. However, there is some evidence investment is lower in the presence of group identity.

Pooling the data across subjects, rounds and treatments gives a total of 209 observations. The share of endowment invested is regressed on sets of indicator variables representing income inequality and group identity, dummy variables for subjects and a variable for the round. The results are reported in Table 1. The specification estimated is a fixed effects model. A generalized Hausman test appropriate for small samples rejected the null hypothesis that the corresponding random effects model is unbiased ($p = 0.0421$).

The First Movers in Treatment 1 serve as the control group in the regression and allow for the identification of the effects of income inequality and group identity. One subject dummy variable from Treatment 1, two from Treatment 2 and one from Treatment 3 are dropped to

Table 1: Investment by First Movers

Variable	Coefficient	Robust Standard Error
<i>rr</i>	-0.4394***	0.0676
<i>rp</i>	-0.4184***	0.0725
<i>pr</i>	-0.2284**	0.1002
<i>pp</i>	-0.2826***	0.0886
<i>ingroup</i>	0.3159***	0.0741
<i>outgroup</i>	-0.4841***	0.0726
<i>round</i>	-0.0177***	0.0050
<i>constant</i>	0.7065***	0.0648
<i>n</i>	209	
<i>R</i> ²	0.8052	

Fixed effects for subjects are included, but are not reported.

***: Significant at 1%.

** : Significant at 5%.

avoid collinearity. The subject dummy variables dropped correspond to subjects who made “representative” choices within their treatment.

The indicator variable *rr* (rich-rich) takes on a value of 1 if the First and Second Movers each have an endowment of \$15 and a value of 0 otherwise. The variable *rp* (rich-poor) takes on a value of 1 if the First and Second Movers have endowments of \$15 and \$5. The variables *pr* and *pp* take on values of 1 when the pairings are poor-rich and poor-poor. The indicator variable *ingroup* takes on a value of 1 when the First and Second Movers are members of the same team and *outgroup* takes on a value of 1 when they are members of different teams.

The negative and significant coefficients estimated for the variables *rr*, *rp*, *pr* and *pp* indicate First Movers with endowments of \$15 and \$5 both choose lower investment shares than First Movers with \$10. The findings regarding the coefficients for the variables *rr* and *rp* are consistent with **H1.1**, but those for *pr* and *pp* are not. F-tests find no significant differences between the coefficients estimated for the variables *rr* and *rp* ($p = 0.6903$) or *pr* and *pp* ($p = 0.5691$), suggesting the endowment of the Second Mover does not affect the investment decision of the First Mover. This neither confirms nor contradicts **H1.2**. A supplementary regression finds First Movers with \$15 choose significantly lower investment shares than First Movers with \$5 ($p = 0.0290$) and this is consistent with **H1.1**.

The in-group effect is positive and highly significant, indicating First Movers invest more

when the Second Mover shares their team affiliation. In contrast, the out-group effect is negative. Both of these findings are consistent with **H2.1**. Note that the magnitude of the out-group effect is greater than the magnitude of the in-group effect, suggesting that in this context, the negative out-group effect associated with group identity dominates the positive in-group effect.

The coefficient for the variable indicating the round is negative and significant, suggesting investment decreases with repetition of the game. A similar regression that included a dummy variable for each round of play found no significant negative effect on investment in the final round. Rather, investment gradually trended downward over the eleven rounds. This differs from the results of Cochara et al. (2004), who find that investment tends to rise with repetition until a sudden decline in the final two rounds. The constant term in the regression is positive and significant, providing strong evidence in favour of rejecting the Nash prediction of zero investment under the assumption of individual wealth maximization.

We now consider the decisions of Second Movers. The ratio of the amount each Second Mover returned to the amount they received is regressed on income inequality and group identity indicator variables, round and the First Mover's investment share to capture the effects of reciprocity (Rabin, 1993; Dufwenberg and Kirchsteiger, 2004). The regression results are given in Table 2. A random effects model is used for efficiency since the generalized Hausman test failed to reject the null hypothesis that the random effects model is unbiased ($p = 0.6001$). Once again, the subjects in Treatment 1 serve as the control group.

The positive and highly significant coefficient for the variable *FM investment share* indicates the strong effect of reciprocity. Second Movers return a higher portion of the amount they receive when First Movers invest a larger share of their endowment. This finding is consistent with Oxoby and Friedrich (2006).

The income inequality indicator variables have the same interpretation as in Table 1, the first letter refers to the endowment of the First Mover and the second letter to the endowment of the Second. In general, return ratios are lower when there is income inequality. However, the effects are not uniform. The coefficient estimated for the variable *rr* is lower than the one

Table 2: Return Ratios of Second Movers

Variable	Coefficient	Robust Standard Error
<i>FM investment share</i>	0.0825***	0.0155
<i>rr</i>	-0.1147***	0.0395
<i>rp</i>	-0.0848*	0.0499
<i>pr</i>	0.0535	0.0547
<i>pp</i>	-0.1654***	0.0355
<i>ingroup</i>	0.1296**	0.0532
<i>outgroup</i>	-0.1515***	0.0365
<i>round</i>	-0.0038	0.0038
<i>constant</i>	0.1581***	0.0419
<i>n</i>	209	
<i>R</i> ²	0.5490	

***: Significant at 1%.

**: Significant at 5%.

*: Significant at 10%.

estimated for the variable *pr* ($p = 0.0025$). This suggests Second Movers with endowments of \$15 return a lower proportion of what they receive to First Movers with \$15 than to those with \$5. This is consistent with **H1.4**. The coefficient estimated for the variable *rp* is higher than the coefficient estimated for the variable *pp* ($p = 0.0640$), which suggests Second Movers with \$5 return a higher proportion of what they receive to First Movers with \$15 than to those with \$5. This finding is inconsistent with **H1.4**. A supplementary regression finds that Second Movers with endowments of \$15 choose higher return ratios than Second Movers with \$5 ($p = 0.0093$), as predicted by **H1.3**.

The coefficients for the income inequality indicator variables reveal something important about the implications of inequality. First Movers should not invest large amounts in Second Movers with endowments of \$5 if they are seeking high returns on their investment. High investment levels can only be rationalized in these pairings if they are motivated by concerns about equity.

Second Movers are affected by group identity in the same manner as First Movers. The in-group effect is positive and the out-group effect is negative, which provides evidence in favour of **H2.2**. Notice that once again, the out-group effect is stronger than the in-group effect.

The variable *round* is insignificant, suggesting Second Movers' choices are robust to repetition. The constant is positive and significant, providing evidence in favour of rejecting the Nash prediction of zero returns.

5 Conclusions

In spite of the positive relationship between trust and growth rates identified by Knack and Keefer (1997), the determinants of trust are not well understood. Some authors find ethnic diversity has important implications for trust, but that income inequality does not (Alesina and La Ferrara, 2002). Others find the reverse (Zak and Knack, 2001; Bjornskov, 2006). Empirical work regarding trust involves using a questionable measure of trust and may give misleading results due to endogeneity.

The experiment presented here finds that income inequality and group identity both have important effects. When there is income inequality, trust is generally lower. Low endowment subjects also show reduced levels of trustworthiness compared to high endowment subjects. The in-group identity effect is positive for trust and trustworthiness, while the out-group effect is negative for both traits. These results are significant because previous research has been unable to find that lab-induced heterogeneity affects demonstrated trust (Anderson et al., 2006).

The current results raise a number questions to be answered with further research. To begin, the effects of group identity are clear in the event there are two groups (or "teams" in our experiment) of the same size, but it is not obvious how the effects might change in the event there are n groups and/or the groups are of variable size. One might expect that if there are more groups, so that each group represents a smaller share of the population, the in-group effects might be larger and the out-group effects smaller. Holding the number of groups constant, one might think decreasing a group's size might strengthen the effects of identity, while increasing a group's size might weaken them. Further research along these lines would produce results more relevant for policy because real economies are typically populated by different numbers of groups of varying sizes.

Another possible path for further research involves examining the interaction effects between income inequality and group identity. The current experiment manipulates each of these variables independently, so nothing is determined regarding how they interact. Work by Alesina and La Ferrara (2000) suggests one of the challenges facing the United States is the interaction between the effects of income inequality and ethnic diversity. Part of a study regarding interaction effects could involve an experiment designed to determine if positive in-group identity effects are strong enough to overcome negative income inequality effects. The obvious policy implication would be that if group identity can be used to overcome income inequality, income would not need to be redistributed to encourage cooperation among citizens. It would be sufficient to implement programs aimed at building a common identity.

References

- Akerlof, G. (1982).** "Labor Markets as Partial Gift Exchange." *Quarterly Journal of Economics*, 97 (4), 543-569.
- Akerlof, G., Kranton, R. (2000).** "Economics and Identity." *Quarterly Journal of Economics*, 115 (3), 715-753.
- Alesina, A., La Ferrara, E. (2002).** "Who Trusts Others?" *Journal of Public Economics*, 85 (2), 20-34.
- Alesina, A., La Ferrara, E. (2000).** "Participation in Heterogeneous Communities." *Quarterly Journal of Economics*, 115 (3), 847-904.
- Anderhub, V., Engelmann, D., Guth, W. (2002).** "An Experimental Study of the Repeated Trust Game with Incomplete Information." *Journal of Economic Behavior and Organization*, 48, 197-216.
- Anderson, L., Mellor, J., Milyo, J. (2006).** "Induced Heterogeneity in Trust Experiments." *Experimental Economics*, 9, 223-235.
- Armantier, O. (2006).** "Do Wealth Differences Affect Fairness Considerations?" *International Economic Review*, 47 (2), 391-429.
- Arrow, K. (1974).** *The Limits of Organization*. Norton Press.
- Arrow, K. (1972).** "Gifts and Exchanges." *Philosophy and Public Affairs*, 1, 343-362.
- Becker, G. (1974).** "A Theory of Social Interactions." *Journal of Political Economy*, 82 (6), 1063-1093.
- Berg, J., Dickhaut, J., McCabe, K. (1995).** "Trust, Reciprocity, and Social History." *Games and Economic Behavior*, 10, 122-142.
- Bjornskov, C. (2006).** "Determinants of Generalized Trust: A Cross-Country Comparison." *Public Choice*, 130, 1-21.
- Bolle, F. (1998).** "Does Trust Pay?" Working Paper: Europa-Universitat Viadrina Frankfurt (Oder).
- Buchan, N., Croson, R. (2004).** "The Boundaries of Trust: Own and Others' Actions in the US and China." *Journal of Economic Behavior and Organization*, 55, 485-504.

- Buchan, N., Croson, R. (2002).** "Swift Neighbors and Persistent Strangers: A Cross-Cultural Investigation of Trust and Reciprocity in Social Exchange." *American Journal of Sociology*, 108, 168-206.
- Buchan, N., Johnson, E., Croson, R. (2006).** "Let's Get Personal: An International Examination of the Influence of Communication, Culture and Social Distance on Other Regarding Preferences." *Journal of Economic Behavior and Organization*, 60, 373-398.
- Camerer, C. (2003).** *Behavioral Game Theory*. Princeton University Press, Princeton, NJ.
- Cherry, T., Frykblom, P., Shogren, J. (2002).** "Hardnose the Dictator." *American Economic Review*, 92 (4), 1218-1221.
- Cherry, T., Kroll, S., Shogren, J. (2005).** "The Impact of Endowment Heterogeneity and Origin on Public Good Contributions: Evidence from the Lab." *Journal of Economic Behavior and Organization*, 57, 357-365.
- Cochard, F., Van, P., Willinger M. (2004).** "Trusting Behavior in a Repeated Investment Game." *Journal of Economic Behavior and Organization*, 55, 31-44.
- Cox, J. (2004).** "How to Identify Trust and Reciprocity." *Games and Economic Behavior*, 46, 260-281.
- Croson, R., Buchan, N. (1999).** "Gender and Culture: International Experimental Evidence from Trust Games." *American Economic Review*, 89 (2), 386-391.
- Dufwenberg, M., Kirchsteiger, G. (2004).** "A Theory of Sequential Reciprocity." *Games and Economic Behavior*, 47 (2), 268-298.
- Fehr, E., Gächter, S. (2000).** "Fairness and Retaliation: The Economics of Reciprocity." *Journal of Economic Perspectives*, 14 (3), 159-181.
- Fehr, E., Schmidt, K. (1999).** "A Theory of Fairness, Competition and Cooperation." *Quarterly Journal of Economics*, 114 (3), 817-868.
- Fershtman, C., Gneezy, U. (2001).** "Discrimination in a Segmented Society: An Experimental Approach." *Quarterly Journal of Economics*, 116 (1), 351-377.
- Fischbacher, U. (2007).** "z-Tree: Zurich Toolbox for Ready-made Economic Experiments." *Experimental Economics*, 10 (2), 171-178.

- Glaeser, E., Laibson, D., Scheinkman, J., Soutter, C. (2000).** "Measuring Trust." *Quarterly Journal of Economics*, 115 (3), 811-846.
- Hoffman, E., McCabe, K., Smith, V. (1996).** "Social Distance and Other-Regarding Behavior in Dictator Games." *American Economic Review*, 86 (3), 653-660.
- Holm, H., Nystedt, P. (2005).** "Intra-Generational Trust: A Semi-Experimental Study of Trust Among Different Generations." *Journal of Economic Behaviour and Organization*, 58, 403-419.
- Johansson-Stenman, O., Mahmud, M., Martinsson, P. (2005).** "Does Stake Size Matter in Trust Games?" *Economic Letters*, 88, 365-369.
- Knack S., Keefer, P. (1997).** "Does Social Capital Have an Economic Payoff? A Cross-Country Investigation." *Quarterly Journal of Economics*, 112 (4), 1251-1288.
- Leigh, A. (2006).** "Trust, Inequality and Ethnic Heterogeneity." *The Economic Record*, 82 (258), 268-280.
- Leigh, A. (2006).** "Does Equality Lead to Fraternity?" *Economic Letters*, 93, 121-125.
- McLeish, K., Oxoby, R. (2007).** "Identity, Cooperation, and Punishment." Working Paper: University of Calgary.
- Oxoby, R., Friedrich, C. (2006).** "Trust and the Structure of Incentives." Working Paper: University of Calgary.
- Rabin, M. (1993).** "Incorporating Fairness into Game Theory and Economics." *American Economic Review*, 83 (5), 1281-1302.
- Willinger, M., Keser, C., Lohmann, C., Usunier, J. (2003).** "A Comparison of Trust and Reciprocity Between France and Germany: Experimental Investigation Based on the Investment Game." *Journal of Economic Psychology*, 24, 447-466.
- Zak, P., Knack, S. (2001).** "Trust and Growth." *The Economic Journal*, 111 (470), 295-321.