

Traditional Trust Measurement and the Risk Confound: An Experiment in Rural Paraguay *

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Abstract

Researchers have hypothesized that play in the traditional trust experiment depends both on trust preferences and on risk preferences. We run two experiments, the traditional trust experiment measuring both trust and risk preferences, and a new risk experiment measuring only risk preferences. We run these experiments with a diverse set of subjects in fifteen villages of rural Paraguay. We find that risk attitudes are highly predictive of play in the trust game (while altruism is not). In addition, omitting risk aversion as an explanatory variable in trust regressions significantly changes the coefficients of some of the most commonly included explanatory variables in trust regressions such as gender, religion, and language.

1 Introduction

The trust/investment game, originally described in Berg, Dickhaut & McCabe (1995) (BDM), has become the trademark means of measuring trust in a burgeoning literature on trust and its effects on economic outcomes. Some authors have noted that the trust game does not allow one to distinguish

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between a highly trusting person and a person with low levels of risk aversion (Barr 1999, Karlan 2003, Eckel & Wilson 2000); i.e. a person may take more trusting actions because he actually trusts more, or because he is more willing to take a gamble. In this paper, we run both the traditional trust game, and a very similar gambling game with 188 players in fifteen villages of rural Paraguay, and compare agents' actions in the two games. We find that play in the risk game is significantly predictive of play in the trust game and risk game, no matter what additional explanatory variables we include. We also find that controlling for risk aversion in trust regressions significantly changes the coefficients of some of trust play's correlates.

It is important to determine what portion of play in the trust game depends on trust preferences and what portion depends on risk preferences for both academic as well as policy oriented reasons. There is a growing literature on the benefits of trust for increasing economic growth, improving the functioning of institutions, and increasing the gains to cooperation. Is the policy prescription for increasing trusting behavior to encourage increasing social capital and trust between members of society? Or, if trusting behavior is for the most part a signal of risk preferences, should policy-makers focus on providing insurance instead. The rest of this paper is organized as follows: the second section discusses the game design and previous applications of trust and risk games, section three discusses the data and the experimental procedures, the fourth section calculates risk aversion parameters for the players, the fifth section disentangles the contribution of risk preferences to play in the trust game, and the sixth section concludes.

2 Game Design and Previous Applications of Trust and Risk Games

In the original trust game (sometimes called the investment game), the trustor is given a sum of money. In the first move, the trustor must decide how much, if any, to send to an anonymous trustee. Any money sent to the trustee is tripled. The trustee makes the second move, deciding how much money to return to the trustor. Under the assumption of selfish preferences, the only Nash equilibrium is for the trustor to send no money to the trustee, using backward induction to infer that the trustee will never return any money. Money sent by the trustor is commonly used to measure his trust

that the anonymous trustee will return his money. Money returned by the trustee is used to measure his trustworthiness. In fact, participants do not tend to play the Nash equilibrium. In the U.S., Berg et al. (1995) find that only two out of 32 trustors sent nothing, and of the 30 trustees who were sent money, only six returned nothing. In this paper we will not be looking at why a trustee would return any money at all, instead of keeping all of it for himself. A trustee who returns money may do so out of concerns for fairness or altruism, or because he makes a connection in his mind between this game and some other social interaction with his village-mates in which trust and reciprocity increase total social welfare. We define trust as the expectation of the distribution of trustee responses, without discussing why the trustee responds as he does.

We can compare outcomes for the trust game played in developed countries (Berg et al. 1995, Glaeser, Laibson, Scheinkman & Soutter 2000, Ashraf, Bohnet & Piankov 2003, Chaudhuri & Gangadharan 2002) with outcomes for the trust game played in developing countries (Karlan 2003, Barr 2003, Carter & Castillo 2002). Direct comparison is impossible, as the rules of the game in each of these studies was slightly different, and the authors do not report all the results. In general though, we find that the average amount sent in the trust game is around 50%, with developed-country players sending on average slightly more than half, and developing-country players sending slightly less than half. On the other hand, trustees in developed countries tend to return less than their counterparts in developing countries. In monetary terms, on average, trust seems not to pay in the developed countries, while trust does pay in the developing countries.

Results from the investment game confound differing levels of risk aversion with differing levels of trust. Two people with the same (non-zero) level of trust, but different risk preferences will play the role of trustor differently (Barr 1999, Eckel & Wilson 2000).¹ Assume two players believe that half of the trustees will return double and half will return half of their original investment. Although both players are equally trusting, the more risk averse trustor will send less money, and appear less trusting. Thus, play in the trust game depends both on trust preferences and on risk preferences. In this paper we define trust as the players' expectations of the distribution of

¹Measures of trustworthiness, on the other hand, will be unrelated to levels of risk aversion. Given the amount he is sent, the trustee's payoffs depend only on his own actions.

returns, including both its mean and its variance.

Many researchers have already taken note of this confound. Barr (1999) finds that villagers in resettled villages of Zimbabwe send more in the trust game than those in older villages. She hypothesizes that this is because the resettled villagers are more uncertain about each other's behavior, but she cannot rule out the possibility that this is due to self-selection of more risk averse individuals into resettlement areas.² Karlan (2003) finds that, in Peru, individuals who send more in the trust game are more likely to default on their microfinance loans and save less. He interprets his results as showing that play in the trust game actually measures levels of risk-aversion and that apparently highly trusting people are actually just "risk-takers".³ Thus Barr (1999) hypothesizes that play in the trust game represents only trust preferences while Karlan (2003) assumes play in the trust game represents only risk preferences, but neither has data on risk preferences to test their hypothesis.

Recently, other researchers have been comparing trust and risk preferences in a controlled setting (Bohnet & Zeckhauser 2003, Ashraf et al. 2003, Chaudhuri & Gangadharan 2002, Eckel & Wilson 2000). These papers use university students as their subjects and give relatively small payoffs compared to wages. Chaudhuri & Gangadharan (2002) calculate risk aversion from the amount sent by the trustor given an assumed distribution of trustee responses. This technique cannot distinguish between trust and risk aversion, as everyone is thus assumed to trust equally, but have differing levels of risk aversion. Bohnet & Zeckhauser (2003) have designed two separate experiments to measure risk and trust. Each player only plays one of the two games, in a between-subjects design. They elicit players' "minimum acceptable probabilities" (MAP) for the gamble or the trust game. The two games have similar payoffs but in the risk game nature decides the payoffs, and in the trust game another person's action determines the payoffs. They find that peoples' MAPs are higher when they are playing with another human as opposed to with a random lottery and claim this is due to betrayal costs

²In a later paper Barr analyzes the relation between trust in resettled and traditional villages more deeply, and hypothesizes that resettled villagers trust more because of their desire to 'community-build' to compensate for the lack of kin-based ties that are evidenced in the traditional villages (Barr 2003).

³There are other possible interpretations of this observation. Trusting people may lend more money to others in their daily interactions, and if their trust is unfounded they may not get paid back. This may cause them to default on their microfinance loan.

(i.e. the disutility a trustor receives if he is betrayed by the trustee). They cannot compare a player's risk aversion to his trustingness, as each player only played one of the two games. Ashraf et al. (2003) run both trust and risk experiments in a within-subjects design. The risk experiment measures willingness to pay for a 50/50 lottery to win \$300 or nothing. They find that risk aversion has almost no effect on trust decisions, though the game used to measure risk preferences is quite different from the trust game, and so may not lead as easily to direct comparison. Eckel & Wilson (2000) find that more risk averse trustors choose less risky games. Their measure of risk aversion is based on the player's choice between different lotteries with varied expected values and variances. Trust is measured as a binary choice decision instead of in the continuous BDM version. They find no significant effect of risk preferences on whether or not the player chooses to trust, only in their choice of risk level in a game. Because the players choose which trust game to play, game choice becomes endogenous, and it is not possible to distinguish between trust preferences and risk preferences in play in the trust game. None of these papers attempts to separate what share of play in the traditional trust game is due to risk preferences and what share is due to trust per se.

Our game design allows us to begin to disentangle trust preferences from risk preferences. We ran two experiments, one measuring player's risk preferences, and then the more traditional BDM trust game. The risk experiment was designed to resemble the first move in the trust experiment, but involved only risk, and no trust, as the payoffs were decided by the roll of a die. Some characteristics of these games which may vary with some or all of the previous papers are a) the players are not students, they are rural villagers with diverse wealth levels and ages, b) the payoffs were quite large, as players won an average of two days' wages, c) we use a within-subjects design, i.e. all players play both games, d) the trust game was not played as a 0/1 decision, but, as in the version played by Berg et al. (1995), with a range of discrete choices, e) the risk game was designed to be quite similar in format and have quite similar payoffs to the trust game, and f) all players played the same trust game.

The rules of the risk game were as follows. The investor was given a sum of money (the same amount he was given in the trust game) and was given the same five choices of how much (if any) to invest. The experimenter then rolled a die to determine the investor's payoffs. A roll of one meant the investor lost his investment, two meant he recovered only half his investment,

three meant he recovered his investment, four meant he earned 1.5 times his investment, five meant he doubled his investment, and six meant he earned 2.5 times his investment. We designed the risk game to yield similar returns to those from trust games played in rural Zimbabwe (Barr 2003). In actuality, the returns from the risk game looked like a mean preserving spread of the returns from the trust game. This may make it a bit harder to compare decisions made in the two games than it would have been if the distribution of returns in the two games were more similar.

3 Data Source and Experimental Procedures

In 1991 the Land Tenure Center at the University of Wisconsin in Madison and the Centro Paraguayo de Estudios Sociológicos in Asunción worked together in the design and implementation of a survey of 300 rural Paraguayan households in three departments (i.e. states) and sixteen villages across the country. This was a random sample, stratified by land-holdings. The original survey was followed up by subsequent rounds of data collection in 1994, 1999, and, most recently, 2002. In 2002 we interviewed 223 households. Of the 223 households we interviewed, 166 are the original households interviewed in 1991 and 30 are one of their family members (usually the son or daughter of the original farmer after his death). The other 27 households bought or are using the land and house of the original interviewee, but are not his family member.

More detailed experimental procedures are explained in an appendix, but we will give a brief summary here. After three or four days of surveying in each village we invited a player from each household which had participated in the survey to play the games, which took place in a public location, usually the church. They were told they would win, on average, one and a half day's wages, or 18,000 Guaranies.⁴ In the two largest villages, we held the game in two sessions, one in the morning and one in the afternoon. The groups for the two sessions were chosen based on location of the households, and there seemed to be no communication between the two groups, as the houses of

⁴Although winnings obviously depend on the choices players made, I predicted the average winnings based on results of experiments run by other researchers in developing countries. I predicted that players would win a bit more than 18,000 Guaranies, but preferred to exceed their expectations rather than disappoint. The players ended up winning, on average, 24,000 Guaranies each.

the two groups were quite far apart. 188 of the 223 families surveyed sent a family member to play the game.⁵

The risk game was played first. The game's instructions were given in a group setting in which no questions were allowed to be asked. Then the players were called into the church one at a time, given another explanation, and allowed to ask any questions in private. Then they made their bet and saw the roll of the die, and we gave them an IOU for their winnings. The players were then called back into the church to hear the explanation of the second game. Every player played both the roll of the trustor and the trustee. They came into the church one at a time to put the money they were sending to the trustee in an envelope, and they watched me triple it. The envelopes were then shuffled and the players came back into the room one at a time. We used the strategy method to elicit how much they would send back to the trustor given each of the four possible amounts they might receive. Then they opened the envelope that was assigned to them, took out the amount that they had precommitted to taking out and left the rest in the envelope. The players then came into the room one at a time one final time to open their original envelope and see how much was left. At this point we paid them the total of their winnings. Due to the importance of making sure players with varying levels of education all understood the game, and difficulties in running experiments in a village setting, the game was not double blind, and I saw each player's choices.⁶

In Table 1 we find the summary statistics for the players. The players are of extremely diverse ages, education levels, and wealth levels. In the risk game, seven percent of the players bet nothing, 27% bet 2,000 Guaranies, 48% bet 4,000 Guaranies, ten percent bet 6,000 Guaranies, and nine percent bet all 8,000 Guaranies (for a mean bet of 3,436 Guaranies). In the trust game nine percent of the players sent nothing, 36% sent 2,000 Guaranies and another 36% sent 4,000 Guaranies, while twelve percent sent 6,000 and seven percent sent all 8,000 Guaranies (sending a mean of 3,745 Guaranies). In Table 2 we find the summary statistics for the villages surveyed. They

⁵None of the eight households in the Japanese immigrant village were interested in playing. Excluding the Japanese, who are exponentially wealthier than the rest of the population, those households which did not send a player were significantly more wealthy and had significantly younger household heads.

⁶Hoffman, McCabe, Shachat & Smith (1994) found that whether or not a game is double blind does effect people's decisions. On the other hand Roth (1995) reviews the literature on this topic and finds it does not have a large effect on players' decisions.

| Variable ^a | Mean | Min | Max |
|----------------------------------------|-----------|---------|-------------|
| Male | 69.7% | | |
| Catholic | 95.7% | | |
| Guarani language | 81.4% | | |
| Brazilian | 9.0% | | |
| Age | 48.67 | 18 | 84 |
| Educ (years) | 4.80 | 0 | 12 |
| Family size | 5.59 | 1 | 12 |
| Land owned (hectares) | 22.37 | 0 | 580 |
| Per-capita inc. ^b | 4,233,225 | 124,058 | 104,323,700 |
| Petty theft | 118,952 | 0 | 3,664,000 |
| Share experiencing petty theft | 44.1% | | |
| Gifts given | 309,060 | 0 | 3,290,000 |
| Donations given | 211,684 | 0 | 2,140,000 |
| # chickens stolen in village | 46.5 | 0 | 400 |
| No sickness in past year | 44.1% | | |
| % income lost to animal death | 2.9% | 0% | 31.9% |
| Per-capita pension income | 178,775 | 0 | 6,190,476 |
| P.I. at survey | 31.9% | | |
| Trust most village-mates ^c | 2.82 | 1 | 5 |
| Bet in risk game ^d | 3,436 | 0 | 8,000 |
| Sent in trust game | 3,745 | 0 | 8,000 |
| Bet minus sent | 309 | -6,000 | 8,000 |
| Share returned by trustee ^e | .436 | 0 | 1 |
| No. of Obs. | 188 | | |

Table 1: Individual Summary Statistics

^aThe variables are described in more detail in an appendix.

^bThe relevant exchange rate is approximately 4,800 Guaranies to the dollar.

^c1 means they trust all and 5 means none of their villagemates.

^dFor both the risk and trust game the choice set was 0, 2,000, 4,000, or 8,000.

^eThis is the average of the four strategies elicited from the trustee based on each possible amount they might receive. Note, any share greater than .33 means that trust has positive payoffs, as the amount the trustor sent had been tripled originally.

| | Mean | Min | Max |
|------------------------|-----------|-----------|------------|
| Households | 175.7 | 30 | 720 |
| Households Migrated In | 12.2 | 0 | 55 |
| Km to bus | .67 | 0 | 7 |
| Mean income | 4,550,144 | 1,451,086 | 21,100,000 |
| CV of income | 0.920 | 0.474 | 1.977 |
| CV of theft | 1.973 | 1.475 | 2.747 |
| No. of Obs. | 15 | | |

Table 2: Village Summary Statistics

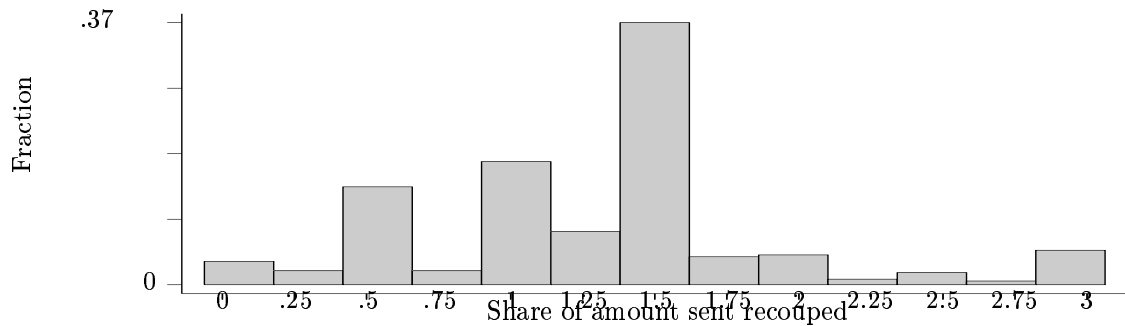


Figure 1: Distribution of Results of Trust Game, Includes All Strategies Elicited, Mean=131%, SD=64.2

are also of diverse wealth levels, sizes, and distances from bus lines. A more detailed description of the variables is found in an appendix.

The average percent of a bet recouped from a fair die, given our rules, would be 125% (with a standard deviation of 85.6). The average from the actual rolling of the die was 118% (with a standard deviation of 84.5). The average percent of the amount sent by the trustor in the trust game recouped was from all of the different strategies elicited by the trustee was 131% (with a standard deviation of 64.2). The distribution of these returns can be found in Figure 1. If we ignore all the strategies elicited from trustors which were not actually played and only look at those strategies which were played we find that the average percent recouped was 130% (with a standard deviation

of 61.0).⁷⁸ Figures 1-4 show, respectively, the probabilistic returns from the roll of the die, the actual returns from the roll of the die, the average returns from all strategies elicited from the trustee, and the actual returns for the trustor.

Even though the returns from the risk game look like a mean-preserving spread of the trust game payoffs, there is a high correlation between the amount bet in the risk game and the amount sent in the trust game. The Pearson correlation coefficient between the two is 0.2691 and the Spearman rank correlation coefficient is 0.2672, and both have p -values of .0002. Forty percent of players bet the exact same amount in the risk game as they sent in the trust game (23% of the players bet more, and 36% trusted more.)

4 Calculating Risk Aversion Parameters

We can calculate the coefficient of relative risk aversion for each player, given the bet they make in the risk game. To calculate these coefficients we assume that the bet the player chooses is the amount which maximizes his utility. In addition, since no player should ever choose to bet nothing when given a continuous choice set over a bet with positive average returns, we have assumed that the optimal bet size for those who chose not to bet was slightly greater than 0. More details on how these coefficients were calculated are found in an appendix. If one assumes exponential (CARA) utility,

⁷We used the strategy method, so the trustee had to decide a strategy for every possible amount he might receive, but then he only played one of those strategies, depending on how much the trustor had sent him. This acts as a sort of check that the game was truly anonymous. If the players had somehow knew how much their friends had sent or who they were playing with, we might expect the actual returns to be higher than the average returns from all strategies elicited.

⁸The percentage returns from sending lower amounts of money was just slightly significantly higher (133%) than those from sending higher amounts of money (127%). Although Camerer & Fehr (forthcoming) argue that positive reciprocity is usually exhibited in trust games, they are only claiming that trustees who receive more tend to return more. They do not discuss whether these trustees return proportionally more. Berg et al. (1995) also found that players who sent half (\$5) of their endowment were returned 143% (\$7.17) of what they sent, while players who sent their full endowment (\$10) were only returned 102% (\$10.20) of what they sent. From talking to players, it seemed that trustees often felt responsible to reciprocate the trustor's trust when the stakes were low even considering the limited commitment problem. It became much harder for the players to rationalize reciprocating when large sums of money were at stake.

and no savings (i.e. the player must spend his winnings that same day) the average coefficient of relative risk aversion in the population is 1.42. If one does allow for savings, the average coefficient of relative risk aversion is 3222.48. If, instead, we assume CES (CRRA) utility, and no savings, the average coefficient of relative risk aversion is 2.57, and if we allow for savings it is 397.88. If we disallow savings these numbers seem fairly reasonable, given risk parameters estimated by other researchers. Allowing for savings, these numbers seem quite large. In addition, the few very wealthy players have astronomical coefficients of relative risk aversion. Without savings and assuming CARA (CRRA) utility, the highest coefficient of relative risk aversion is 34.4 (36.7), and allowing for savings it rises to 77,746 (763). Rabin (2000) has argued that expected-utility theory does not properly explain risk attitudes over modest stakes. As this bet's stakes are modest in comparison with yearly income, especially for the few extremely wealthy households in the dataset, these results are not surprising.

We can use these risk aversion parameters to look at how much the players should have sent in the trust game if their decisions were based purely on their risk preferences, and a knowledge of the distribution of how Paraguayan trustees would behave. Let us assume that the players have CARA utility, and keep in mind that the proportional payoffs for sending 8,000 Guaranies are not as high as the proportional payoffs from sending 2,000 Guaranies. We assume that the players know the distribution of payoffs for each possible quantity sent. Using this criterion, a player who did not bet anything in the risk game, should send 2,000 Guaranies in the trust game. A player who bet 2,000 Guaranies should send 4,000 Guaranies. Players who bet 4,000 or 6,000 Guaranies should send 6,000 Guaranies, and players who bet 8,000 Guaranies should send 8,000 Guaranies in the trust game.⁹ Given their risk preferences and the observed payoffs, we find that 54 players send the amount that they 'should'. Twenty-two players send more than they should, and 112 players send less than they should. We find that players are must less trusting than they ought to be given their risk preferences.

Payoffs are quite different from village to village. Players may know that, and may be using only their expectations of what the other players playing with them will do when deciding how much money to send. Let us see if the

⁹Although allowing or disallowing savings affects the derived constant of absolute risk aversion for each bet level, it does not affect the amount the players should send given their risk preferences and rational expectations of payoffs.

players come closer to sending the ‘correct’ amount in the trust game given the actions of the trustees in their game session.¹⁰ In fact, when we use only the strategies elicited from trustees in the player’s own game session as the distribution of play they are facing, we still find that only 50 players send the amount they ”should”, and 107 send less, and 31 send more.

In general, if trust were based only on risk preferences and an accurate perception of the distribution of trustee actions, we would say that most Paraguayans do not send enough in the trust game, i.e. they do not trust their village-mates as much as they ought to. Given that the monetary returns to trusting are, on average, positive, these results hint that play in the trust game is not strongly influenced by altruistic preferences, fairness preferences, or social-welfare maximizing preferences.¹¹ Firstly, a trustor with altruistic preferences would be expected to send more than the amount pure risk aversion and accurate knowledge of the distribution of returns would tell him to, not less. Secondly, a trustor maximizing total winnings would send all of his endowment to the trustee. Lastly, a trustor who cared only about fairness would send 8,000 Guaranies if he expected the trustee to return half of what he received (the mode returned) for earnings of 12,000 Guaranies per person. He would send 6,000 Guaranies if he expected the trustee to return 44% of what he received (the average returned) for earnings of 10,000 Guaranies per person. He would only send less than 4,000 Guaranies if he believed the trustee would return less than 30% of the amount received (which only 22% of the trustees did). The average sent in the trust game, 3,745 Guaranies, is much lower than the amounts suggested by considerations of fairness, altruism, or social-welfare maximizing behavior.¹²

¹⁰The results of calculating how players in different villages should play are quite variable. There are villages where players who bet nothing should send nothing, but also a village where players who bet nothing should send all 8,000 Guaranies. There are villages where players who bet 8,000 Guaranies should send 8,000 Guaranies, but also villages where players who bet 8,000 Guaranies should send only 4,000 Guaranies.

¹¹This foreshadows the results found in Section 5.3 that proxies for altruism do not influence play in the trust game.

¹²Of course, the players may have inaccurate expectations of how their village-mates will respond. They also may feel more comfortable betting on a die for which they know the exact probability distribution, as opposed to their village-mates whose actions are uncertain. See Ellsberg (1961) for a discussion of risk aversion in situations with uncertain probability distributions.

5 Disentangling Risk from Trust

We will look at our results in three different ways, running three different types of regressions. We will look at correlates of (1) the amount bet in the risk game, (2) the amount sent in the trust game without controlling for the amount bet, and (3) the amount sent controlling for the amount bet with a dummy for each of the possible bet choices (betting nothing is the excluded category). In all of these regressions we divide the amounts sent and bet by 1,000. We assume that, although both trust and risk preferences affect play in the trust game, only risk preferences affect play in the risk game. As play in the risk game depends only on the roll of a die, and not on expectations over the actions of other players, this seems to be a valid assumption. In a later section of the paper we instrument for risk and look at if our results still hold.

5.1 Correlates of risk aversion and trust

We find that variations in play in the trust game are largely explained by risk attitudes. Using the coefficients on bet size from the trust regression in Table 4 we predict the amount sent in the trust game for each bet size. In Figure 2 we plot bet size on the x -axis and the amount sent in the trust game as predicted by the coefficients on bet size in 4 on the y -axis. As the amount the player bets in the risk game increases, so does the amount he sends in the trust game. Play in the trust game depends importantly on risk attitudes.

We might wonder if this result holds for all players, or only certain groups. We rerun the trust regressions including the bet size and the bet size interacted with the gender of the player. In Table 4 we see that men are less risk-averse than are women. Nevertheless, in Table 3 we see that the correlation between risk attitudes and play in the trust game for men and women are not significantly different. Risk attitudes affect both male and female players' choices in the trust game. We also rerun the trust regression, once including an interaction with a dummy for whether or not the player has an elementary school degree, and again with an interaction with non-Guarani speakers. In general, the effect of risk preferences on play in the trust game for each group is quite similar. Actions taken in the trust game by both men and women, educated and non-educated people, and speakers of Spanish and Guarani are all affected similarly by risk preferences. This suggests that the

| | | | | | |
|------------------|---------------------|---------------------------|---------------------|-----------------------|---------------------|
| Male (N=131) | 0.269*** (0.080) | Primary Ed. (N=76) | 0.249** (0.107) | Guarani (N=153) | 0.322*** (0.082) |
| Female (N=57) | 0.232 (0.147) | No Primary Ed. (N=112) | 0.261*** (0.091) | Non-Guarani (N=35) | 0.093 (0.134) |
| Difference | 0.037 (0.166) | Difference | -0.012 (0.137) | Difference | 0.229 (0.156) |

Table 3: Coefficients on interactions with bet size in three trust regressions. (Control variables were included as in Table 4.)

result of the importance of risk attitudes in predicting play in the trust game might be generalizable to other populations.

In Table 4 we see that males tend to be less risk averse, betting more. In the trust regression which does not control for risk attitudes, men also seem to trust significantly more than women, but this is due to risk attitudes. Once we control for risk aversion, men and women no longer have significantly different levels of trust. Age has no significant effect on either risk or trust. More educated people bet more in the risk game, suggesting they are less risk averse, but send less in the trust game, suggesting that they are less trusting as well. Once we control for risk aversion, this lack of trust of the well-educated is even more accentuated. Households which speak Guarani at home, instead of Spanish or Portuguese, tend to be more risk averse (bet less). Catholic households are much less trusting, and no more or less risk averse, though because there are only eight Protestant households in the sample this result must be taken with a grain of salt. Income and nationality surprisingly have no effect on either risk aversion or trust.¹³ The dummy variable for whether or not I sat in on that household's survey (meaning that the household met me prior to playing the game) is slightly significant in explaining the amount bet on the roll of the die. Perhaps those households felt more comfortable with me, and thus bet more. This did not effect play in the trust game, possibly because the villagers now had to trust each other instead of my die, or because by the time we played the second game all

¹³We also ran regressions with different proxies for income such as material of floor, material of walls, water source, and type of fuel used for cooking to control for income effects, none of which are significant at the 10% level. Only the dummy for using a latrine (as opposed to a flushing toilet) was significant at the 5% level.

| | Bet | | Trust |
|------------------------|--------------------|--------------------|---------------------|
| | (1) | (2) | (3) |
| Male | .783** (.342) | .574* (.341) | .308 (.332) |
| Age | .064 (.045) | -.0004 (.045) | -.018 (.044) |
| Age ² | -.0006 (.0005) | 0 (.0005) | .00005 (.0004) |
| Education | .098 (.071) | -.155** (.071) | -.18*** (.069) |
| Catholic | .702 (.755) | -1.559** (.752) | -1.989*** (.729) |
| Family Size | .048 (.071) | -.083 (.07) | -.112* (.068) |
| Log(Per-Capita Income) | -.05 (.203) | .144 (.202) | .237 (.198) |
| Brazilian | -1.422 (1.307) | -.024 (1.301) | -.093 (1.265) |
| Guarani | -1.628*** (.58) | -.327 (.577) | -.026 (.568) |
| P.I. at Survey | .568* (.321) | .2 (.32) | .002 (.309) |
| Roll of Die | .086 (.094) | .107 (.093) | .081 (.089) |
| Bet 2000 | | | -.181 (.541) |
| Bet 4000 | | | 1.079** (.542) |
| Bet 6000 | | | .967 (.631) |
| Bet 8000 | | | 1.909** (.765) |
| Constant | 1.211 (2.217) | 5.582** (2.207) | 5.559** (2.22) |
| No. of Obs. | 188 | 188 | 188 |
| R^2 | .251 | .213 | .304 |

Table 4: Correlates of risk and trust. Numbers in parenthesis are standard errors. *-90%, **-95%, and ***-99% significant. Game session fixed effects were included in the regression.

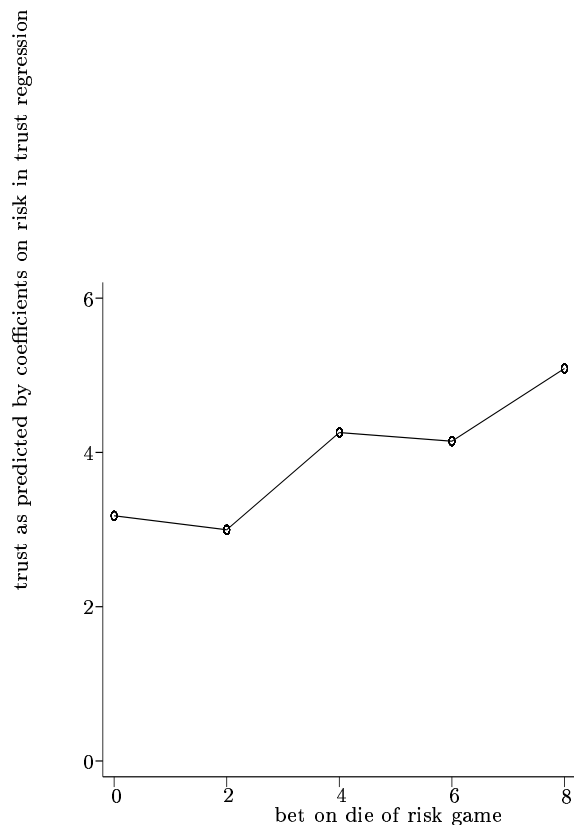


Figure 2: Effect of bet in risk game on trust, as given by coefficients on the bet in Table 4

players felt comfortable with me.

Because the risk game was played first, we might worry that players who were lucky in the risk game (had high die rolls) might send more in the trust game, feeling they were on a lucky streak. This is not borne out by the evidence, as the roll of the die¹⁴ is statistically insignificant in explaining the amount sent in the trust game, nor does controlling for the roll of the die change the other results substantively. In the trust regression the coefficients on the dummies on bet size are significant and increasing.

In Table 5 we show results from regressions including variables which one would expect to affect trust such as theft experienced and stated trust. In the survey we included a question similar to that found in the World Values Survey (WVS) asking if the respondent trusted his or her village-mates. Higher values indicate less trusting households. This variable is not significant in predicting either risk preferences, or trusting behavior. We also included a dummy variable for households which experienced no theft, as well as the log

¹⁴For those seven percent of players who bet nothing, and thus did not roll the die, we allocated them a roll of 3.5, the mean of all possible rolls of the die.

| | Bet | Trust | | Bet | Trust | |
|-------------------------|---------------------|---------------------|--------------------|--------------------|--------------------|-------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Male | .713** (.347) | .572* (.335) | .39 (.329) | .729** (.343) | .595* (.345) | .377 (.339) |
| Age | .08* (.044) | -.023 (.042) | -.042 (.042) | .079* (.044) | -.02 (.044) | -.043 (.043) |
| Age ² | -.0008** (.0004) | .0001 (.0004) | .0003 (.0004) | -.0007* (.0004) | .0001 (.0004) | .0004 (.0004) |
| Education | .115 (.071) | -.14** (.069) | -.161** (.068) | .11 (.071) | -.143** (.071) | -.165** (.07) |
| Log(PC Income) | -.155 (.198) | .173 (.191) | .263 (.19) | -.132 (.194) | .153 (.195) | .242 (.193) |
| Guarani | -1.403** (.551) | -.805 (.531) | -.511 (.527) | -1.349** (.527) | -.342 (.529) | -.041 (.522) |
| P.I. at Survey | .494 (.329) | .381 (.317) | .225 (.311) | .517 (.32) | .294 (.321) | .13 (.314) |
| No Theft | 1.25 (2.543) | 5.343** (2.454) | 4.527* (2.421) | | | |
| Log(Theft) | .733 (1.066) | 2.877*** (1.028) | 2.491** (1.013) | | | |
| Log(Theft) ² | -.077 (.108) | -.327*** (.104) | -.289*** (.102) | | | |
| WVS Trust | | | | .024 (.133) | .06 (.134) | .054 (.13) |
| Bet 2000 | | | -.008 (.526) | | | -.113 (.542) |
| Bet 4000 | | | 1.023* (.53) | | | 1.002* (.548) |
| Bet 6000 | | | 1.026* (.622) | | | 1.03 (.64) |
| Bet 8000 | | | 1.625** (.744) | | | 1.742** (.768) |
| Constant | 1.34 (3.278) | -.701 (3.163) | -.671 (3.217) | 2.403 (2.061) | 4.084** (2.069) | 3.426 (2.104) |
| No. of Obs. | 188 | 188 | 188 | 188 | 188 | 188 |
| R ² | .241 | .251 | .314 | .233 | .181 | .257 |

Table 5: Correlates of risk and trust preferences controlling for theft variables and stated level of trust. Numbers in parenthesis are standard errors. *-90%, **-95%, and ***-99% significant. Game session fixed effects were included in the regression.

and squared log of petty theft¹⁵ experienced by the households in the previous year. In order to maintain degrees of freedom we have omitted some of the insignificant variables from the previous regressions. The amount of theft the household experienced is not correlated with the player's risk aversion, while it is significantly correlated with their play in the trust game. Households which experienced no theft are significantly more trusting, but no more or less risk averse. The turning point for the log of theft experienced is approximately 4.4. Of the 83 households which experienced some amount of petty theft, 39 experienced less than 4.4 units of theft. This gives the somewhat strange implication that there is an inverse U relationship between trust and amount stolen, with a turning point approximately halfway through the continuum. Including these additional variables does not mute the significant correlation between risk attitude and trusting behavior.

In results not shown we included other variables related to theft and familiarity with the village. We had asked the villagers to tell us how many chickens they thought were stolen in their village in the past year. Households which thought more chickens were stolen also trusted significantly less (at the 10% level).¹⁶ We also included the number of years each household has lived in the village and the number of close relatives of the player who live in the village, and neither was significant in any of the regressions even at the 20% level. Again, including any of these variables does not lessen the predictive power of risk attitudes on trusting behavior.

In Table 6, we include village characteristics instead of dummies for the 17 game sessions held. Considering that these regressions have fewer explanatory variables, their *R*-squared's do not decrease much. All but one of the village-level variables (the coefficient of variation of income in the village) have insignificant effects on risk preferences. We might think that risk preferences do not depend on village characteristics once personal characteristics are accounted for. On the other hand, trust is affected by village characteristics. Villages with more inequality (a higher coefficient of variation of income) not only bet more, they also trust less. The coefficient of variation of the amount stolen from households in the village is insignificant. Larger villages are more trusting.¹⁷ Villages into which more new households have

¹⁵We actually take $\log((\text{petty theft}/1,000) + 1)$ so as not to exclude households which experienced no theft.

¹⁶142 of the game players also had answered the survey questionnaire with us, while 46 households sent a different member to play the game.

¹⁷In results not shown here, we included the number of people who played the game in

| | Bet | Trust | |
|--------------------------|---------------------|---------------------|-------------------|
| | (1) | (2) | (3) |
| Male | .741** (.347) | .514 (.33) | .328 (.323) |
| Age | .084* (.044) | -.02 (.041) | -.041 (.041) |
| Age ² | -.0008** (.0004) | .0002 (.0004) | .0004 (.0004) |
| Education | .12* (.07) | -.116* (.067) | -.14** (.065) |
| Log(Per-Capita Income) | -.22 (.182) | .196 (.174) | .308* (.172) |
| Guarani | -1.25** (.505) | -1.066** (.481) | -.762 (.471) |
| P.I. at Survey | .568* (.331) | .446 (.315) | .25 (.307) |
| No Theft | .653 (2.548) | 5.323** (2.425) | 4.583* (2.375) |
| Log(Theft) | .564 (1.07) | 2.875*** (1.018) | 2.502** (.995) |
| Log(Theft) ² | -.066 (.108) | -.328*** (.103) | -.289*** (.1) |
| Bet 2000 | | | -.102 (.51) |
| Bet 4000 | | | 1.008* (.518) |
| Bet 6000 | | | 1.092* (.605) |
| Bet 8000 | | | 1.606** (.717) |
| Size of Village | .003 (.003) | .005** (.002) | .004 (.002) |
| # of Incoming Households | -.045 (.029) | -.046* (.028) | -.027 (.027) |
| Km. to Bus Route | -.008 (.126) | .455*** (.12) | .456*** (.116) |
| CV of Income | .945* (.54) | -.561 (.514) | -.877* (.502) |
| CV of Theft | .087 (.484) | .008 (.461) | -.071 (.446) |
| No. of Obs. | 188 | 188 | 188 |
| R ² | .175 | .207 | .284 |

Table 6: Correlates of risk and trust preferences with village characteristics. Numbers in parenthesis are standard errors. *-90%, **-95%, and ***-99% significant.

| Table | Insig. | 10% | 5% | 1% | Total w/o fixed effects | Total |
|---------|--------|-----|----|----|-------------------------|-------|
| Table 4 | 8 | 2 | 1 | 0 | .0804 | .0060 |
| Table 5 | 7 | 3 | 0 | 0 | .0940 | .0077 |
| Table 6 | 9 | 2 | 4 | 0 | .0044 | .0049 |

Table 7: Significant difference in coefficients between two regressions

migrated in during the past three years are slightly less trusting. Villages which are further away from a road on which a bus passes are more trusting.¹⁸ Risk attitudes remain strongly predictive of trust play.

5.2 Trust: With and Without Controlling for Risk Preferences

One goal of this paper is to uncover the consequences of using results from the trust experiment as a measure of trust preferences without controlling for risk preferences. Are the coefficients in the trust regression significantly different when one does or does not control for risk preferences? Due to budget and time constraints, it may not always be possible to play multiple games with the same players. It is desirable to know the implications and interpretability of results from the most commonly played economic games.

To answer this question, we conduct an analysis of whether or not the coefficients in the trust regressions, including and excluding risk preferences, are significantly different from each other. We allow for a correlation in errors between regressions and employ the covariance matrix of the coefficients in the regressions. A summary of these results is presented in Table 7.

We compare the coefficients between trust regressions which do and do not include risk preferences as explanatory variables. Eight of the explanatory variables from Table 4 do not have significantly different coefficients at the 10% level. Gender, P.I. at survey, and religion have significantly different coefficients. We can reject at the .080 level that all the explanatory variables have the same coefficient excluding the village dummies, and at the

each session and it's coefficient was insignificant, thus this result is not explained by the size of the game playing group. We also included the share of male players in the group, but its effect was insignificant.

¹⁸This is surprising given the findings of Henrich, Boyd, Bowles, Camerer, Fehr, Gintis & McElreath (2001) that villages with more market integration are more trusting.

.006 level when including the village dummies. Moving on to Table 5 we again find similar results. Seven of the ten explanatory variables do not have significantly different coefficients, while P.I. at survey, gender, and language do. We can reject at the .094 level that all the explanatory variables have the same coefficient, and at the .008 level when including the village dummies. Looking lastly at the results in Table 6, nine of the variables are not significantly different between the two regressions. The remaining six include gender, language, P.I. at survey, log-income, number of new households entering the village in the last three years, and the coefficient of variation of income in the village. We can reject the hypothesis that all the coefficients (excluding the regional dummies) are equivalent with a p -value of .004, and including the regional dummies, with a p -value of .005. Variables such as gender, religion, and language are often included in trust regressions, but their effects on trusting behavior are not stable when one does and does not control for risk attitudes.

5.3 Trust and Altruism or Fairness

Many researchers have argued that the measure of trust in the trust game confounds trust with altruism or concerns of fairness (Andreoni & Miller 2002, Carter & Castillo 2002, Cox 2000). A player may send money to his anonymous partner because a) he trusts his village-mates, b) he is not very risk averse, c) he cares about increasing the total sum of money won by the village as a whole, d) he is an altruistic person, or e) he has a preference for fairness. In Section 4 we began to hint at some of these issues. In this section we control for altruism or fairness with three different sets of variables.

First we control for the share of money the player returns when he is playing the roll of trustee, as well as the average share returned by players playing with him. One might hypothesize that an altruistic player will return more money to the trustor. Looking at the first two columns of Table 8 we find that the share the player returns to the anonymous trustor when he plays the role of trustee (his trustworthiness or his generosity) is highly correlated with the amount he sends to the anonymous trustee when he plays the role of trustor. Village level trustworthiness is, surprisingly, insignificant. This might lead one to believe that trusting behavior is correlated with concerns over fairness, but play as a trustee is an endogenous decision. The amount the trustee returns to the trustor may represent his beliefs as to how other players will play, and his desire to play similarly. For example, a player may

| | Trust | | | | | |
|-------------------------|---------------------|--------------------|---------------------|--------------------|--------------------|--------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Male | .413 (.327) | .231 (.32) | .518 (.33) | .334 (.322) | .512 (.331) | .327 (.324) |
| Age | -.029 (.041) | -.051 (.041) | -.011 (.042) | -.032 (.041) | -.021 (.041) | -.041 (.041) |
| Age ² | .0002 (.0004) | .0005 (.0004) | .00006 (.0004) | .0003 (.0004) | .0002 (.0004) | .0004 (.0004) |
| Education | -.104 (.066) | -.131** (.064) | -.106 (.067) | -.13** (.065) | -.115* (.067) | -.14** (.065) |
| Log(PC Income) | .136 (.178) | .249 (.176) | .184 (.174) | .297* (.172) | .185 (.174) | .302* (.173) |
| Guarani | -.838* (.503) | -.578 (.491) | -1.116** (.482) | -.826* (.472) | -1.111** (.485) | -.783* (.476) |
| P.I. at Survey | .489 (.311) | .303 (.303) | .465 (.314) | .272 (.306) | .405 (.32) | .233 (.311) |
| No Theft | 4.68* (2.396) | 3.92* (2.35) | 5.583** (2.429) | 4.753** (2.373) | 5.377** (2.429) | 4.629* (2.385) |
| Log(Theft) | 2.648*** (1.005) | 2.266** (.983) | 2.997*** (1.021) | 2.592*** (.995) | 2.89*** (1.02) | 2.518** (.999) |
| Log(Theft) ² | -.306*** (.101) | -.267*** (.099) | -.34*** (.103) | -.298*** (.1) | -.329*** (.103) | -.291*** (.101) |
| Session Trustworthy | 1.988*** (.754) | 1.91*** (.731) | | | | |
| Individ. Trustworthy | 1.059 (3.11) | .582 (3.006) | | | | |
| Log(Donations) | | | -.121 (.095) | -.125 (.093) | | |
| Log(Gifts) | | | | | .048 (.063) | .022 (.062) |
| Bet 2000 | | -.131 (.502) | | -.179 (.512) | | -.074 (.517) |
| Bet 4000 | | .932* (.511) | | .967* (.518) | | 1.017* (.52) |
| Bet 6000 | | .982 (.597) | | .959 (.611) | | 1.109* (.608) |
| Bet 8000 | | 1.645** (.707) | | 1.56** (.716) | | 1.618** (.72) |
| Size of Village | .004* (.002) | .003 (.002) | .005** (.002) | .004* (.002) | .005** (.002) | .004* (.002) |
| # of Incoming Hhs | -.041 (.028) | -.024 (.027) | -.049* (.028) | -.03 (.027) | -.05* (.028) | -.03 (.028) |
| Km. to Bus Route | .47*** (.12) | .466*** (.116) | .481*** (.121) | .481*** (.117) | .461*** (.12) | .458*** (.116) |
| CV of Income | -.701 (.528) | -.984* (.514) | -.487 (.516) | -.805 (.504) | -.608 (.518) | -.896* (.507) |
| CV of Theft | .328 (.572) | .177 (.556) | .036 (.461) | -.054 (.445) | .099 (.477) | -.028 (.464) |
| No. of Obs. | 188 | 188 | 188 | 188 | 188 | 188 |
| R ² | .243 | .315 | .215 | .292 | .21 | .285 |

Table 8: Correlates of risk and trust preferences with village characteristics and generosity. Numbers in parenthesis are standard errors. *-90%, **-95%, and ***-99% significant.

send a higher share of his endowment because he thinks that the trustees will return a high share of the money they receive and so he may return a high share of the money he receives to play as he believes others will. Another possibility is that the player remembers his own first move as trustor when he chooses his second move as trustee. A player who sends a large amount as trustor may return a large amount as trustee, hoping that the person who receives his money will do the same.

In columns three through six we use two other proxies for altruism which do not suffer this same endogeneity bias. Columns three and four include the log of donations (in time or money) made to the church, road repairs, electrification, and other communal goals. Columns five and six include the log of gifts (of agricultural and animal products) given to friends and family. None of these other variables proxying for generosity has a significant coefficient.¹⁹ In results not shown here we included measures of relative wealth. We included the percent of players in the game session with lower annual incomes than the player himself. If fairness were a concern of the players, we might expect the relatively wealthier players to send more money in the trust game. The coefficient on this variable was not significant. The most important thing to notice about the table is how little the other coefficients change both across the columns of Table 8, as well as in comparison with the results in Table 6. Even without entering into the debate on the relation between play in the trust game and altruism or fairness preferences, we find that controlling for altruism has little effect on the relationship between trust play and risk preferences.

5.4 Instrumental Variables Approach

Throughout this analysis we have been assuming that, although risk preferences may affect play in the trust game, trust preferences do not affect play in the risk game. In the trust game players decide how much to send based both upon how they expect the other villagers to respond and on their risk aversion. On the other hand, the risk game depends only on the roll of a die, and does not involve expectations over how other villagers will play.

Still, there may be some other omitted variable which is correlated with both trust preferences and risk preferences, and causes a spurious correlation

¹⁹In results not included here we also included all four altruism variables in the risk regressions. None of the altruism variables has a significant coefficient at the 10% level.

| | Bet | Trust | Trust with IV |
|------------------------|---------------------|-------------------|-------------------|
| | (1) | (2) | (3) |
| Male | .787** (.344) | .418 (.334) | .048 (.573) |
| Age | .079* (.043) | -.041 (.043) | -.081 (.067) |
| Age ² | -.0008* (.0004) | .0004 (.0004) | .0008 (.0007) |
| Education | .112 (.071) | -.172** (.069) | -.227** (.101) |
| Log(Per-Capita Income) | -.189 (.203) | .192 (.188) | .258 (.225) |
| Guarani | -1.393*** (.532) | .014 (.52) | .692 (.986) |
| P.I. at Survey | .539* (.321) | .152 (.312) | -.105 (.463) |
| No Sickness | .491* (.292) | | |
| Animal Death / Income | -.631 (2.709) | | |
| Log(Pension) | .061 (.083) | | |
| Bet | | .269*** (.076) | .77 (.592) |
| Constant | 2.774 (2.103) | 3.547* (1.986) | 2.318 (2.658) |
| No. of Obs. | 188 | 188 | 188 |
| R^2 | .249 | .238 | |

Table 9: First and second stage IV regression. Numbers in parenthesis are standard errors. *-90%, **-.95%, and ***-.99% significant. Game session fixed effects were included in the regression.

between the two. An instrumental variables approach will help solve this dilemma. We must find variables which affect play in the trust game only through their affect on risk preferences. One possible instrument is an indicator variable for whether someone in the household has been sick enough to lose a day of work in the past year (excluding household members who are so elderly as to never work). This health shock might make household members more risk averse, but should not affect their trust in their fellow village-mates. Another possible instrument is the value of the household's animals which died in the previous year, divided by the household's total income for the year. A last possibility is the log of pension income divided by the adult equivalents in the household. In Paraguay most males over 85 or their widows receive a veteran's pension for fighting in the Chaco War. This constitutes a dependable income every month. Almost all males of the appropriate age fought in the Chaco War, so this pension income only depends on age of the veteran. Households which receive this pension income should be less risk averse, as they have a steady income they can depend on.

The IV results can be found in Table 9. We use a dummy for no sickness in the past year, the value of animals which died divided by total income, and the log of pension income, as instruments for the amount bet. In the first column of Table 9 we see that having no sickness in the family has a significant effect on risk preferences, increasing the amount bet by 500 Guaranies. The effect of the death of animals and pension income are insignificant, though they go in the correct direction. In the second column we find the trust regression which controls for the amount bet (no longer a dummy variable for each possible bet). We find that the amount bet has a significant positive affect on the amount sent in the trust game. In the third column are the IV results. The amount bet still has a positive affect on the amount sent in the trust game, and the coefficient is significant at the 20% level. Given the weakness of our instruments, it is notable that even when we control for the possible endogeneity of risk preferences, we still find a large effect of risk preferences on trust preferences. In addition, our data set contains much more information than most data sets which are used to look at play in the trust game, and the omitted variable bias problem we face should be less than those most other researchers on this topic face. It is still a fact that measured risk attitudes are predictive of play in the trust game.

6 Conclusion

The traditional trust/investment game first studied by Berg et al. (1995) measures a combination of trust preferences and risk preferences. Risk preferences play an important role in determining play in the trust game, both for the population as a whole, and for different subgroups (male/female, educated/non-educated, and Guarani/Spanish). Adding risk preferences as an explanatory variable in trust play regressions significantly changes the coefficients of other explanatory variables in the regression. In order to gain the benefits often attributed to high levels of trust, it may be sufficient for policy makers to insure against risks rather than conducting trust-building exercises, a difficult exercise at best.

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A Detailed Description of Experimental Procedures

The three enumerators and I spent three or four days in each of the sixteen villages. The first two or three days were spent surveying the households. Before we began asking questions we mentioned to the households that we would be playing a game a few days later with all the survey respondents. We said that one person per household could go to play (and we preferred, if possible, that it be the same person as the one who answered the survey questionnaire with us), and that he or she would win on average one and a half day's wages (18,000 Guaranies). When we settled on a time and place to hold the game we informed each of the households. We also told them that they would receive 1,000 Guaranies if they showed up on time, and we offered to pick them up for the game in our vehicle. The location was, in all but two of the villages, the village church.²⁰ Two of the villages were so large that people lived quite far apart, and we had many households to survey. We were worried that picking up all the players in our vehicle and playing the two games with so many people would take too much time, so we split the households up into two groups and played the game with half in the morning and half in the afternoon.²¹ In these two villages the participants of the two sessions were chosen based on their proximity to each other, and there didn't seem to be any communication between players of the morning group and the afternoon group, as the households were quite far apart.

Of the 223 households, 188 showed up for the game session. There was one village of Japanese immigrants in which none of the nine households we surveyed were interested in playing such a game and for such low stakes (they are quite wealthy) and so that village did not play the game at all. Even ignoring the Japanese, the households who did not show up are significantly wealthier than those who did²², have significantly younger household heads,²³ and trust significantly less (as measured by the World Values Survey trust question).

Almost all players showed up on time and received their 1,000 Guaranies

²⁰In the other two villages we used their dance hall instead.

²¹In these two villages we interviewed twenty and twenty-four households, while in the other villages we only interviewed between seven and sixteen households.

²²This is probably not due to their higher opportunity cost of time, as they did respond to the long survey with no pay.

²³This may be because older households have more free time to attend meetings.

immediately. We went inside the church where I had hung a chart on the wall showing different play and the payoffs each would lead to. I first explained the risk game and gave four examples of bets and rolls of the die and their payoffs to the players in Guarani (the indigenous language of Paraguay). After that, one of the enumerators went through the exact same explanation and three different examples again in Guarani, using the excuse that he thought people might not understand my accented Guarani (in fact we just wanted them to hear the instructions twice, though, my accented Guarani may have been an issue as well). They were not allowed to ask questions in the group setting, and were told to reserve questions until they came in individually to play the game.

After the explanation the players left the church and went outside to wait. The three enumerators waited outside with them, and were there to monitor that no one talked about the game. (The players were told that if they were caught talking about the game they would be disqualified.) At the same time, one of the enumerators carried out a community survey (asking the players questions about the community as a whole). I called the players into the church one at a time from a randomly sorted list. I asked each player if he or she had any questions, and went through a few more examples with them. Then I gave the player 8,000 (fake plastic) Guaranies. They could choose to bet 0, 2,000, 4,000, 6,000, or 8,000 on the roll of the die. If I rolled a 1, the player lost his bet, if I rolled a 2 he lost half of his bet, if I rolled a 3 he recuperated his bet, if I rolled a 4 he received 150% of his bet, a roll of 5 meant he doubled his bet, and a roll of 6 meant he received 250% of his bet. If they chose to bet, I then rolled the die, and we counted their payoffs. I wrote their earnings on an IOU which they saved until the end of the second (trust) game.

After all of the players had played the first game (the risk game), we called them back into the church and explained the second game (the trust game). We had a second poster explaining the payoffs of the trust game hanging on the wall, and again both I and an enumerator explained the game using different examples. The players were each given the same endowment of 8,000 Guaranies and the exact same choice options as in the first game, i.e. sending 0, 2,000, 4,000, 6,000, or 8,000. I told them I would triple the amount they decided to send and put it in an envelope with a design on the front (i.e. curve, circle, diamond, triangle, etc.) and told them not to tell anyone what their symbol was. I called them each into the church one at a time in the same order as the previous game and each one made their decision.

They handed me back their IOU on which I added the amount they had kept (i.e. not sent). After all players had chosen how much money to send I went outside and shuffled the envelopes and had one of the players ‘cut the deck’ of envelopes (upside down so they couldn’t see the figures on the front of the envelopes).

I then called the players back into the room one by one and asked them how much they would keep if they received 6,000, 12,000, 18,000, and 24,000 Guaranies respectively, thus eliciting data on all 4 possibilities. The order of the shuffled envelopes was the order in which they were given out.²⁴ When a player opened the envelope he counted how many bills were inside, and took out the amount he had precommitted to take, replacing the remaining bills in the envelope. I added the amount he had taken out of the envelope to his IOU.

After that each player was called into the church individually one last time, and was given back his original envelope. The players opened their envelopes and counted how much money had been returned to them. Then I added that amount to the other three numbers on their IOUs and gave them the cash. Playing both games took approximately two and a half hours. The players were always extremely grateful for the cash they won, as the Argentinian crisis has severely effected Paraguay as well. As of late it is extremely difficult to find a paying job. Sometimes the players would jokingly complain that we should have brought them cookies too, because they got hungry. We did always bring ice and yerba mate so that they could drink the traditional Paraguayan tea while they were waiting.

B Description of Variables

- Brazilian – Two of the 15 villages in this study had Brazilian immigrants. One of the villages was made up entirely of Brazilians while the other village was a mixture of Brazilian and Paraguayan nationals.
- Chickens stolen – The survey asked each household to estimate how many chickens had been stolen in their village in the past agricultural year.

²⁴Before the person entered the room, I checked the design on the envelope to make sure that it was not their own envelope. If it was (which did happen in rare cases) I put their envelope back into the middle of the deck and gave them the next one in the stack.

- Death of Animals – The survey asked each household how many farm animals died (of natural causes) in the past year, and what their value was. This variable is the value of the animals which died divided by the household’s total income.
- Distance to bus – In the community survey we asked how many kilometers the closest house in the village was to a bus route. In 12 of the 15 villages the answer was 0, as at least one household lived on a road where a bus passed. In 3 of the villages the answer was positive, as all households had to walk relatively far to get to the nearest bus crossing.
- Donations – We asked people how much money they donated to the church, and (separately) how much money they donated to communal goals such as electrification, running water, road repair etc. We also asked them how many days of work they donated (without pay) to the church, and (separately) to communal goals. Here we value the days of work donated at 12,000 Guaranies per day, which is a common wage for agricultural laborers. Here we use $\log(((\text{monetary donations} + 12,000 * \text{work donations}) / 1,000) + 1)$.
- Gifts – We asked people how much of each agricultural or animal product they produced they gave as gifts to family and friends. Here we use $\log((\text{gifts} / 1,000) + 1)$.
- Guarani – Paraguay is an officially bilingual country, with all schools taught in both Spanish and Guarani. Still, there is a distinct rural/urban bias in language of choice. It is NOT the case that those who speak Guarani at home have more indigenous heritage, as Paraguay is a relatively homogeneous population culturally. The survey asked which language was spoken most at home. The Brazilian immigrant population speak German or Portuguese and the Paraguayan population speak either Guarani, Spanish, or both at home.
- Income – This was calculated as agricultural income plus other income. Agricultural income is the sum of all agricultural and animal products sold in the past year, plus the sum of all agricultural and animal products which the family consumed from their own production in the year, plus the sum of all the agricultural and animal products the household gave as gifts in the past year. In addition we subtract all input costs

(e.g. fertilizers and seeds), rent they paid for agricultural land, and wages they paid to agricultural workers (in money and in kind). Other income includes remittances received, income they received for daily agricultural labor (in money and in kind) as well as for full-time salary work, pension, interest, income from running a store, income from selling prepared food products, and income from renting out machinery or land. We divide income by the adult equivalents in the household. Here we use $\log(((\text{income}/1,000)/\text{adult eq.})+1)$.

- New households – In the community survey we asked the people how many new households had moved into the village in the past 3 years.
- No sickness – The survey whether someone in the household was sick enough in the past year to miss a day of work. The elderly and mentally disabled who did not work all year are not included. This variable is 1 if there was no sickness in the household in the past year.
- Pension – Households which contain a male over the age of approximately 85, or their widow, will receive a veteran’s pension for fighting in the Chaco War. All men were required to fight in this war, no matter their education or wealth level. Here we use $\log(((\text{pension}/1,000)/\text{adult eq.})+1)$.
- Petty theft – In the household survey we asked the households about all theft experienced. Petty theft does not include the theft of cattle or horses, the theft of tractors, and armed assaults made on households (which happened more often to the households which ran stores). These larger thefts were generally considered to be perpetrated by people from outside of the village. Petty theft includes all agricultural theft (corn, watermelon, etc), theft of smaller tools (machetes and hoes), and theft of smaller animals (pigs and chicken). Here we use $\log((\text{petty theft}/1,000)+1)$.
- P.I. at survey – This is a variable which represents whether or not I sat in on the survey with that household. I attended surveys with a different enumerator each day, alternating between the three. This is a truly exogenous variable, as there was no specific type of household I tended to visit more.

- WVS Trust - In the survey we ask what share of your village-mates can you trust. 1-all, 2-more than half, 3- half, 4-less than half, and 5-none.

C Game Protocol

This protocol was copied very heavily from that which will be used by Barr, Barrett, Bolyanatz, Cardenas, de la Pena, Ensminger, Gil-White, Gurven, Gwako, Henrich, Johnson, Marlowe, McElreath, Lesorogol, Patton, and Tracer in their project “The Roots of Human Sociality: An Ethno-Experimental Exploration of the Foundations of Economic Norms in 16 Small-Scale Societies”.

INTRODUCTORY COMMENTS

Thank you all for taking the time to come today. Today’s games may take 2 to 3 hours, so if you think you will not be able to stay that long let us know now. Before we begin I want to make some general comments about what we are doing here today and explain the rules that we must follow. We will be playing some games with money. Whatever money you win in the games will be yours to keep and take home. I will be supplying the money. But you should understand that this is not my own money. It is money given to me by the University of California to use for research. These games are part of a research project involving many researchers in different countries in North America, South America, Asia, and Africa.

Before we proceed any further, let me stress something that is very important. Many of you were invited here without understanding very much about what we are planning to do today. If at any time you find that this is something that you do not wish to participate in for any reason, you are of course free to leave whether we have started the game or not.

We will be playing two games here today. If you have heard anything about any other games, you should try to forget about that. These games are completely different. It is important that you listen as carefully as possible, because only people who understand the games will actually be able to play. We will run through some examples here while we are all together. You cannot ask questions or talk while here in the group. This is very important. Please be sure that you obey this rule, because it is possible for one person to spoil the game for everyone. If one person talks about the game while

sitting in the group, we would not be able to play the game today. Do not worry if you do not completely understand the game as we go through the examples here in the group. Each of you will have a chance to ask questions in private to be sure that you understand how to play.

After we have explained the first game, you will all go outside and wait while I call you in one at a time to play. While you are outside you can talk about soccer, medicinal herbs, or anything else you want other than the games played here today. Fulgencio, Ever and Vicente will be waiting with you all and if they hear you talking about the game then you will not be allowed to play.

INSTRUCTIONS FOR THE RISK GAME

This game is played by one person alone. I will give 8,000 Guaranies to each player to start the game. The player will then have the opportunity to bet a share of this money. The player can bet 8,000, 6,000, 4,000, or 2,000 Guaranies, or can choose not to bet. After the player decides how much money he would like to bet, I will roll a six-sided die. If the die lands on one, the player will lose the money he bet. If the die lands on two, the player will lose half of the money he bet. If the die lands on three, the player will recuperate his bet, thus he will neither lose nor win money. If the die lands on four, the player will receive 1.5 times his bet. If the die lands on five the player will double his bet, and if the die lands on six the player will win 2.5 times his bet. Thus, rolls of one and two are bad, a roll of three is neither good nor bad, and rolls of four, five, and six are good.

This is the end of the game. The player will go home with the share of the original 8,000 Guaranies he did not bet, plus whatever money he won in the bet. This game will only be played once with each person and then the game is over.

Here are a few examples [*These examples were all given using fake plastic money and a die to show all the possible outcomes. I gave the first four examples and an enumerator repeated the above instructions and then gave the last three examples.*]:

1. Imagine that the player bets 8,000 Guaranies. He is left with no money. Laura throws the die. The die lands on 3. This means that Laura will give the player back his original bet. Thus the player will return home with 8,000 Guaranies.

2. Now we will try another example. Imagine that the player bets 6,000 Guaranies. He is left with 2,000 Guaranies. Laura throws the die. The die lands on 2. This means that the player loses half of his bet. The player loses 3,000 Guaranies and Laura gives him back 3,000 Guaranies. Thus the player has the 2,000 Guaranies he didn't bet plus the 3,000 Guaranies that Laura gave back to him, and so he goes home with 5,000 Guaranies.
3. Now we will try another example. Imagine that the player bets 4,000 Guaranies. He is left with 4,000 Guaranies. Laura throws the die. The die lands on 4. This means that Laura gives the player back his original bet plus an extra half of his original bet. This means she gives him 4,000 plus 2,000, i.e. 6,000 Guaranies. Thus the player has the 4,000 Guaranies he didn't bet plus the 6,000 Guaranies that Laura gave back to him, and so he goes home with 10,000 Guaranies.
4. Now we will try another example. Imagine that the player bets 2,000 Guaranies. He is left with 6,000 Guaranies. Laura throws the die. The die lands on 5. This means that the player doubles his bet. The player bet 2,000, and 2 times 2,000 is 4,000 so Laura gives him back 4,000. Thus the player has the 6,000 Guaranies he didn't bet plus the 4,000 Guaranies that Laura gave back to him, and so he goes home with 10,000 Guaranies.
5. Now we will try another example. Imagine that the player bets 6,000 Guaranies. He is left with 2,000 Guaranies. Laura throws the die. The die lands on 6. This means that the player doubles his bet, plus gets an extra half of his bet in addition. The player bet 6,000, and two times 6,000 is 12,000. He wins an additional extra half of his original bet, or 3,000 Guaranies. Thus Laura gives him 12,000 plus 3,000 or 15,000 Guaranies. Thus the player has the 2,000 Guaranies he didn't bet plus the 15,000 Guaranies that Laura gave back to him, and so he goes home with 17,000 Guaranies.
6. Now we will try another example. Imagine that the player bets 8,000 Guaranies. He is left with nothing. Laura throws the die. The die lands on 1. This means that the player loses his entire bet. Thus the player goes home with 0 Guaranies.

7. Now we will try another example. Imagine that the player doesn't bet anything. He is left with all 8,000 Guaranies. There is no need for Laura to throw the die. The player goes home with 8,000 Guaranies.

Note that, the more money the player bets, the more he can win, but the more he can lose as well. He could go home with more or less than 8,000 Guaranies as a result. Please remember that you are not betting the money you may have brought with you in your pocket here today. The money you will be using to bet is money that I have given you for that purpose.

We will discuss a few more examples with you when it is your turn to come in and play. At that point you can ask any question you want. Please remember that while you are waiting you cannot talk about the game or you will be disqualified.

[Then each person was taken in one at a time. There was another list of examples and test questions for which I went through as many as seemed necessary until the player understood the game. Then the player decided how much money to bet, and if he bet some positive amount I rolled the die. Then I gave him an IOU that said I owed him the amount of money that corresponded to the roll of the die.]

Now you must wait until all of the other players have played this game. Then we will play another game, and at the end of both games I will pay you. Remember that you cannot talk about the game while you are waiting to play the second game.

INSTRUCTIONS FOR THE TRUST GAME

This game is played by pairs of individuals. Each pair is made up of a Player 1 and a Player 2. Each of you will play this game two times, once as a Player 1 and once as a Player 2. Each of the two times you play it will be with a different person. You will be playing with someone from your own village. However, none of you will know exactly with whom you are playing. Only I know who is to play with whom and I will never tell anyone else. It is important for you to remember that each time you play will be with a different person. When you play as Player 1, you will play with one person from this room here today. When you play as Player 2 you will be playing with a totally different person.

I will once again, as in the previous game, give 8,000 Guaranies to each Player 1. Player 1 then has the opportunity to send a portion of his 8,000 Guaranies to Player 2. He could send 8,000, or 6,000, or 4,000, or 2,000, or

nothing. I will triple whatever amount Player 1 decides to give to Player 2 before it is passed on to Player 2. Player 2 then has the option of returning any portion of this tripled amount to Player 1. Then the game is over.

I will triple any money that Player 1 decides to send to Player 2 before it is put in an envelope. Each envelope has a different symbol on it, such as a circle, triangle, square, etc. You can try to remember the symbol on your envelope, but if you don't I will remember it. It is extremely important not to tell anyone the symbol on your envelope. If you are sending money to Player 2, I will put the tripled amount into the envelope with your symbol on it, if you are not sending money to player 2, the envelope with your symbol on it will remain empty.

After every player has decided how much, if any, to put into the envelope with his symbol on it I will shuffle all the envelopes. Then, each of you will come into the room one at a time, and you will be assigned the envelope that is on the top of the stack. You will not receive your own envelope; it will be the envelope that another player in this room has sent. [*This stack of envelopes was placed behind some kind of border, so that the player could not see how thick they were before we elicited his strategies.*] You will then decide how much (if any) of the money in the envelope you want to keep and how much (if any) you want to leave in the envelope to be returned to the person who placed the money there.

After every player has decided what to do with the money in the envelope and opened an envelope to do as he precommitted to do. I will call you into the building one last time one at a time to open up your original envelope and see how much, if any, money is left in it. Thus in playing the role of Player 1, the player will go home with whatever he kept from his original 8,000 Guaranies, plus anything returned to him by Player 2. In playing the role of Player 2 he goes home with whatever was given to him by Player 1 and then tripled by me, minus whatever he returned to Player 1. Then I will pay you the amount I owe you from both the first and second games.

Here are some examples [*I worked through these examples having all the possibilities laid out in front of people. When each hypothetical Player 1 made their choice I visually showed the effect of tripling the money and putting it in the envelope. Then I visually showed Player 2 opening the envelope and making his decision. I gave the first three examples and the enumerator repeated the above instructions and gave the last two examples.*]:

1. Imagine that Player 1 gives 8,000 Guaranies to Player 2. Laura triples

this amount, so Player 2 gets 24,000 Guaranies (3 times 8,000 equals 24,000). At this point, Player 1 has nothing and Player 2 has 24,000 Guaranies. Then Player 2 has to decide whether he wishes to give anything back to Player 1, and if so, how much. Suppose Player 2 decides to return 6,000 Guaranies to Player 1. At the end of the game Player 1 will go home with 6,000 Guaranies and Player 2 will go home with 18,000 Guaranies.

2. Imagine that Player 1 gives 6,000 Guaranies to Player 2. Laura triples this amount, so Player 2 gets 18,000 Guaranies (3 times 6,000 equals 18,000). At this point, Player 1 has 2,000 Guaranies and Player 2 has 18,000 Guaranies. Then Player 2 has to decide whether he wishes to give anything back to Player 1, and if so, how much. Suppose Player 2 decides to return nothing to Player 1. At the end of the game Player 1 will go home with 2,000 Guaranies and Player 2 will go home with 18,000 Guaranies.
3. Imagine that Player 1 gives 4,000 Guaranies to Player 2. Laura triples this amount, so Player 2 gets 12,000 Guaranies (3 times 4,000 equals 12,000). At this point, Player 1 has 4,000 Guaranies and Player 2 has 12,000 Guaranies. Then Player 2 has to decide whether he wishes to give anything back to Player 1, and if so, how much. Suppose Player 2 decides to return 6,000 Guaranies to Player 1. At the end of the game Player 1 will go home with 10,000 Guaranies and Player 2 will go home with 6,000 Guaranies.
4. Imagine that Player 1 gives 2,000 Guaranies to Player 2. Laura triples this amount, so Player 2 gets 6,000 Guaranies (3 times 2,000 equals 6,000). At this point, Player 1 has 6,000 Guaranies and Player 2 has 6,000 Guaranies. Then Player 2 has to decide whether he wishes to give anything back to Player 1, and if so, how much. Suppose Player 2 decides to return 4,000 Guaranies to Player 1. At the end of the game Player 1 will go home with 10,000 Guaranies and Player 2 will go home with 2,000 Guaranies.
5. Imagine that Player 1 doesn't send anything to Player 2. There is nothing for Laura to triple. Player 2 gets 0 Guaranies and so can't return anything. At the end of the game Player 1 will go home with 8,000 Guaranies and Player 2 will go home with nothing.

Note that the larger the amount that Player 1 gives to Player 2, the greater the amount that can be taken away by the two players together. However, it is entirely up to Player 2 to decide what he should give back to Player 1. The first player could end up with more than 8,000 Guaranies or less than 8,000 Guaranies as a result.

We will go through more examples with each of you individually when you come to play the game. In the meantime, do not talk to anyone about the game. Even if you are not sure that you understand the game, do not talk to anyone about it. This is important. If you talk to anyone about the game while you are waiting to play, we must disqualify you from playing.

Now I will call in each person one by one to decide whether or not to send any money to the other anonymous player, and if so, how much. After all of you have played as Player 1 and decided what to do with your envelope I will come back out to shuffle the envelopes and then redistribute them. Then each of you will come in a second time to play as Player 2.

[Then I brought in each player one by one and used more examples from a list of examples and asked some test questions until the person understood.]

First player: Now you will play as Player 1. Here are your 8,000 Guaranies. *[At this point 8,000 Guaranies are placed on the table in front of the player.]* You should hand me the amount of money you want to be tripled and passed on to Player 2. You can give me nothing, 2,000 Guaranies, 4,000 Guaranies, 6,000 Guaranies, or 8,000 Guaranies. Player 2 will receive this amount tripled by me. Remember the more you give to Player 2 the greater the amount of money at his or her disposal. While Player 2 is under no obligation to give anything back, we will pass on to you whatever he or she decides to return. *[Now the player hands back whatever he or she wants to have tripled and passed to player 2.]*

Second player: Now you are playing as Player 2. Before you get to look at the envelope which is assigned to you I will ask you how much you would keep and how much you would give back depending on how much money you find in the envelope. Whatever you say now will be binding when you actually open the envelope. Remember you can return nothing or keep nothing or anything in between. So, if Player 1 put 2,000 Guaranies in the envelope, and I tripled it, so that you open the envelope and find 6,000 Guaranies inside, what will you do with the 6,000 Guaranies? *[Write down their response.]* If player 1 put 4,000 Guaranies in the envelope, and I tripled it so you find 12,000 Guaranies in the envelope, what will you do with the 12,000 Guaranies? *[Write down the response.]* If player 1 put 6,000

Guaranies in the envelope, and I tripled it so you find 18,000 Guaranies in the envelope, what will you do with the 18,000 Guaranies? [*Write down the response.*] If player 1 put 8,000 Guaranies in the envelope, and I tripled it so you open it and find 24,000 Guaranies, what will you do with the 24,000 Guaranies? [*Write down the response.*] Here is the envelope that is assigned to you. You can now open it and count the money inside. How much is in it? You said that if you found X Guaranies you would keep Y and return Z . Please take Y out of the envelope and put Z back in.

D Estimating Risk Aversion Parameters

First we calculate risk aversion parameters assuming the player must consume his winnings that same day. If we know a player chose to bet 4,000 Guaranies, we assume that a bet of 4,000 Guaranies maximizes his utility. When the player chooses to bet nothing, we have assumed that he maximizes his utility by choosing to bet 1,000 Guaranies.²⁵

We assume that there is no uncertainty in earnings. Thus, the player's daily earnings equal the household's annual income divided by the number of adult equivalents in the household and divided by 365. We also assume that the player will not share his winnings with other members of his family. As the coefficient on family size was not significant in the risk regression, this assumption does not seem too egregious. We have also divided all monetary quantities by 1,000.

When we allow for savings, we must take into account the interest rate and the share of winnings that each player will save. The annual interest rate given by Crédito Agrícola de Habitación, which is the main lender to small-scale farmers, is 17.5%. This implies a daily interest rate of .0442% with compounding. Let us define the following variables: y is the player's daily income, c is his consumption, w is his winnings in the risk game, s is the amount he decides to save, R is one plus the daily interest rate, and β is his discount factor. Thus the player's problem can be written as

$$V(w) = \max_s [U(y + w - s) + \beta V(sR)]$$

²⁵For the case of CES utility with savings, when the player bets nothing, we have had to assume he maximizes his utility by choosing to bet 1,900 Guaranies, because the program had problems converging for the wealthier villagers with lower bet sizes.

and, taking the first order condition, we find

$$U'(y + w - s) = \beta R V'(sR)$$

which, by the envelope theorem simplifies to

$$U'(y + w - s) = \beta R U'(y + sR - s).$$

Exponential utility implies that $U(c) = -\frac{1}{\sigma} \exp^{-\sigma c}$, while CES utility implies that $U(c) = \frac{c^{1-\gamma}}{1-\gamma}$. We can solve iteratively, first for s (which may be negative), and then for the value of σ or γ which this implies given the player's bet.

Changing the discount factor does not change the risk aversion parameters implied. With exponential utility, changing the player's discount factor changes the amount he saves by a constant, and with CES utility, it changes the amount he saves proportionally, so neither affects the risk aversion parameters implied. On the other hand, changing the interest rate does affect the risk aversion parameters implied by the model.