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

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April 27, 2004

Abstract

Play in the traditional trust experiment depends both on trust beliefs and on levels of risk aversion. We ran two experiments with a diverse set of subjects in fifteen villages of rural Paraguay, the traditional trust experiment and a new experiment measuring only risk aversion. We find that risk attitudes are highly predictive of play in the trust game. In addition, omitting risk aversion as a regressor in trust regressions significantly changes the coefficients of important explanatory variables such as gender and wealth. We also use data on income and bet choice to calculate players' coefficients of relative risk aversion.

*This research has received funding from the Social Science Research Council (SSRC) Program in Applied Economics, the Russell Sage Foundation (RSF) Small Grants in Behavioral Economics, Berkeley Institute of Business and Economic Research (IBER), Berkeley Center for International and Development Economics Research (CIDER), and the Giannini Foundation. I'd like to thank Nava Ashraf, Colin Camerer, Jeff Carpenter, Herb Gintis, E. Lance Howe, Dean Karlan, Margaret Levi, Richard McElreath, Perry Shapiro, and participants at the NEUDC 2003 conference for comments. I am grateful to José Molinas and everyone at Instituto Desarrollo for their support while in Paraguay. I am indebted to Ethan Ligon and Matthew Rabin for their invaluable advice and their patience.

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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 between a highly trusting person and a person with low levels of risk aversion (Barr 1999, Karlan 2003, Eckel & Wilson 2004); i.e. a person may take more trusting actions because he actually trusts more or because he is more willing to take a gamble.[1] Consistent with Gambetta (1988) we define trust to be an agent's subjective probability that another agent will perform an action beneficial to him. In the trust game it is represented by the player's assessment of the probability distribution over the actions of his anonymous partner, where a higher level of trust means a subjective distribution with higher mean and lower variance.

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 by the trustor (player 1) in the trust game.[2] This effect is not dissipated when we control for altruism. In addition, controlling for risk aversion in trust regressions significantly changes the coefficients of some of the correlates of play in the trust game. Males have often been found to be more trusting than woman in the trust game (Chaudhuri & Gangadharan 2002, Burks, Carpenter & Verhoogen 2003, Eckel & Wilson 2000, Buchan, Croson & Solnick 2003). In this paper we find that this effect is due to females' lower levels of risk aversion, and not to lower levels of trust *per se*. We also run a robustness check and find trustworthiness and trust are highly correlated with each other, while risk and trustworthiness are not.

It is important to determine what portion of play in the trust game depends on trust and what portion depends on risk aversion for both academic as well as policy oriented reasons. There is a growing literature on the benefits of trust for increasing economic growth (Knack & Keefer 1997), improving the functioning of organizations (Fukuyama 1995, La Porta, Lopez-

[1] In fact, Andreoni, Castillo & Petrie (2003) found "unexpectedly" that risk aversion importantly affects play in ultimatum games as well.

[2] Henceforth when we write "play in the trust game" we are referring to the trustor's move, not the trustee's move (player 2). The trustee's move will be briefly analyzed in Section 5.3

de-Silanes, Shleifer & Vishny 1997) and increasing village incomes (Narayan & Pritchett 1999). Is the policy proscription for increasing trusting behavior to encourage increasing trustworthiness and social capital in communities? Or, if trusting behavior is mostly a signal of low risk aversion, should policy-makers focus on providing insurance instead. The rest of this paper is organized as follows: Section two discusses the game design and previous applications of trust and risk games, Section three discusses the data and the experimental procedures, the Section 4 calculates risk aversion parameters for the players, Section 5 disentangles the contribution of risk aversion to play in the trust game, and section 6 concludes.

2 Game Design and Previous Applications of Trust and Risk Games

In the original trust game (sometimes called the investment game) designed by Berg et al. (1995), 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 sub-game perfect 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 sub-game perfect 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. A trustee who returns money may do so out of concerns for fairness or reciprocity, but in this paper we do not focus on why a trustee would return money rather than keeping it for himself.

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 levels of risk aversion will play the role of trustor differently (Barr 1999, Eckel & Wilson 2004). 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 by the trustor in the trust game depends both on trust beliefs and on risk aversion. Play be the trustee, on the other hand, will be unrelated to levels of risk aversion. Given the amount he is sent, his payoffs are not uncertain and depend only on his own actions.

Many researchers have already taken note of this confound. Barr (1999) found that villagers in resettled villages of Zimbabwe sent less 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. Karlan (2003) finds that, in Peru, individuals who sent more in the trust game were more likely to default on their microfinance loans and save less. He concludes that apparently highly trusting people may actually just be "prone to taking bad risks".

Other papers have compared trust and risk aversion in a controlled setting (Ashraf, Bohnet & Piankov 2003, Eckel & Wilson 2000, Eckel & Wilson 2004) using university students as their subjects. Ashraf et al. (2003) ran both trust and risk experiments in a within-subjects design. Their risk experiment was a choice between cash and a 50/50 lottery to win \$300 or nothing. They find that risk aversion has no significant effect on trust decisions, though the effects do go in the correct direction. The game they used to measure risk aversion is quite different from the trust game, and so may not lead as easily to direct comparison. In addition, though the stakes were relatively high, only one player in a group of approximately thirty was randomly chosen to be paid according to his or her choices. 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 rather than the BDM version with multiple discrete dollar choices. Eckel & Wilson (2004) play a binary choice trust game and a binary choice risk game with similar payoffs with a group of college students. They find that risk and trust are not correlated. Because their bet size is only \$5 it is improbable that this measures risk aversion in American college students.[3]

Our game design allows us to begin to disentangle actual trust (belief that the trustee will reciprocate) from risk aversion. We ran two experiments,

[3]In fact, 75% of the subjects chose the risky gamble over the certain amount with the *same* expected value, indicating apparently risk-seeking behavior.

one measuring players' risk aversion, as well as the more traditional BDM investment game. The risk experiment was designed to resemble the first move in the investment game but involved only risk and no trust, as the payoffs were decided by the roll of a die. A major contribution of this paper is that 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 in total an average of two days' wages, c) the trust game was not played as a binary decision, but, as in the version played by Berg et al. (1995), with a range of discrete choices, and d) the risk game was designed to be quite similar in format and have quite similar payoffs to the 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).

3 Data Source and Experimental Procedures

The data used in this paper was collected in 2002 as the fourth round of a panel data set.[4] We interviewed 223 households, 166 of which were the same household as in the original panel and 30 of which were an offshoot of the original household (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 related to him.

More detailed experimental procedures are explained in Appendix A, 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

[4]In 1991 the Land Tenure Center at the University of Wisconsin in Madison and the Centro Paraguayo de Estudios Sociológicos in Asunción designed and implemented a survey of 300 rural Paraguayan households in three departments (i.e. states) and sixteen villages across the country. The sample was random, and stratified by land-holdings. The original survey was followed up by subsequent rounds of data collection in 1994, 1999, and, most recently, 2002.

in the survey to play the games. They were told they would win, on average, one and a half day's wages, or 18,000 Guaranies.[5] 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 the two groups were quite far apart. 188 of the 223 families surveyed sent a family member to play the game.[6]

The risk game was played first. The game's instructions were given in a group setting with no questions allowed. Then the players were called into the room one at a time, given a second explanation, and allowed to ask any questions in private. They then made their bet, saw the roll of the die, and were given an IOU for their winnings. The players were then called back into the room to hear the explanation of the second game. Every player played both the role of trustor and trustee. They came into the room 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, asking the trustees how much they would send back given each of the four possible amounts they might receive and told them that they were then committed to sending back that amount. 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 to open their original envelope and see how much was left. At this point we paid them the total of their winnings.

As in many games played in rural villages (Barr 2003, Karlan 2003), 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. In addition, Burks et al. (2003) find that playing both roles in the trust game has the effect of decreasing both trust (the amount sent) and trustworthiness (the share returned). They hy-

[5]I predicted average winnings of a bit more than 18,000 Guaranies based on results of experiments run by other researchers in developing countries, but preferred to exceed expectations rather than disappoint. In actuality the players won, on average, 24,000 Guaranies each (9,000 in the risk game, 9,000 as trustor, and 6,000 as trustee).

[6]None 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.

Table 1: Individual Summary Statistics

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 Wealth[b]	23,700,000	40,000	763,000,000
Gifts given	309,060	0	3,290,000
Donations Given	211,684	0	2,140,000
P.I. at Survey	31.9%		
Bet in Risk Game[c]	3,436	0	8,000
Sent in Trust Game	3,745	0	8,000
Share Returned by Trustee[d]	.434	0	1
No. of Obs.	188		

[a]The variables are described in more detail in Appendix B.

[b]The relevant exchange rate is approximately 4,800 Guaranies to the dollar.

[c]For both the risk and trust game the choice set was 0, 2,000, 4,000, 6,000, or 8,000.

[d]Note, any share greater than .33 means that trust has positive payoffs, as the amount the trustor sent had been tripled originally.

pothesize that playing both roles reduces the player's sense of responsibility for the well being of his partner and reduces his sense of guilt for behaving selfishly. If this is the case, then playing both roles will decrease the correlation of play in the trust game with altruism and cause trust beliefs and risk aversion to be the two main determinants of play.

In Table 1 we find summary statistics for the players. The players are of extremely diverse ages, education levels, and wealth levels. In Table 2 we find the summary statistics for the villages surveyed. They are also of diverse levels of wealth, inequality, and size. A more detailed description of the variables is found in Appendix B. In the risk game nine percent of the players bet nothing and seven percent of the players bet all 8000 Guaranies,

Table 2: Village Summary Statistics

Variable	Mean	Min	Max
Households	175.7	30	720
Households Migrated In	12.2	0	55
Km to Bus	.67	0	7
Mean Wealth	25,500,000	2,272,317	140,000,000
Gini of Wealth among Players	.577	0.273	.838
No. of Obs.	15		

while the mean bet was 3,436 Guaranies. The average amount sent in the trust game was slightly higher, with seven percent of the players sending nothing, nine percent sending everything, and a mean amount sent of 3,745 Guaranies. Forty percent of players bet the same amount in both games, while 23% of the players bet more and 36% trusted more. A Wilcoxon signed-rank test for paired data rejects the hypothesis that the median difference between the bet in the risk game and the amount sent in the trust game is zero with a p-value of .0386.

We can compare our results on trust with those of other trust games (Barr 2003, Berg et al. 1995) to test for understanding by the players and comparability of results. The trust game played by Barr in rural Zimbabwe was also designed to give payoffs to each player of approximately one half day's wages. The principal difference between the experiments she ran in Zimbabwe and those we ran in Paraguay is that in Paraguay players played both the role of trustor and trustee, rather than only playing one role. In addition, the Paraguayan players played the risk game first, which they did not in Zimbabwe. A Mann-Whitney rank sum test of equality in the distributions of the amount sent in the Paraguayan and Zimbabwean populations cannot reject the null that the two distributions are the same with a p-value of .1374, and a two-sample Kolmogorov-Smirnov test for equality of distributions cannot reject the null with a p-value of .580. We can also compare our results with those of Berg et al. (1995). Their trust game was played in the United States and it was double-blind (which neither the games in Paraguay nor the games in Zimbabwe were). Players in developed countries have been found to be more trusting than those in developing countries (Ensminger 2002), which makes comparisons difficult, but we find that in Paraguay 7% of players sent

nothing, in Zimbabwe 6% of players sent nothing, and in the US 9% of players sent nothing. In Paraguay the mean investment was 47% of the endowment, in Zimbabwe it was 43% of the endowment, and in the US it was 52% of the endowment. The mean response by the trustee (as a proportion of the initial investment) was 130% in Paraguay, 128% in Zimbabwe, and 89% in the US. Thus, the results from our Paraguayan experiments seem quite comparable to previous results in other countries.

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 sample average from the actual rolling of the die was 118%.) The average percent of the amount sent by the trustor in the trust game recouped from all of the different strategies elicited by the trustee was 131% (with a standard deviation of 64.2). 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).[7] There was only one village in which trust didn't pay on average, and in that village the mean percentage of the amount bet which was recouped was 97%.

4 Calculating Risk Aversion Parameters

In the previous section we found that the returns to trusting are slightly higher (and have a smaller standard deviation) than the returns to betting and on average people trust more than they bet. In this section we use information on players incomes and bets in the risk game to calculate their coefficient of relative risk aversion. Then we use this coefficient and the distribution of potential returns in their session of the trust game to see if they bet as much as they should have assuming they knew the distribution of returns from the trust game and assuming their only consideration was maximizing their earnings.

We first calculate the coefficient of relative risk aversion for each player,

[7] We 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.

given the bet they made in the risk game. We assume that the bet the player chose is the exact amount which maximized his utility. 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 Appendix C. If one assumes exponential (CARA) utility, 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. 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 level of risk aversion, and a knowledge of the distribution of how trustees in their village would behave. Let us assume that the players have CES (constant elasticity of substitution) utility. Given the players' levels of risk aversion and the observed distribution of payoffs[8], and assuming no savings, we find that 50 players send the amount that they 'should', 33 players send more than they should, and 105 players send less than they should. If we allow for savings we find that only 43 players send the amount that they 'should', 5 players send more than they should, and 140 players send less than they should.[9] We find that players are much less trusting than they ought to be given their levels of risk aversion.

In general, if trust were based only on risk aversion and an accurate perception of the distribution of trustee responses, we would say that most

[8] As we used the strategy method, we know the full distribution of payoffs in each village for each possible amount sent.

[9] The results are similar if one uses the distribution of payoffs in the whole country rather than the distribution of payoffs in each village or if one assumes exponential rather than CES utility.

Paraguayans do not send enough in the trust game. This would mean that they do not trust their village-mates as much as they ought to, and they have inaccurate expectations of how their village-mates will respond. On the other hand, they may feel more comfortable betting on a die for which they are sure of the probability distribution, rather than on their village-mates whose actions are uncertain. See Ellsberg (1961) for a discussion of choice rules for situations with uncertain probability distributions. This apparent lack of trust could also be due to betrayal costs discussed by Bohnet & Zeckhauser (2004). They claim a trustor receives disutility if he is betrayed by the trustee and so he might send less to avoid this disutility (which does not occur when playing with a die).

5 Disentangling Risk from Trust

We will disentangle risk aversion from trust in Section 5.1 by 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 in the trust game controlling for the amount bet.[10] In Section 5.2 we see if our results still hold after controlling for altruism and reciprocity. In Section 5.3 we run a robustness check on the assumption that although both trust and risk aversion affect play in the trust game, only risk aversion affects play in the risk game.

5.1 Correlates of Risk Aversion and Trust

We find that variations in play in the trust game are largely explained by risk attitudes. As the amount the player bets in the risk game increases, so does the amount he sends in the trust game. Throughout all regressions, no matter what other variables were included, play in the trust game depends importantly on risk attitudes.

In the first column of Table 3 we see that males tend to be less risk averse than females, betting more. In the trust regression which does not control for risk attitudes (column 2), men also seem to trust significantly more

[10] All regressions are OLS with heteroskedasticity-consistent standard errors. Running the same analysis with the ordered probit model gives quite similar results, though the OLS results are presented for ease in interpretation of the coefficients.In all regressions we divide the amounts sent and bet by 1,000.

Table 3: Correlates of play in the risk and trust games using OLS. Numbers in parenthesis are heteroskedasticity-consistent standard errors. *-90%, **-95%, and ***-99% significant. Game session fixed effects were included in the regression.

	Bet	Trust	Trust
	(1)	(2)	(3)
Male	.778**	.578*	.362
	(.328)	(.335)	(.324)
Age	.069	.004	-.014
	(.044)	(.042)	(.04)
Age-Squared	-.0007*	-.00009	.00004
	(.0004)	(.0004)	(.0004)
Education	.077	-.157**	-.178**
	(.067)	(.076)	(.077)
Catholic	.583	-1.584***	-1.746***
	(.702)	(.592)	(.565)
Family Size	.057	-.087	-.103
	(.075)	(.067)	(.068)
Log(Per-Capita Wealth)	.221**	.132	.071
	(.096)	(.108)	(.102)
Brazilian	-2.121	-.164	.424
	(1.729)	(1.236)	(1.213)
Guarani	-1.565**	-.332	.102
	(.646)	(.582)	(.552)
P.I. at Survey	.532*	.222	.074
	(.314)	(.318)	(.301)
Roll of Die	.093	.108	.082
	(.089)	(.089)	(.084)
Bet			.277***
			(.079)
Obs.	188	188	188
R^2	.271	.219	.278

than women, but this is found to be due to risk attitudes. Once we control for risk aversion in column 3, men and women no longer have significantly different levels of trust. Women have often been found to trust significantly less than men in the trust game (Chaudhuri & Gangadharan 2002, Burks et al. 2003, Buchan et al. 2003, Eckel & Wilson 2000) but in Paraguay we find that this is solely due to their higher levels of risk aversion.

We also see that wealthier households are less risk averse implying decreasing absolute risk aversion. These wealthier households are also slightly more trusting before one controls for risk aversion, though after controlling for risk aversion they trust no differently than less wealthy households. More educated people send less in the trust game, suggesting that they are less trusting. Households which speak Guarani at home, instead of Spanish or Portuguese, are slightly more risk averse (bet less) but trust no more or less than others. Catholic households are much less trusting, and no more or less risk averse, though there are only eight non-Catholic (Protestant) households in the sample. The dummy variable for whether or not I sat in on that household's survey (meaning that the household met me a few days 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 by the time we played the second game all 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 die[11] 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 Table 4, we include five village characteristics instead of dummies for the 17 game sessions held. The individual-level results are not greatly affected by the change. Players in smaller villages with more immigration bet less, perhaps because these players live in a rapidly changing environment which makes them more risk averse. Villages further away from a road on which a bus passes are more trusting. Mean wealth of the players and wealth inequality among the players are insignificant in all regressions. In results not shown here, we included the number of players in each game session

[11] We allocated the nine percent of players who bet nothing, and thus did not roll the die a roll of 3.5, the mean of all possible rolls of the die.

Table 4: Correlates of play in the risk and trust games with village characteristics using OLS. Numbers in parenthesis are heteroskedasticity-consistent standard errors. *-90%, **-95%, and ***-99% significant.

	Bet	Trust	Trust
	(1)	(2)	(3)
Male	.749**	.668**	.479
	(.319)	(.303)	(.296)
Age	.084**	-.004	-.025
	(.042)	(.038)	(.036)
Age-Squared	-.0009**	-1.00e-05	.0002
	(.0004)	(.0004)	(.0004)
Education	.069	-.137*	-.154**
	(.066)	(.075)	(.078)
Log(Per-Capita Wealth)	.189*	.119	.072
	(.106)	(.105)	(.103)
Guarani	-.702	-.567	-.391
	(.526)	(.437)	(.433)
P.I. at Survey	.523	.34	.208
	(.319)	(.308)	(.293)
Bet			.252***
			(.084)
Size of Village	.004**	.002	.001
	(.002)	(.002)	(.002)
# of Incoming Households	-.05**	-.012	-.0003
	(.022)	(.023)	(.022)
Km. to Bus Route	.002	.344***	.344***
	(.066)	(.107)	(.105)
Mean(Log-Wealth)	-.031	.204	.212
	(.247)	(.226)	(.225)
Gini of Wealth	.967	.434	.191
	(1.236)	(.942)	(.943)
Obs.	188	188	188
R^2	.165	.123	.179

Table 5: Coefficients on interactions with bet size in three trust regressions. (Control variables were included as in Table 4.)

Male	0.288***	Primary Ed.	0.290**	Guarani	0.312***
(N=131)	(0.096)	(N=76)	(0.116)	(N=153)	(0.097)
Female	0.130	No Primary Ed.	0.225*	Non-Guarani	0.081
(N=57)	(0.180)	(N=112)	(0.115)	(N=35)	(0.160)
Difference	0.158	Difference	0.065	Difference	0.231
	(0.208)		(0.161)		(0.185)

and the share of male players in each game session, but their effects were insignificant. Risk attitudes remain strongly predictive of trust play.

We might wonder if the relationship between risk and trust is the same for all players, or if it only holds for certain groups. We rerun the trust regressions from Table 4 three times, the first time including the bet size and the bet size interacted with the gender, the second time with the bet size interacted with an education dummy interacted with, and lastly with an interaction with primary language of the player.[12] In Table 3 and 4 we saw that men were less risk-averse than women. Nevertheless, in Table 5 we see that the correlation between risk attitudes and play in the trust game for men and women are not significantly different (though men's risk attitudes affect their play in the trust game more so than do women's). In general, the effect of risk aversion 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 aversion, and are not significantly different from each other. It is not the case that some groups of people view the trust game as a pure game of risk while others view it purely as a game of trust. This suggests that the result of the importance of risk attitudes in predicting play in the trust game might be generalizable to other populations.

One goal of this paper is to uncover the consequences of using results from the trust experiment as a measure of trust without controlling for risk aversion. Are the coefficients in the trust regression significantly different

[12]The education variable is a dummy for whether or not the player completed elementary school.

Table 6: Significant difference in coefficients between regressions with and without controlling for risk.

Table	Insig.	10%	5%	1%	Total w/o fixed effects	Total
Table 3	5	3	2	1	.0041	.0008
Table 4	4	4	4	0	.0005	.0005

when one does and does not control for risk aversion? 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 the bet in the risk game, are significantly different from each other. We allow for a correlation in the errors between the two regressions and use the covariance matrix of the coefficients in the regressions to test equality in coefficients. A summary of these results is presented in Table 6.

Five of the explanatory variables from Table 3 do not have significantly different coefficients at the 10% level when one does and does not control for the bet in the risk game. The coefficient on Guarani is significantly different at the 1% level, gender and wealth at the 5% level, and age-squared, Brazilian, and P.I. at survey at the 10% level. We can reject at the .0041 level that all the explanatory variables have the same coefficient excluding the village dummies, and at the .0008 level when including the village dummies. Looking at the results in Table 4, four of the coefficients are not significantly different between the two regressions. The remaining eight include gender, age and age squared, and wealth at the 5% level and Guarani, P.I. at survey, size of village, and number of new households entering the village in the last three years at the 10% level. We can reject the hypothesis that all the coefficients are equivalent with a p-value of .0005. Variables such as gender, age, wealth, and indigenous heritage 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.

5.2 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 2003, Cox 2004). There are many reasons a player may send money to his anonymous partner including the possibilities that a) he trusts his village-mates (believing they will return a high share of the amount they receive as trustee), 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 altruistic, or e) he has a preference for fairness. We now control for altruism or fairness and see if this affects our results on the relationship between trust and risk aversion.

First we control for the share of money the player returned when he played the role of trustee, as well as the average share returned by all trustees in the same game session. One might hypothesize that an altruistic player will send more as trustor and return more as trustee, thus appearing more trusting and more trustworthy. Looking at the first two columns of Table 7 we find that the share the player returns to the anonymous trustor when he plays the role of trustee (his trustworthiness) 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 in determining trust. This might lead one to believe that trusting behavior is correlated with altruism or fairness. Trust beliefs and trustworthiness may also be correlated because a player plays as trustee in the same way he expects others to play (his trust beliefs). 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: the log of gifts (of agricultural and animal products) given to friends and family and the log of donations (in time or money) made to the church, road repairs, electrification, and other communal goals. Neither of these variables is a significant predictor of trust. The most important thing to notice about the table is how little the other coefficients change both across the columns of Table 7, as well as in comparison with the results in Tables 3 and 4. Even without entering 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 aversion.

Table 7: Correlates of play in the risk and trust games with village characteristics and generosity using OLS. Numbers in parenthesis are heteroskedasticity-consistent standard errors. *-90%, **-95%, and ***-99% significant.

	Trust	Trust	Trust	Trust	Trust	Trust
	(1)	(2)	(3)	(4)	(5)	(6)
Male	.5*	.333	.603**	.435	.617**	.448
	(.298)	(.297)	(.304)	(.301)	(.306)	(.302)
Age	-.006	-.03	-.0004	-.023	.009	-.015
	(.037)	(.035)	(.037)	(.035)	(.038)	(.035)
Age-Squared	-2.58e-06	.0003	-.00006	.0002	-.00009	.0001
	(.0004)	(.0004)	(.0004)	(.0004)	(.0004)	(.0004)
Education	-.119	-.14*	-.129*	-.15*	-.125*	-.146*
	(.075)	(.078)	(.075)	(.078)	(.074)	(.077)
Log(Per-Capita Wealth)	.125	.075	.095	.048	.118	.069
	(.104)	(.103)	(.111)	(.107)	(.106)	(.104)
Guarani	-.442	-.275	-.588	-.416	-.557	-.387
	(.423)	(.419)	(.44)	(.439)	(.432)	(.428)
Bet		.256***		.256***		.256***
		(.082)		(.084)		(.084)
Trustworthiness of Individual	1.891**	1.864**				
	(.895)	(.85)				
Trustworthiness of Session	-1.006	-.985				
	(2.244)	(2.093)				
Log(Gifts)			.065	.059		
			(.068)	(.066)		
Log(Donations)					-.09	-.078
					(.088)	(.084)
Size of Village	.002	.0006	.002	.001	.002	.001
	(.002)	(.002)	(.002)	(.002)	(.002)	(.002)
# of Incoming Households	-.009	.003	-.017	-.003	-.015	-.001
	(.023)	(.022)	(.023)	(.022)	(.024)	(.022)
Km. to Bus Route	.33***	.332***	.345***	.346***	.356***	.355***
	(.117)	(.114)	(.109)	(.106)	(.11)	(.107)
Mean(Log-Wealth)	.206	.212	.253	.254	.233	.236
	(.225)	(.223)	(.229)	(.227)	(.229)	(.229)
Gini of Wealth	.458	.191	.439	.177	.548	.273
	(.979)	(.986)	(.945)	(.937)	(.962)	(.96)
Obs.	188	188	188	188	188	188
R^2	.147	.206	.122	.181	.121	.18

5.3 Issues of Endogeneity

Throughout this analysis we have been assuming that although risk aversion may affect play in the trust game, trust does not 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.

Still, one might think that because we played the risk game before the trust game we encouraged the players to think of the trust game as a gamble as well.[13] We have shown in Section 3 that the distribution of our results for play in the trust game is similar to that in other countries. In addition, in Table 8 we have run two regressions, one on trustor behavior and one on trustee behavior. In both regressions we include as regressors the bet made by the player and his play in the other role in the trust game. We find that both risk-aversion and trustworthiness (or reciprocity) are significant predictors of trust. On the other hand, a player's play as trustor is a significant predictor of his play as trustee, while his risk aversion is not. This robustness check shows that play in the trust game and in the risk game are measuring two very different quantities. The player sees his play as trustor as being partly related to his trust and trustworthiness and partly related to his risk aversion. On the other hand, his trustworthiness is only related to his trust. Trustworthiness is not correlated with risk aversion, as it shouldn't be since the trustworthiness decision is not made under any uncertainty.[14] 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 that faced by most other researchers on this topic. No matter what other variables we include, we still find that measured risk attitudes are predictive of play in the trust game.

[13] This problem is faced by any researcher using more than one experiment in a 'within' players design. Eckel & Wilson (2004) play the trust game first followed by 11 risky decisions, Ashraf et al. (2003) play two dictator games and a trust game (in different orders for different players) and then six risky decisions, Karlan (2003) played a trust game and then a public goods game, while Carter & Castillo (2003) play a dictator game and then a trust game.

[14] It is interesting to note that households which give more gifts (a sign of altruism or reciprocity) are significantly more trustworthy. Also, females are slightly less trustworthy, as found by Barr (2003). From discussions with the players, this seemed to be because women were not accustomed to having access to money of their own and so were much less willing to give it up.

Table 8: Trust and trustworthiness regressions using OLS. Numbers in parenthesis are heteroskedasticity-consistent standard errors. *-90%, **-95%, and ***-99% significant.

	Trust	Trustworthiness
	(1)	(2)
Male	.339	.049
	(.298)	(.032)
Age	-.03	.005
	(.035)	(.004)
Age-Squared	.0003	-.00004
	(.0004)	(.00004)
Education	-.136*	-.005
	(.079)	(.008)
Log(Per-Capita Wealth)	.059	-.006
	(.106)	(.012)
Guarani	-.274	-.076
	(.424)	(.049)
Log(Gifts)	.037	.012**
	(.065)	(.006)
Bet	.255***	-.003
	(.082)	(.007)
Amt. Sent as Trustor		.018**
		(.009)
% Returned as Trustee	1.68**	
	(.831)	
Size of Village	.0006	.0004**
	(.002)	(.0002)
# of Incoming Households	.003	-.003*
	(.021)	(.002)
Km. to Bus Route	.334***	.001
	(.113)	(.01)
Mean(Log-Wealth)	.23	.01
	(.223)	(.022)
Gini of Wealth	.054	.07
	(.95)	(.114)
Obs.	188	188
R^2	.206	.132

6 Conclusion

The traditional trust/investment game first studied by Berg et al. (1995) measures a combination of trust beliefs and levels of risk aversion. Risk aversion plays 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). This result is robust to including variables representing altruism. In addition, including the bet in the risk game as an explanatory variable in trust play regressions significantly changes the coefficients of other explanatory variables in the regression. Though men are often found to be more trusting than women, this seems to be due to risk aversion, and not due to differences in levels of trust. The finding that wealthier people trust more than poorer households is also muted when one controls for risk aversion. Caution must be used when correlations between trust and wealth are used to encourage the formation of social capital, rather than the institution of insurance mechanisms.

A Detailed Description of Experimental Procedures and Protocol

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 the survey 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 total (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 drive them to the game in our vehicle. The location was either the village church or the village dance hall. Two of the villages were so large that people lived quite far apart, and we had many households to survey so in these villages we split the households into two groups and played the game with half in

the morning and half in the afternoon.[15] Participants were assigned to one of the two sessions 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 surveyed, 188 showed up for the game session. None of the nine households surveyed in the village of Japanese immigrants were interested in playing such a game 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 did[16], have significantly younger household heads,[17] 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 immediately. We went inside the room where I 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 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 room 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.) I called the players into the room 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 by placing their bills on the table. 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 recouped his bet, if I

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

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

[17] This may be because older households have more free time to attend meetings.

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 both games.

After all of the players had played the first game (the risk game), we called them back into the room 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 the same instructions but 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 room 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.[18] 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 room 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

[18]Before 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.

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.

A.1 Game Protocol

This protocol is closely related to that employed 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. There are many researchers in different countries in North America, South America, Asia, and Africa playing these same games.

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 recoup 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 his winnings.*]

Now you must wait outside 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 Player2. 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 doing, 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.

B Description of Variables

- Brazilian – A dummy for players of Brazilian heritage. One of the fifteen villages was made up entirely of Brazilians while another village was a mixture of Brazilian and Paraguayan nationals.

- Distance to bus – The number of kilometers the closest house in the village was to a bus route. In 12 of the 15 villages the answer was 0, and in 3 of the villages the answer was positive.

- Donations – The sum of money a household donated to the church and donated to communal goals such as electrification, running water, road repair etc. as well as the number of days of work they donated (without pay) to the church and communal goals where a day of work was valued at 12,000 Guaranies per day. Here we use log((monetary donations + 12,000*work donations)/1,000) +1).

- Gifts – The sum of the value of each agricultural or animal product a household produced that it gave as gifts to family and friends. Here we use log((gifts/1,000)+1).

- Guarani – Paraguay is an officially bilingual country, with all schools taught in both Spanish and Guarani. It is not the case that those who speak Guarani at home have more indigenous heritage. The survey asked which language was spoken most at home. The Brazilian immigrant population speaks German or Portuguese and the Paraguayan population speaks either Guarani, Spanish, or both at home.

- New households – The number of new households which moved into the village in the past 3 years (from the community survey).

- P.I. at survey – A dummy for 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 and there was no specific type of household I tended to visit more.
- Wealth – This is the sum of the value of the land, tools, and animals they own. Here we use log(wealth/1,000).

C 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 maximized his utility. When the player chose to bet nothing, we have assumed that he would have maximized his utility by choosing to bet 1,000 Guaranies.[19]

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 mulitplied 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 Habilitación, 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

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

and, taking the first order condition, we find

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

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

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 implied by 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.

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