Report on the bias in the probabilities assigned to the high and low payoff is the gamble choice game played as part of the risk pooling game in Colombia

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1. The problem

We first noticed that there was a problem with the risk pooling game data from Colombia when preparing a presentation in March 2011. Specifically, we noticed that according to Table 2 of the paper the highest expected payoff that the participants could secure was 6,000 Peso. However, Table 3 reports that the average winnings in the 2nd round of gamble choice games were 6,133 Pesos. If all of the participants had selected gambles 5 or 6, this average payoff would have been acceptable. However, Table 3 also reports that around two thirds of the participants chose gambles with lower expected payoffs.

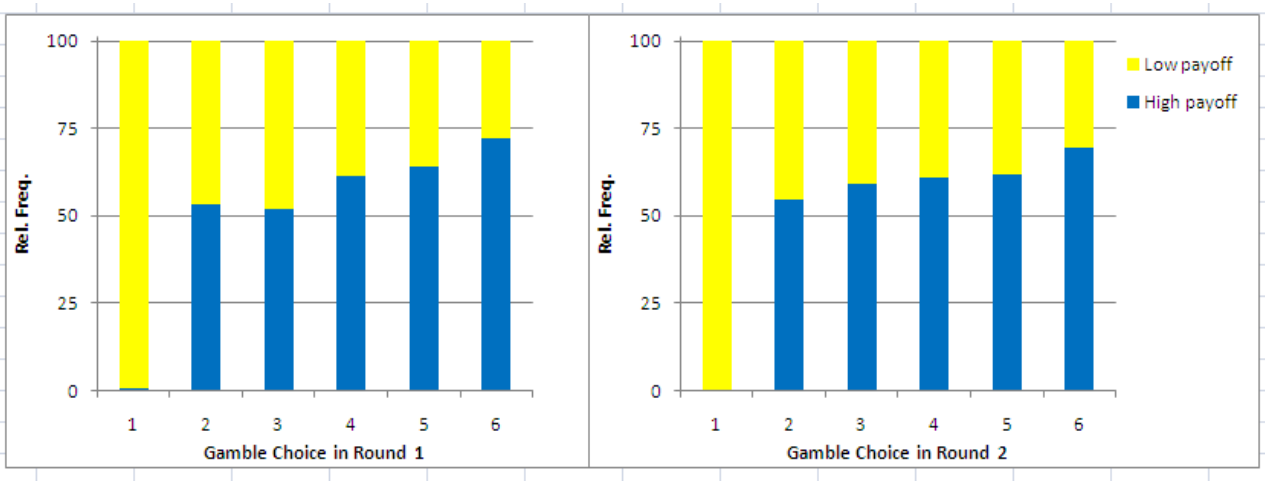
2. A closer look at the problem

Overall, according to our data 58 percent of the participants won the high payoff in the 2nd gamble choice game. This is already elevated given our sample size. Moreover, if we cross tab the participants' 2nd round gamble choice with whether, according to our data, they won the high payoff, we get a different picture (see the right-hand panel of Table A and Figure A below). First, all those who chose gamble 1, the safe choice, were coded as winning the low payoff and this lowered the overall rate of winning the high payoff. Second, the likelihood of being recorded as winning the high payoff increases as we move from gamble 2 to gamble 6, i.e., as the spread between the low and high payoff increases.

Table A: The percentages of participants who won low and high payoffs in the first and second rounds of the gamble choice game

	Round 1			Round 2		
Gamble chosen	low payoff %	high payoff %	Obs.	low payoff %	high payoff %	Obs.
1	100.0	0.0	206	100.0	0.0	140
2	46.5	53.5	419	45.4	54.6	306
3	48.3	51.7	435	40.9	59.1	421
4	38.9	61.1	697	39.2	60.8	681
5	36.0	64.0	267	38.2	61.8	416
6	27.7	72.3	354	30.5	69.5	413
All	45.2	54.8	2,378	42.2	57.8	2,377

Figure A



The same problem can be observed in the 1st round gambles (see left-hand panel of Table A). In this case the average recorded winnings were 5,842 Peso.

2. Possible Explanation

We have considered and investigated three possible explanations:

a. fraud on the part of the field researchers without the participants knowing;
b. fraud with the participants complicit;
c. a form of altruism on the part of the field researchers.

2.1 Fraud on the part of the field researchers without the participants knowing

How it could have worked: A participant chooses his gamble, plays and gets the low or high payoff. However, on occasions when the participant gets the low payoff, the field researcher(s) in charge of recording the data pays the participant the low payoff but records and charges the project the high payoff and pockets the difference. Note that the riskier the gamble chosen by the participant the more lucrative this would have been to the field researchers. And this could explain the apparent relationship between winning the high payoff and the riskiness of the gamble.

In addition, the field researchers could have recorded a riskier gamble choice than a participant actually made. Recording a riskier gamble choice and winning the high payoff would have yielded a pocketable return for the field researchers under all conditions, although the added return to falsifying the gamble choice data would have been small.

Investigation and findings: With the cooperation of the organization in Colombia who undertook the experiments in the field, we were able to establish that the data on gamble choice winnings in the

dataset matches the receipts signed by the participants. Given that the majority of the participants were literate and, thus, able to read the receipts, this rules out this possible explanation.

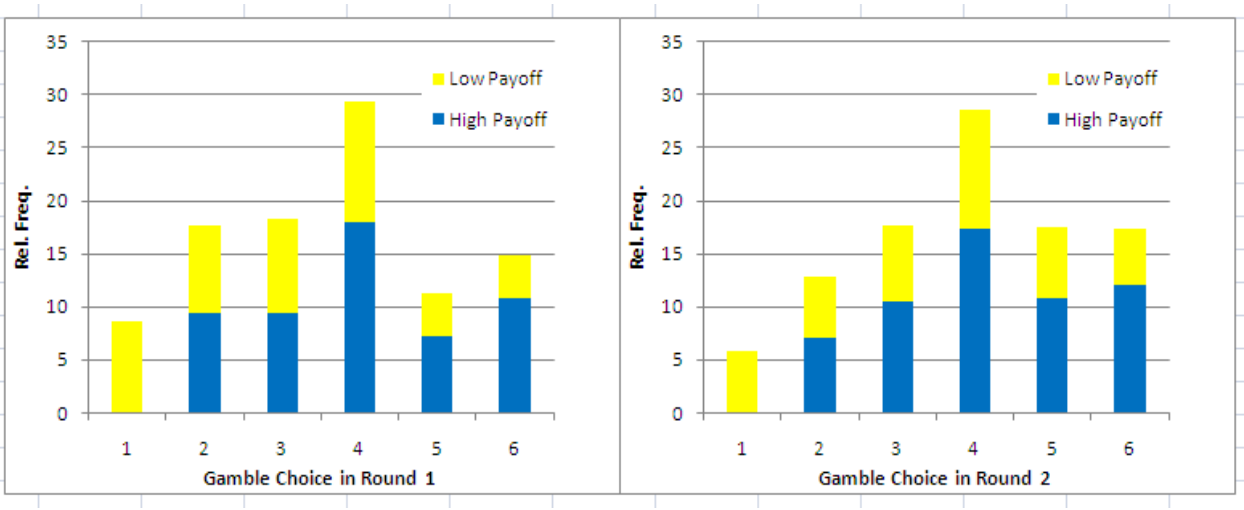
2.2 Fraud with the participants complicit

How it could have worked: A participant chooses his gamble, plays and gets the high or the low payoff. However, on occasions when the participant gets the low payoff, the field researcher(s) records and charges the project the high payoff and split the difference between the low and high payoff between themselves and the participant.

In addition, the field researchers could have recorded a riskier gamble choice than a participant actually made and thereby generated another sum of money to split between the two of them.

Investigation and findings: We cannot unequivocally rule this out. However, given how much work the field researchers had to do in order to ensure that each experimental session ran smoothly and was completed within a single day, we think it highly unlikely that they would have had time to negotiate divisions of the spoils of complicit corruption with a sufficient number of participants to generate the findings reported above. Further, given the small return per negotiation, the time, effort, and possible risk associated with each and every negotiation with a participant, it seem unlikely that it would have appeared worth the effort to the field researchers.

Figure B



The possible miss-recording of the gamble choice data is a particular cause for concern, especially in the first round of the game as gamble choice in the first round is a key variable in our analysis. Again, we cannot unequivocally rule out this possibility. However, we are inclined to conclude that, if there were incidences of miss-recorded gamble choices, they were rare. We conclude this because:

- in general, the distributions of gamble choices are broadly in line with distributions generated by other similar experiments and not excessively skewed to the right as one would expect had low risk gamble choices been recorded as high risk choices (see Figure B);

- the higher incidence of recorded gamble choice "6"s as compared to "5"s in round 1 is the most worrying feature of Figure A because the greatest return to miss-recording *both* the gamble choice and the winnings occurs when the subject chooses gamble 5 and then wins the low payoff. In this case, if the field researcher records a gamble choice of 6 and a high payoff win, the pocketable amount is 11,000Pesos. However, note that this is only 1,000Pesos more than if they record the actual gamble choice made and also note that this would do only marginal damage to the validity of the data.

2.3 A form of altruism on the part of the field researchers

How it could have worked: Imagine an other regarding field researcher conducting the one-on-one gamble choice games with participants who are much poorer than herself. It seems reasonable to assume that she would prefer participants to leave their meeting with her having won more rather than less money. And, this being the case, she might, either consciously or sub-consciously, take subtle steps to reduce the chances of a participant receiving the low payoff.

The experimental protocol was very clear about how the gamble choice games should be conducted and was designed to ensure that the probability of getting the high or low payoff was 50:50 and that this was obvious to the participants. Here is a back translation (from the Spanish to the English) of the relevant passage in the protocol:

> "How do we know how much you will earn? It will be determined by playing 'pick a hand' game. I'll explain: in my hands I will have a yellow ball and a blue ball (*always have the two balls in the same hand before bringing it to your back*); I will hide my hands behind my back and I will place a ball in each hand. I will then show you my two hands closed and you will have to pick one of the two. If you pick the hand where I have the blue ball, you will win the amount of money in the blue part of the colored chart for the option you chose; if you pick the hand with I have the yellow ball, you will win the amount of money in the yellow part of the chart for the option that you picked. (*show the decision chart*)" [1]

However, if the field researcher were to ignore the protocol and start with one ball in each hand and not mix them when her hands were behind her back or if, having followed the protocol, she were to allow the colour of one ball to be seen by the participant through gaps in her fingers she would increase the likelihood of the participant picking the hand with the blue ball in and thereby securing the high payoff.

[1] In Spanish: "Como vamos a saber que valor usted se va a ganar? Eso va a estar determinado por el juego escoja una mano. Ya le explico de que se trata ese juego: En mis manos yo tendré una bolita amarilla y una bolita azul, (*siempre poner las dos bolitas en la misma mano antes de llevarlas a la espalada*) yo voy a esconder mis manos detrás de mi espalda y allí pondré en cada mano una bolita. Luego le mostraré a usted mis dos manos cerradas y usted tendrá que escoger una de las dos. Si usted escoge la mano en donde yo tengo la bolita azul, usted se ganará la cantidad de dinero que esta en la parte azul de la tabla, de la opción que usted escogió, si usted escoge la mano en donde yo tengo la bolita amarrilla, usted se ganará la cantidad de dinero que está en la parte amarilla de la tabla de la opción que usted escogió. (*mostrar la tarjeta de decisión*)"

The riskier the gamble, the greater the incentive to an other regarding field researcher to bias the odds in favour of the participant picking the hand with the blue ball in. So, this could also explain the relationship between the riskiness of the gamble chosen and the likelihood of winning the high payoff that we observed in Table A above.

Investigation and findings: Having eliminated non-complicit fraud, all but eliminated complicit fraud, and had several meetings with both the directors and some of the field researchers employed by the organization that conducted the experiments in the field, we decided that this was the most likely explanation for the observed biases in the probabilities. Then, we gave some thought to whether and how we could set this up as a testable hypothesis.

Table B: Logit analysis of winning the high payoff to a gamble

	Round 1		Round 2
Gamble Chosen (GC)	0.363	**	-0.185
	(0.155)		(0.175)
Ln(consumption) (LnC)	0.040		-0.070
	(0.048)		(0.060)
GC x LnC	-0.020	*	0.020
	(0.012)		(0.014)
Female	-0.036		-0.024
	(0.035)		(0.042)
Age	0.001		-0.001
	(0.001)		(0.001)
Education	0.003		0.001
	(0.004)		(0.005)
Session dummies included	yes		yes
Observations	2378		2377

Notes: Unit of analysis a participant; marginal effects and corresponding standard errors (in parentheses) reported; ** significant at the 5% level; * significant at the 10% level.

While we could not think of a way to test the hypothesis in its simple form, we came up with the following related and testable hypothesis: an other regarding field researcher who manipulated the probabilities in favour of a participant would have been more likely to do so the poorer the participant. To test this hypothesis we estimated the two logit models presented in Table B. In each, the dependent variable takes the value 1 if an individual won the high payoff in their gamble and zero otherwise. The key explanatory variables are the gamble chosen, which takes values 1 to 6 with higher numbers indicating riskier gambles, the natural log of household consumption and the interaction between the two. If other regarding preferences on the part of the field researchers are the origin of the bias and those preferences are more strongly invoked when the field researchers faced poorer participants, we would see a positive coefficient on “Gamble Chosen” and a negative coefficient on the interaction term

"GC x LnC" as this would indicate that the observed biases are greater for poorer households. The analysis of the first round of gamble choices offers evidence in support of the hypothesis. The analysis of the second round does not, possibly owing to some sort of self correction on the part of the field researchers.

Admittedly, the evidence based on hard data is weak, but combined with the interviews we conducted we considered it sufficient to conclude that the biased probabilities were owing to other regarding preferences on the part of (some of) the field researchers

Further implications: Having concluded that this was the case, we had to consider the possibility that some of the experimental participants might have realized that they were not facing 50:50 odds prior to engaging in their group formation and choosing their second round gambles. The rest of this report presents the various analyses we have undertaken in order to establish whether they knew and whether the results reported in our paper were driven by them knowing. Our findings from these analyses can be summarized as follows: we find no compelling evidence that the participants knew that they were facing more favourable odds and we find that the results reported in our paper are robust to the exclusion of those subjects who could have known.

3. Did some participants know the likelihood of winning a risky lottery was greater than 50 percent?

To address the question of whether some participants know the likelihood of winning a risky lottery was greater than 50 percent, we need to construct a variable indicating with some degree of accuracy the likelihood that each participant faced a biased upwards probability of winning a risky lottery. We took two different approaches to defining such a variable. One of these approaches is based on the assumption that those who did not win a high payoff in the first round could not have known that the likelihood of winning a risky lottery was greater than 50 percent.

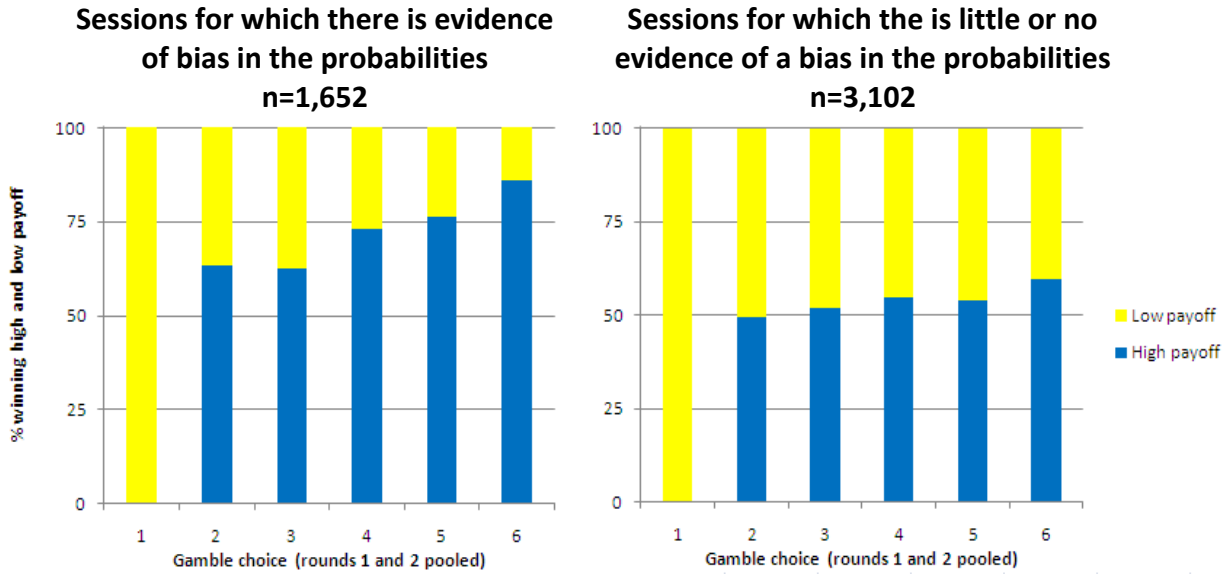
The other approach is based on an analysis of how the probability of winning a high payoff varied across experimental sessions. We work with sessions for three reasons. First, we were unable to identify which field researchers worked with which participants during the gamble choice games second, the teams were occasionally remixed between sessions, and third, the propensity for a field researcher to manipulate the probabilities may not have been stable over time. Focusing on sessions allows us to identify field research team effects, while also accounting for those effects changing over time and owing to the re-mixing of teams.

The approach involved estimating a linear probability model with a dependent variable equal to 1 if the participant got a payoff>3000Pesos for their gamble and zero if they got a payoff<=3000Pesos and a full set of session dummies as the explanatory variables. We did this

focusing on first round gamble choices for all participants, all participants who chose gamble 4, 5 or 6, only participants who chose gamble 6. Then we went through the same process focusing on second round gamble choices and finally we went through the process one more time focusing on the pooled sample of all gamble choices. So, we estimated nine linear probability models in all. For each model we conducted a series of linear restriction tests designed to identify the sessions within which the probability of winning the high payoff was greater than 50 percent. Finally, we collated the results from the nine sets of linear restriction tests and identified the sessions for which the tests consistently indicated a bias. By consistently we mean that the probability was significantly (10% level) greater than 50 percent according to at least four of the nine linear restriction tests relating to the session, at least one of those significant test results related to each of the rounds, and none of the tests indicated that the probability was significantly less than 50 percent. Thus we identified 23 out of the 70 sessions in which the probabilities appeared to be biased upwards.

In Figure C we split the sample of participants into those in sessions where there is consistently significant evidence that the probabilities are biased (left-hand panel) and those where there is not (right-hand panel).

Figure C



The figure indicates that this approach to identifying the sessions in which there was a bias in the probabilities was largely though possibly not entirely successful.

Now, we can investigate whether some participants knew that the likelihood of winning a risky lottery was greater than 50 percent by looking at whether and how they adjusted the lottery choices between the first and second round. If, during the first round, they discovered that the

probability of winning the high payoff was greater than 50 percent we would expect them to take a riskier gamble in the second round.

Table C: Cross tabs of gamble choices in rounds 1 and 2 dividing the sample according to whether they won a high or low payoff in the first gamble choice

Those who, according to the data, received the **low** payoff in round 1

		2nd Gamble choice						
		1	2	3	4	5	6	Obs
1st Gamble choice	1	12.68	14.15	20	28.78	11.22	13.17	205
	2	8.21	19.49	27.18	21.54	12.31	11.28	195
	3	10.95	15.24	19.05	25.71	16.19	12.86	210
	4	5.17	15.13	16.24	28.78	21.03	13.65	271
	5	8.33	14.58	12.5	29.17	23.96	11.46	96
	6	15.46	12.37	18.56	22.68	15.46	15.46	97
	Obs	102	166	208	283	176	139	1,074

Those who, according to the data, received the **high** payoff in round 1

		2nd Gamble choice						
		1	2	3	4	5	6	Obs
1st Gamble choice	1	0	0	100	0	0	0	1
	2	4.46	20.98	19.2	25.45	10.71	19.2	224
	3	4	9.33	27.56	32.44	13.78	12.89	225
	4	1.88	9.15	16.2	42.72	17.61	12.44	426
	5	1.75	9.94	10.53	19.88	39.18	18.71	171
	6	3.13	6.25	7.81	20.31	16.8	45.7	256
	Obs	38	140	213	398	240	274	1,303

10% - 20%
20% - 30%
30% - 40%
40% - 50%

Table C presents two cross tabs of round 1 and round 2 gamble choices. The top cross tab is for those who received the low payoff in round 1, the bottom cross tab is for those who, according to our data, received the high payoff in round 1. If high payoff winners in round 1 had discovered the greater than 50 percent probabilities and had tended to choose riskier gambles in the second round, it would manifest as darker shading towards the top right-hand corner of the bottom table. No such pattern is evident. The most visible pattern is that high payoff winners are more inclined to stick with their first choices than the low payoff winners.

In Table D we split the sample between those who attended sessions for which there is consistent and significant evidence of a bias in the probabilities and those who attended apparently non-problematic sessions. Once again, a comparison of the two cross tabs gives very little cause for concern. That almost half of those who chose the riskiest gamble in the first round in the problematic sessions chose the

riskiest gamble again in the second round is worthy of note. However, this could simply be owing to their winnings in the round 1 rather than to discovering that the chance of winning the high payoff for that gamble was greater than 50 percent.

Table D: Cross tabs of gamble choices in rounds 1 and 2 dividing the sample according to whether they attended a session for which there is evidence of a bias in the probabilities

Those who, according to the data, participated in sessions where there is little or no evidence of a bias in the odds

		2nd Gamble choice						
		1	2	3	4	5	6	Obs
1st Gamble choice	1	14	15.33	18.67	30.67	9.33	12	150
	2	7.24	20.00	23.45	23.79	11.03	14.48	290
	3	9.59	12.18	25.46	28.78	13.28	10.70	271
	4	4.15	12.23	17.03	38.86	17.47	10.26	458
	5	5.63	11.88	13.75	25.62	31.25	11.88	160
	6	7.66	8.56	13.51	22.52	17.57	30.18	222
	Obs	113	208	295	462	251	222	1,551

Those who, according to the data, participated in sessions where there is evidence of a bias in the odds

		2nd Gamble choice						
		1	2	3	4	5	6	Obs
1st Gamble choice	1	8.93	10.71	25.00	23.21	16.07	16.07	56
	2	3.88	20.93	21.71	23.26	12.40	17.83	129
	3	3.66	12.2	20.12	29.88	17.68	16.46	164
	4	1.26	10.04	14.64	34.31	21.76	17.99	239
	5	1.87	11.21	7.48	19.63	37.38	22.43	107
	6	4.58	6.87	6.11	18.32	14.5	49.62	131
	Obs	27	98	126	219	165	191	826

10% - 20%
20% - 30%
30% - 40%
40% - 50%

These cross tabs are reassuring. They suggest that the participants were unaware of the bias in the probabilities or, if they were aware of a bias in the first round gamble, considered it to be an isolated incident that was unlikely to be repeated in the second round.[2]

[2] It is worth recalling here that the participants were unlikely to meet with the same field researcher in both rounds of the gamble choice game.

4. Are the results reported in our paper driven by the bias in the probabilities introduced by the field researchers?

In this section of the report we present two additional sets of analyses:

- we rerun each of the Logit estimations presented in Table 5 using only the sample of participants who won less than 3000Pesos from their first round gamble;
- we rerun each of the Logit estimations presented in Table 5 using only the sample of participants who participated in sessions for which there is little or no evidence of upward bias in the probabilities.

Table E: Re-working Table 5 using only the sample of participants who won less than 3000Pesos from their first round gamble

	All dyads		Close friends and family	Other dyads	
	1	2	3	4	5
Difference in gamble choice (round 1)	$-5.9e^{-4}$	-0.004	-0.023	-0.005	-0.006
	(0.002)	(0.008)	(0.083)	(0.007)	(0.007)
Close friends and family	0.324 ***	0.076 *			
	(0.068)	(0.042)			
Diff. in gamble choice 1 x Close friends and fam	-0.016 *	-0.013 ˙			
	(0.009)	(0.008)			
Both recognised friendship		0.374 ***	0.362 ***	0.340 ***	0.341 ***
		(0.057)	(0.111)	(0.072)	(0.072)
Both recognised kinship		0.101 ˙	0.143	-0.033	-0.033
		(0.063)	(0.200)	(0.044)	(0.044)
One recognised friendship, other kinship		0.260 **	0.154	0.262	0.259
		(0.133)	(0.192)	(0.269)	(0.265)
One recognised friendship		0.097 ***	-0.020	0.104 ***	0.106 ***
		(0.026)	(0.086)	(0.026)	(0.026)
One recognised kinship		0.146 *		0.155	0.152
		(0.068)		(0.130)	(0.127)
Max no. of close friends and family options					-0.003
					(0.004)
Diff. in gamble choice x Max no. close friends and family options					$4.2\ e^{-5}$
					$(8.5e^{-4})$
Other control variables included#	no	yes	yes	yes	yes
Municipality dummy variables included	yes	yes	yes	yes	yes
Number of observations	17964	17964	940	16920	16920
Pseudo R-sugared	0.134	0.159	0.252	0.137	0.138

Notes: Marginal effects reported. Corresponding standard errors (in parentheses) adjusted to account for non-independence within municipalities by clustering; *** - sig. at 1% level; ** - sig. at 5% level; * - sig. at 10% level; # - Controls included: One lives in municipal centre, one not, Different genders, Difference in age, Difference in years of schooling, Difference in marital status, Difference in log household consumption, Difference in household size, Difference in round 1 winnings, Sum of gamble choices, Number who live in municipal centre, Number of females, Sum of ages, Sum of years of schooling, Number who are married (not to each other), Sum log household consumption, Sum of household sizes, Sum of round 1 winnings.

Table E presents the reruns of the Logits using only on the sample of participants who won less than 3000Pesos from their first round gamble. We lose just under 80% of the dyadic sample if we exclude all dyads that contain either one or two high payoff winners. This will have led to a significant reduction in statistical power. Nevertheless, all but one of our key findings remain intact. In columns 1 and 2 the

coefficient on the critical interaction term between "Difference in gamble choice (round 1)" and "Close family and friends" remains negative and significant. In column 3 (close family and friends only) the coefficient on "Difference in gamble choice (round 1)" remains negative and significant. In columns 4 and 5 (other dyads only) the coefficient on "Difference in gamble choice (round 1)" is insignificant. According to the model without controls (column 1), it seems that there may have been a very small amount of assorting on risk attitudes among dyads who were not close family or friends. However, this finding is not robust to the inclusion of controls in the analysis. The only result that is lost is that pertaining to how many close friends and family members each participant could have grouped with given the participants attending their session. The coefficient on this variable, which is significant at the 10 percent level in the paper, retains its negative sign, but is now half the size and is insignificant. We are inclined to put this down to the smaller sample size.

Table F: Re-working Table 5 using only the sample of participants who participated in sessions for which there is little or no evidence of upward bias in the probabilities

	All dyads				Close friends and family		Other dyads			
	1		2		3		4		5	
Difference in gamble choice (round 1)	-0.002	**	-0.001		-0.020	*	-0.001		-0.001	
	(0.001)		(0.001)		(0.010)		(0.001)		(0.002)	
Close friends and family	0.230	***	0.020							
	(0.031)		(0.019)							
Diff. in gamble choice 1 x Close friends and fam	-0.007	***	-0.006	*						
	(0.003)		(0.003)							
Both recognised friendship			0.367	***	0.329	***	0.366	***	0.367	***
			(0.045)		(0.072)		(0.060)		(0.006)	
Both recognised kinship			0.242	***	0.292	**	0.150	***	0.149	***
			(0.060)		(0.124)		(0.051)		(0.052)	
One recognised friendship, other kinship			0.273	***	0.284	**	0.317	**	0.312	**
			(0.101)		(0.142)		(0.137)		(0.136)	
One recognised friendship			0.111	***	0.045		0.113	***	0.115	***
			(0.019)		(0.066)		(0.019)		(0.019)	
One recognised kinship			0.069				0.049		0.050	***
			(0.045)				(0.051)		(0.050)	
Max no. of close friends and family options									-0.008	*
									(0.005)	
Diff. in gamble choice x Max no. close friends and family options									$1.8\ e^{-4}$	
									($6.4e^{-4}$)	
Other control variables included#	no		yes		yes		yes		yes	
Municipality dummy variables included	yes		yes		yes		yes		yes	
Number of observations	54284		54284		2710		51560		51560	
Pseudo R-sugared	0.109		0.137		0.229		0.115		0.118	

Notes: Marginal effects reported. Corresponding standard errors (in parentheses) adjusted to account for non-independence within municipalities by clustering; *** - sig. at 1% level; ** - sig. at 5% level; * - sig. at 10% level; # - Controls included: One lives in municipal centre, one not, Different genders, Difference in age, Difference in years of schooling, Difference in marital status, Difference in log household consumption, Difference in household size, Difference in round 1 winnings, Sum of gamble choices, Number who live in municipal centre, Number of females, Sum of ages, Sum of years of schooling, Number who are married (not to each other), Sum log household consumption, Sum of household sizes, Sum of round 1 winnings.

Table F presents the reruns of the Logits using only the sample of participants who participated in sessions for which there is little or no evidence of upward bias in the probabilities. In this case, we loose only just over one third of the sample. In this case, all of our key findings remain intact. Once again,

according to the model without controls (column 1), it seems that there may have been a very small amount of assorting on risk attitudes among dyads who were not close family or friends. However, this finding is not robust to the inclusion of controls in the analysis. Every other aspect of the estimations is remarkably similar to those reported in Table 5 of the paper.

5. Summary and conclusions

There is evidence of an upward bias in the probabilities of participants in the Colombian risk pooling game winning riskier gambles. There is no evidence to support the hypothesis that this is owing to fraud on the part of the field researchers acting alone. We cannot unequivocally rule out the possibility that there was complicit fraud on the part of (some of) the field researchers and (some of) the participants. However, we believe that this is highly unlikely, given the task list and time constraints that the field researchers faced. Further, there is a modicum of evidence supporting the hypothesis that the bias in the probabilities is owing to other regarding preferences on the part of the field researchers.

This raised the concern that some of the participants may have learned of the bias in the probabilities during the first round and that this may have affected their group formation and second round gamble choices. However, the likely consequence of this for second round gamble choices is not observed in the data. Further, the findings that we report in the paper concerning group formation remain largely unchanged if we exclude those who were most likely to be exposed to the bias from the analysis.

Based on these findings, we are of the opinion that the analysis that we present in our paper is sound.