Social Capital's Role in the Ultimatum Game

Esther Strom[1]

University of California, San Diego

ABSTRACT

Discrepancies between empirical data and economic theory in ultimatum bargaining have been a subject of interest for over 30 years. Previous experiments have observed individuals walking away from essentially positive profits in these games. My paper adds to the existing body of research and attempts to explain these observations by investigating non-monetary aspects of payoff functions. Since bargaining is as much of a psychological interaction as it is economic, a person's reputation can be at stake the same way that money can. In this study, I use the concept of social capital as a proxy for reputation as it can be more easily measured. Using a simple one-shot ultimatum game, I have produced results in line with the hypothesis that social capital does, in fact, play a role in the formation of utility functions in the ultimatum bargaining game.

[1] I would like to thank Vincent Leah-Martin and Michael Kuhn for their guidance in the design of my experiment and survey. I would also like to thank Michael Kuhn and Dr. Maria Candido for their wonderful advice on econometrics and data analysis. Also, for graciously allowing me to experiment on their students, thank you to Dr. Melissa Famulari and Dr. Megumi Naoi. Finally, thank you to Ross Starr for countless hours of great advice and encouragement throughout the process of writing this paper.

I. Introduction

Most (though certainly not all) economists would agree that life is not entirely about money. The field of experimental economics has demonstrated convincingly that an individual's payoff or utility function includes aspects that are so-called "nontraditional." They include factors that are nonmonetary and that force game theorists to reexamine long-standing theories of rationality to account for the many caveats observed in experimental data. Economists have always recognized that resources are not always things that you can physically see. Human society is complex and based on ancient evolutionary principles of survival. Rather than material gains being the guiding force behind human behavior, it seems that all forms of capital are just manifestations of human biology which include hundreds of other factors that are less tangible, yet still have significant influence.

One scenario that has been observed to stray from monetary payoffs is the ultimatum bargaining game. Ultimatum bargaining has puzzled researchers because of its simplicity and its striking deviation from game theory principles and predictions. Most people who have experienced bargaining situations have polarized opinions: either they find them extremely uncomfortable or believe that they are something of a "superior" bargainer. If bargaining games were based completely on what material objects each party walks away with, there really is no reason to be uncomfortable during bargaining and there is even less reason to believe one is a superior bargainer unless there is asymmetric information (e.g. one player does not know the true worth of the goods). However, most people consider effective bargaining to be a valuable skill, which signifies that some bargainers have more information about the other party or are more convincing or more intimidating.

It is reasonable to assume that there is a social aspect to bargaining that some people have and some people do not. In the ultimatum game, there is perfect information for both players and

there is no possibility of incurring any losses – only gains. However, data has consistently shown that players in this game will turn down positive profits, opting instead to receive nothing. There is clearly an aspect of the players' payoff functions that is non-monetary.

II. Literature Review

Extensive experimental data has been collected on the ultimatum game and many of its derivations to narrow down what aspects of utility other than profits are at play in these decisions. My initial research into the previous literature was heavily influenced by an excellent lecture on the Ultimatum Game given by Professor Robert Goldstone (2001) of the Indiana University Department of Psychology (Goldstone, 2001). His summary led me to the following authors' papers: Guth, Schmittberger, and Schwarz (1983), Rubinstein (1982), and Kahneman et al. (1986), which provided a great foundation for my review of the previous literature. Abreu and Gul (2000) give a compelling explanation for the ultimatum game phenomenon: that an individual's reputation may play a role in determining their bargaining behavior. There are other explanations for the presence of nonmonetary aspects in preferences, but reputation is the avenue which I will investigate and attempt to test.

i. Ultimatum Game: Rules, Assumptions, and Equilibrium

As defined in Guth et al. (1983), a game that seeks to solve a distribution problem among individuals is called a bargaining game. Bargaining games have perfect information and there are no points at which any of the players are unaware of any previous decisions. A bargaining game classifies as an ultimatum game if one of the players (in a two player game) can narrow the game down to a single offer which the other player can either accept or reject. For the purposes of my study, I will define the ultimatum game as a relatively simple bargaining game with two players who are tasked to divide a sum of money between them (for the remainder of this paper, assume the sum of money is equal to $10). Similar to the way Guth, et al. (1983) structured the first part

of their experiment, I will examine the case where the players interact once and each player has only one decision to make.

Player 1 is tasked with choosing a proportion of the total sum of money from $0 to $10 to offer to Player 2 (see Figure 1). Player 2 then decides whether to accept or reject said offer. If Player 2 accepts Player 1's offer, Player 2's payoff is x (whatever Player 1 offered to him or her) and Player 1's payoff is ($10-x). If Player 2 rejects Player 1's offer, then both players have a payoff of zero and leave with nothing.

Figure 1

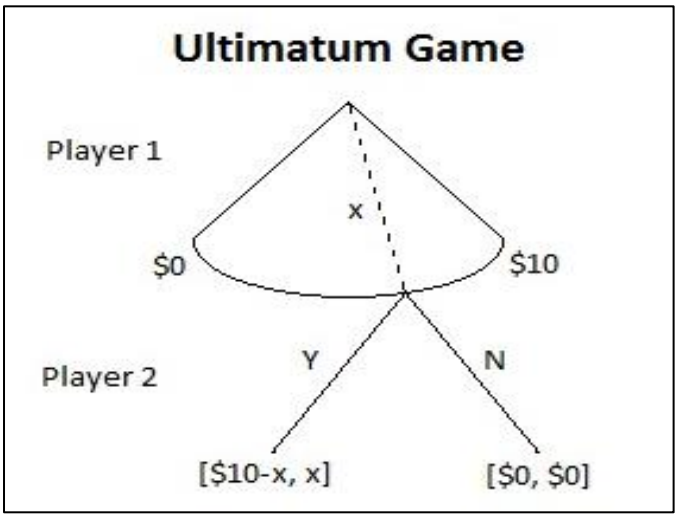


Image adapted from: Asu Ozdaglar, MIT (2010)

As is common in game theory, we make the typical theoretical assumptions that both of the players behave rationally, are only interested in monetary payoffs, and are aware that the other person is also rational and only interested in monetary payoffs, and so on (Watson, 2013, p. 43). Under these assumptions, Ariel Rubinstein (1982) worked to prove a perfect equilibrium solution for bargaining models that has strongly influenced subsequent analysis into this field. According to Rubinstein's general equilibrium solution for bargaining games, the predicted subgame perfect equilibrium for the ultimatum game would be for Player 2 to accept any positive dollar amount offered (no matter how small), because it yields [x], which is greater than

the zero payoff Player 2 would get when he or she rejects the offer. Therefore, Rubinstein concludes that Player 1 should offer the smallest possible dollar amount greater than zero, knowing that Player 2 is rational and will accept the offer, to maximize his or her payoff of [$10-x].

ii. Ultimatum Game: Experimental Data Results

While economic theory predicts payoffs that are close to $10 for Player 1 and close to $0 for Player 2, this is almost never observed in practice. Guth et al. (1983) performed the first experimental study on the simple ultimatum game and found that on average, the subjects who acted as Player 1 offered 36% of the total sum to Player 2 and wanted to keep 64% for themselves (p. 375). Subsequent research comparison has confirmed the 35%-50% range and Player 1 often gives away an even split (Guth & Tietz, 1990, p. 430). Individuals assigned the role of Player 2 have proven to be very concerned with fairness when bargaining in the ultimatum game and they typically reject offers below 20%-25% on average (Guth & Tietz, 1990, p. 430).

In his paper, Telser (1995) suggested that the reason Player 1 offers even splits and Player 2 chooses a zero payoff over unfair offers is because the distribution amount was relatively low. Typically these experiments use less than $10 sums to distribute, after all. However, when the stakes of the ultimatum game are raised, the deviation from our expected equilibrium solution remains (Hoffman, McCabe, & Smith, 1996). Hoffman et al. (1996) states in their empirical analysis that "multiplying the stakes by 10 (from $10 to $100) does not affect the first movers' perceptions of acceptable outcomes" and "subjects continue to offer nearly half the stakes" (p. 296).

Furthermore, consider Cameron (1999), which is a study of high-stakes ultimatum games in Indonesia. Cameron (1996) uses a $100 sum of money to be divided among two players in

Indonesia, where the average GDP per person is $670 (p. 6). In other words, $100 in Indonesia is worth up to about two months' of wages for these individuals. However, despite having extremely high stakes, Cameron's research concludes that "the experiments in this paper do not support the speculation that the rejection of game-theory predictions in the experimental setting of the ultimatum game is an artifact of small stakes," as there was no difference in acceptance rates among Player 2 using high stakes (Cameron, 1996).

iii. Ultimatum Game: Variations

Another commonly cited explanation for the observed deviations from the predicted equilibrium solution is that Player 2 will essentially punish Player 1 for inequitable offers out of a concern for fairness (Kahneman, Knetsch, & Thaler, 1986). Since Player 1 knows this, it explains why average offers are so high compared to our predicted level near zero. Kahneman et al. (1986) confirmed the previously seen trends that mean offers by Player 1 were between 35%-50% and that mean rejections by Player 2 occurred between 20%-25% (p. 290). However, Kahneman et al. also included a second part to their study that allowed Player 1 to choose between two divisions of a $20 sum (either $10:$10 or $18:$2), but with no chance of rejection by Player 2. In other words, no matter which offer Player 1 made to Player 2, he or she would still receive the share they elected to keep despite Player 2 rejecting the offer. Surprisingly, out of the 161 undergraduate students involved in their study, Kahneman et al. observed that "122 (76%) divided the $20 evenly" (p. 291). The results of this study indicate that a fear of punishment is not the motivating factor behind Player 1 offering equitable divisions.

This study posits an interesting outcome about Player 2's behavior that rationality and monetary payoffs simply do not account for. Ochs and Roth (1989) came to a similar conclusion that when Player 2 rejects a nontrivial amount of money in a bargain, this shows that his or her preferences have elements that are not purely monetary. While it may be that human beings

inherently value fairness and equity when dealing with others, this factor is nearly impossible to measure quantitatively and therefore provides little predictive power. An alternative explanation for this behavior can be found in reputation and the concept of social capital. Sampson and Laub (1999, 2005) originally proposed that levels of social capital can help explain the way individuals behave, because they value their reputation and image in society. This, too, can be difficult to quantify. However, the World Bank has had success in measuring social capital, which attempts to gauge an individual's participation in society and the strength of their social network (*Measuring the Dimensions of Social Capital,* n.d.). Social capital in its definition is similar to the idea of reputation and I believe they are strongly correlated, particularly in modern times when people are often defined by their career choice, level of education, and even number of Facebook friends.

iv. Reputation and Social Capital in Utility Functions

The concept of social capital is not widely explored in economics. The term social capital actually originated in the field of criminal psychology in studies by Sampson and Laub (1999, 2005) supporting their Age-Graded Theory. Sampson and Laub's theory focuses on environmental factors causing individuals to commit crimes rather than focusing purely on individual personality traits. Social capital is more precisely defined as "the store of positive relationships in social networks built on norms of reciprocity and trust developed over time upon which the individual can draw for support" (Walsh & Hemmens, 2008, p. 325). Walsh and Hemmens insinuate that social capital is something that can be accumulated over time as an individual goes through life. This also implies that social capital can be lost and that some individuals simply do not have much. This idea goes hand in hand with the idea that "reputation takes a lifetime to build and a moment to destroy."

Walsh and Hemmens link social capital to the study of criminology by suggesting "the accumulation of social capital provides people with a powerful stake in conformity, which they are not likely to risk by engaging in criminal activity" (p. 325). The decision to commit a crime is analogous to many economic decisions in that it essentially involves payoffs and risks. The concept of social capital suggests that individuals have a "stake in conformity" that prevents them from taking actions that essentially offend society (Walsh & Hemmens, 2008, p. 325). There is worth in being a good, cooperative societal partner and so we should expect those with high social capital to behave differently from those with low social capital (similar to the expectation that those with low social capital would be more likely to commit crimes).

In the field of economics, though the idea of social capital was never mentioned in the following studies, some of the conclusions to come out of these studies could be well adapted to the study of social capital's role in ultimatum bargaining games. For example, Blount (1995) found that subjects accept small (uneven) offers more often if they come from a random device than if the offer comes from another human being. By "random device," Blount means a non-adversarial setup where the outcomes are left to chance (like a roulette wheel).

The conclusion of her experiment focuses on individuals punishing unfairness, but one could expand this idea to also consider whether people do not feel threatened by an outcome that is randomized because the social and competitive aspects of the game are removed. There is no need to consider what effect this random output generator will have on one's reputation or image, so there is no need to "act tough" or avoid a weak reputation.

III. Method

The objective of my study is to investigate what role social capital and reputation have in altering an individual's payoff function in a one-shot ultimatum bargaining game. I will attempt to observe this role by designing and distributing a survey which simulates a one-shot ultimatum

game and collects information about each respondent's level of social capital. My sample will be collected from the undergraduate student population at UC San Diego. I define social capital as a person's degree of involvement in society or their conformity to social norms.

i. Model

For my survey experiment, I will model a one-shot ultimatum bargaining game similar to the experiment of Guth, Schmittberger, and Schwarz (1983). However, rather than having partners, each survey respondent will be playing the game individually, without directly interacting with any other subjects. Therefore, I utilize a modified Becker-DeGroot-Marschak Procedure to elicit each subject's "valuation" of the bargain. Subjects were either told that their responses would be randomly matched up with another student in the class who was selected to be the opposite player in the game, or that their responses would be matched up with the results of a random number generator. I asked students assigned to be Player 1 to choose what offer they were going to make to Player 2 by asking them to circle one of the eleven possible whole dollar amounts. I asked students assigned to be Player 2 to make a decision over each of the eleven possible offers.

In this way, I was able to collect data on both the offer that Player 1 subjects chose as well as the lowest minimum offer (or "reservation price") of the Player 2 subjects by identifying where each Player 2 switched from selecting "Accept" to selecting "Reject." I used the reservation prices as the dependent variable in my regressions. The independent variables come from the social capital portion of the survey that collects data about subjects' demographics, as well as some behavioral questions. The questions I used in my survey were heavily influenced by work on social capital done by The World Bank organization. I adapted some of the questions from World Bank surveys done in third-world countries to fit the average UCSD undergraduate

student (*Measuring the Dimensions of Social Capital,* n.d.). To analyze the data, I used a standard OLS regression as follows:

$$ResPrice_i = \beta_0 + \beta_1 Orgs + \beta_2 Role + \beta_3 FB\_Friends + \beta_4 Politics + \beta_5 Income + \beta_6 Ask\_for\_Help + \beta_7 Sim\_to\_UCSD + \beta_8 Nobel + \beta_9 Influence + \beta_{10} Treatment + \varepsilon$$

ResPrice is the dependent variable, as mentioned before, and corresponds to the lowest offer that Player 2 would be willing to accept in the game. These independent variables correspond to the subject's answer to each of the nine social capital questions in the survey, in order of appearance. *Orgs* represents the number of organizations the subject reported being involved in. *Role* represents the highest level of involvement reported in those organizations. *FB_Friends* represents the number of friends the subject has on Facebook. *Politics* represents the subject's reported political involvement. *Income* represents the subject's reported family income range. *Ask_for_Help* indicates the number of people beyond immediate family that a subject could borrow $100 from.

Sim_to_UCSD represents the subject's reported feelings of being similar to other students at UCSD on a scale of 1 to 5. *Nobel* represents a dummy variable that takes on a value of zero if the subject chose to be the sole winner of the Nobel Prize once, and takes on a value of one if the subject chose to be the co-winner of the Nobel Prize twice. *Influence* indicates the subject's reported feelings of influence in making UCSD a better campus on a scale of 1 to 5. Finally, *Treatment* is a dummy variable that takes on a value of zero if a subject was in the control group, and a one if the subject was in the treatment group.

In addition to this, to control for collinearity among the variables, I regressed the subject's reservation price against each of the original independent variables as before, with the addition of an interaction term between each independent variable and Treatment as follows:

$$ResPrice_i = \beta_0 + \beta_1 Orgs + \beta_2 Role + \beta_3 FB\_Friends + \beta_4 Politics + \beta_5 Income + \beta_6 Ask\_for\_Help + \beta_7 Sim\_to\_UCSD + \beta_8 Nobel + \beta_9 Influence + \beta_{10} Treatment + \beta_{11} Tr*Org + \beta_{12} Tr*Rol + \beta_{13} Tr*FB + \beta_{14} Tr*Pol + \beta_{15} Tr*Inc + \beta_{16} Tr*Ask + \beta_{17} Tr*Sim + \beta_{18} Tr*Nob + \beta_{18} Tr*Inf + \varepsilon$$

Finally, for the data collected on Player 1, I again used a standard OLS regression as follows:

$$Offer_i = \beta_0 + \beta_1 Orgs + \beta_2 Role + \beta_3 FB\_Friends + \beta_4 Politics + \beta_5 Income + \beta_6 Ask\_for\_Help + \beta_7 Sim\_to\_UCSD + \beta_8 Nobel + \beta_9 Influence + \beta_{10} PoliSci + \varepsilon$$

The only difference here being that *Offer* is the new dependent variable (which is continuous and can range from 0 to 10, like *ResPrice),* and *Treatment* has been taken out since there was only one version of the Player 1 survey. Instead, in this regression I included a dummy variable called *PoliSci* which indicates whether respondent came from the Economics class (*PoliSci* = 0) or the Political Science class (*PoliSci* = 1).

ii. Procedure

As noted earlier, to gather data I conducted a survey on students in a core undergraduate Economics course of about 100 students. My survey had three versions and consisted of a one-shot ultimatum game set-up followed by 9 demographic and behavioral questions to measure social capital. You can find all three versions of the survey and the social capital questionnaire in Appendix A. Version 1 of the survey was for those students who were randomly assigned to be Player 1 and it asked them to choose which of the eleven possible whole number dollar values they would like to make as an offer to Player 2. Version 2 of the survey was for those students who were randomly assigned to be Player 2 and it asked them to make a decision for each of the eleven possible offers from Player 1.

Finally, Version 3 of the survey was for those students who were randomly assigned to be Player 2 and it asked them to make a decision for each of the eleven possible offers from Player 1, who in this case was a random number generator. This survey version will represent the control group modelled after Sally Blount's 1995 study in which she used a random number generator to act as Player 1 to remove the desire to punish for Player 2. However, my purpose for using this random device is to remove all social aspects of the ultimatum bargaining game and observe a baseline average reservation price for the study.

To conduct the survey, I entered the aforementioned undergraduate Economics class and verbally conveyed the instructions included in Appendix A. I made the students believe that I would be randomly pairing their responses to either another student in the class or to a random number generator after the survey was over. Because of the fact that all of the Player 2's were taking the survey at the same time as all of the Player 1's, I told them that this was why they needed to make a decision for each of the eleven possible offers Player 1 could make. In reality, this only allowed me to easily identify each individual's reservation price for the study. The survey was completely anonymous and all of the students could opt out and not take the survey or could leave any of the questions blank. Since there was a lack of respondents in the Player 1 group from my original survey, I attempted to re-run the experiment in an undergraduate Political Science class. In this survey, I followed the same procedure as in the previous class, but only distributed the Player 1 survey version and was able to add about 15 responses to my Player 1 dataset.

iii. Hypotheses

Based on the results of previous research, my first expectation from this study is that the group chosen to be Player 1 would have a mean offer that is higher than the mean reservation price of the group chosen to be Player 2. In other words, I expect Player 1 to "play it safe" and

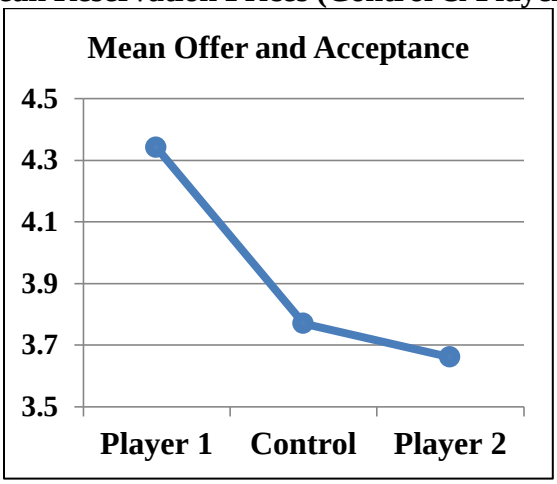
offer a bit higher than they believe Player 2 will accept to make sure they avoid being rejected. Second, I expect that the control group will accept lower offers on average after removing the social and competitive aspects of the game, similar to the results found in Blount (1995).

My third expectation is that in the treatment group, subjects with higher levels of social capital would act as more cooperative social partners. This means that as Player 1, participants with high social capital will make more equitable offers than those with low social capital. As Player 2, participants with high social capital will have a higher rejection point for inequitable offers, on average. In other words, Player 2 participants with high social capital will have a higher reservation price on average than those with lower social capital. So I expect the coefficients on each of the social capital variables to be positive for both Player 1 and Player 2.

IV. Results

Analysis of the data collected from the class showed some interesting results. First of all, an encouraging result of the study is that the mean offer of Player 1 was $4.34, which is right in line with previous studies that hover around $3.70 as stated in the review of previous literature. Similarly, the mean reservation price (or rejection point) of Player 2 from the treatment group was $3.66 which is also in line with previous literature. Player 1's mean offer was higher than Player 2's mean reservation price, which supports my first hypothesis. However, the mean reservation price of the Control group was $3.77, which was higher than that of the Treatment group ($3.66) and not what I had expected to see. These results are summarized in Chart 1, with each group listed on the horizontal axis and the dollar amount listed on the vertical axis.

Chart 1: Mean Offer (Player 1) and Mean Reservation Prices (Control & Player 2)



The second important result worth noting is that when using standard OLS to regress *Offer* against all of the social capital variables for the Player 1 dataset, there was no statistical significance in any of the coefficients (Table 1). My interpretation of these results is that social capital has little to no influence on Player 1's offer. It seems that Player 1 decides his or her offer mainly based on his or her beliefs about Player 2. I believe that if Player 1's beliefs about Player 2 hinged on Player 1 putting his or herself in Player 2's perspective, then social capital would play a role in that decision. However, it seems that Player 1's beliefs about Player 2 do not come from what Player 1 would do if in Player 2's position, but rather what Player 1 believes the average person would do in Player 2's position. Perhaps there exists a general attitude among us that other individuals are not very similar to ourselves (exhibited by the fact that in this survey, the mean response to the "Sim_to_UCSD" question was 2.57, with 5 being "very similar"). More study will need to be done on Player 1 to determine how they are making decisions if social capital plays no part in the process.

Table 1: Offer by Social Capital

VARIABLES (x)	(y) *Offer*
Orgs	0.642 (1.698)
Role	-0.963 (1.487)
FB_Friends (in hundreds)	0.0316 (0.208)
Politics	0.838 (0.628)
Income	0.355 (0.434)
Ask_for_Help	-0.178 (0.240)
Sim_to_UCSD	-0.107 (1.146)
Nobel	-1.571 (1.392)
Influence	-0.247 (1.061)
PoliSci	-1.206 (1.666)
Constant	7.048** (3.115)
Observations	20
F(10, 9)	0.54
Prob > F	0.8259
R-squared	0.359
Root MSE	2.806

The third key result is that when using standard OLS to regress *ResPrice* against all of the social capital variables, there was no statistical significance in any of the results (Table 2). However, since the survey questions were rather similar to each other, there is a good chance that all of the variables exhibit high collinearity. It also makes sense intuitively to believe that the effect of each of the independent variables is highly dependent on whether a person was in the Treatment (*Treatment* = 1) or Control (*Treatment* = 0) group. Therefore, to counteract these issues, I interact each social capital variable with *Treatment*, to allow for the two groups to have separate slopes and intercepts. When interacting each of the independent variables with the

Treatment variable and adding those interaction terms to the regression, I found that in some cases it changed the results (Table 3). *Politics, Ask_for_Help,* and *Sim_to_UCSD* remained statistically insignificant, but the remainder of this section will be spent going through the results for the variables that did exhibit significance under the expanded regression in Table 3.

Table 2: Reservation Price by Social Capital

VARIABLES (x)	(y) *ResPrice*
Orgs	-0.0313 (0.499)
Role	-0.147 (0.427)
FB_Friends (in hundreds)	-0.0739 (0.0669)
Politics	-0.0483 (0.306)
Income	-0.0637 (0.235)
Ask_for_Help	-0.0653 (0.0688)
Sim_to_UCSD	-0.451 (0.461)
Nobel	-0.974 (0.807)
Influence	0.561 (0.400)
Treatment	-0.793 (0.773)
Constant	6.469*** (2.002)
Observations F(10, 62) Prob > F R-squared Root MSE	73 0.92 0.5236 0.124 2.8379

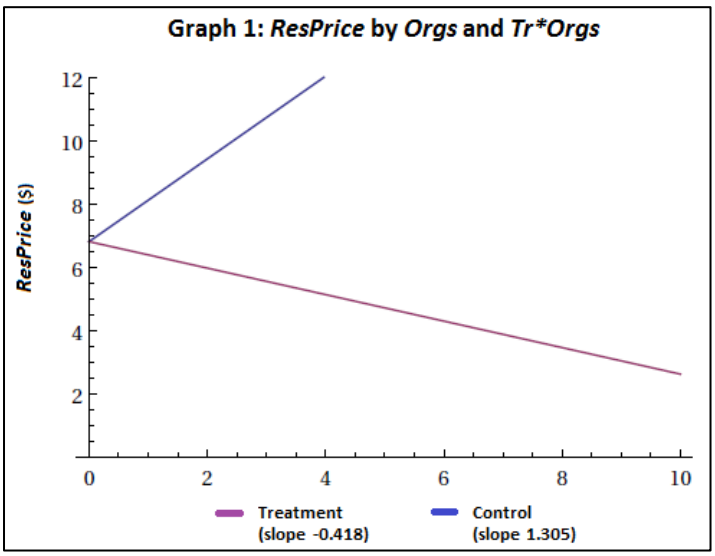
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3: Reservation Price by Social Capital (with Interaction Terms)

VARIABLES (x)	(y) *ResPrice*
Orgs	1.305**
	(0.563)
Role	-1.735***
	(0.649)
FB_Friends (in hundreds)	0.306**
	(0.122)
Politics	0.152
	(0.379)
Income	0.574*
	(0.309)
Ask_for_Help	-0.0304
	(0.0696)
Sim_to_UCSD	-0.243
	(0.802)
Nobel	-2.887**
	(1.227)
Influence	-1.327
	(0.959)
Treatment	-1.700
	(3.997)
*Tr*Orgs*	-1.723**
	(0.829)
*Tr*Role*	1.948**
	(0.809)
*Tr*FB* (in hundreds)	-0.411***
	(0.145)
*Tr*Pol*	-0.119
	(0.531)
*Tr*Inc*	-0.763*
	(0.446)
*Tr*Ask*	-0.114
	(0.108)
*Tr*Sim*	0.0836
	(0.991)
*Tr*Nob*	2.116
	(1.596)
*Tr*Inf*	2.288**
	(1.068)
Constant	6.818*
	(3.427)
Observations	73
F(19, 53)	5.01
Prob > F	0.0000
R-squared	0.326
Root MSE	2.693

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

i. Number of Organizations



Graph created using Wolfram Alpha software

Graph 1 displays the regression line given by *Orgs* on an individual's reservation price (blue line), and comparing it to the regression line given by the interaction term *Tr*Orgs* on reservation price (violet line). The constant term in regression Table 3 represents the y-intercept in this graph and all of the following. The reason that the intercept for both lines in each picture is at the same point (y = 6.818) is because the coefficient on the *Treatment* variable is not significant and is a statistical zero. Had *Treatment* been a significant variable, the line representing the interaction term in all of the graphs would have intercepted the y-axis at 5.118[2], with the non-interaction line still intercepting at 6.818.

The blue line with a positive slope of 1.305 represents the effect on reservation price of increasing the number of organizations an individual is involved in by one, when they are in the *control* group. The violet line with a negative slope of -0.418 represents that same effect, but when the individual is in the *treatment* group. The slope of each of the lines was derived by isolating the effect of *Orgs*, *Treatment*, and *Tr*Orgs* on *ResPrice* as such:

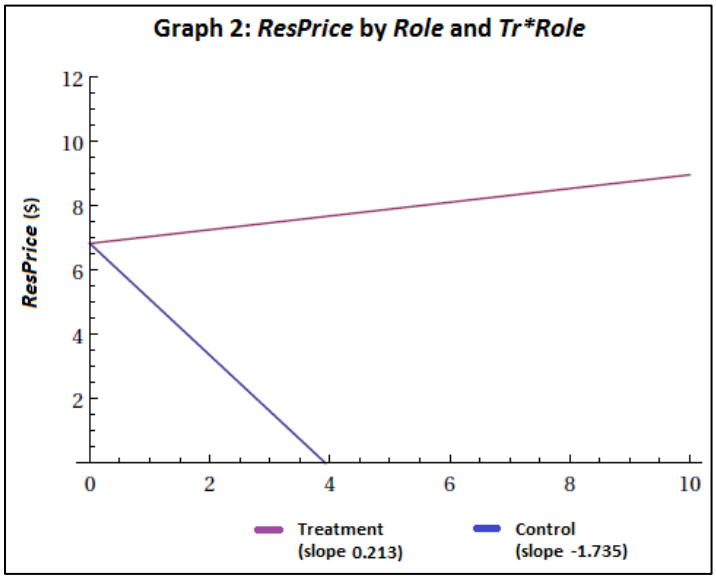
$$ResPrice_i = \beta_0 + \beta_1 Treatment + \alpha_2 Orgs + \alpha_3 Tr*Orgs$$

[2] This figure was estimated assuming that if the coefficient on *Treatment* were statistically significant, it would still be equal to -1.700. Therefore, the new intercept would be 6.818 – 1.700 = 5.118.

The slope of the blue control line is equal to 1.305 because *Treatment* and *Tr*Orgs* are equal to zero when a person is in the control group, which leaves us with only the coefficient α_2 on *Orgs,* taken directly from regression Table 3. The slope of the violet line is equal to -0.418 because even though *Treatment* equals one when a person is in the treatment group, the coefficient on *Treatment* is a statistical zero, which leaves us with adding the coefficients α_2 and α_3. Taking these values from Table 3 gives us [1.305 + (-1.723)] which equals -0.418.

Therefore, increasing social capital (in the form of increasing the number of organizations a person is involved in) leads to a larger and larger gap in reservation price between the Control and Treatment groups. This insinuates that individuals with low social capital will not behave very differently when faced with a computer or human partner. However, individuals with high social capital will behave strikingly differently, to the point where bargaining with a computer and bargaining with a human produce effects in opposite directions. In general, increasing the number of organizations an individual in the control group is involved in by one will increase his or her reservation price by $1.31 on average. Increasing the number of organizations an individual in the treatment group is involved in by one will decrease his or her reservation price by $0.42 on average. These results are the reverse of what I expected to see and are the opposite of what Blount (1995) found.

ii. Role in Organizations



Graph created using Wolfram Alpha software

Graph 2 displays the regression line given by *Role* on an individual's reservation price (blue line), and comparing it to the regression line given by the interaction term *Tr*Role* on reservation price (violet line). The constant term of 6.818 in regression Table 3 still represents the y-intercept in this graph. The blue line with a negative slope of -1.735 represents the effect on reservation price of increasing the number of organizations an individual is involved in by one, when they are in the *control* group. The violet line with a positive slope of 0.213 represents that same effect, but when the individual is in the *treatment* group. The slope of each of the lines was derived by isolating the effect of *Role*, *Treatment*, and *Tr*Role* on *ResPrice* as before:

$$ResPrice_i = \beta_0 + \beta_1 Treatment + \alpha_2 Role + \alpha_3 Tr*Role$$

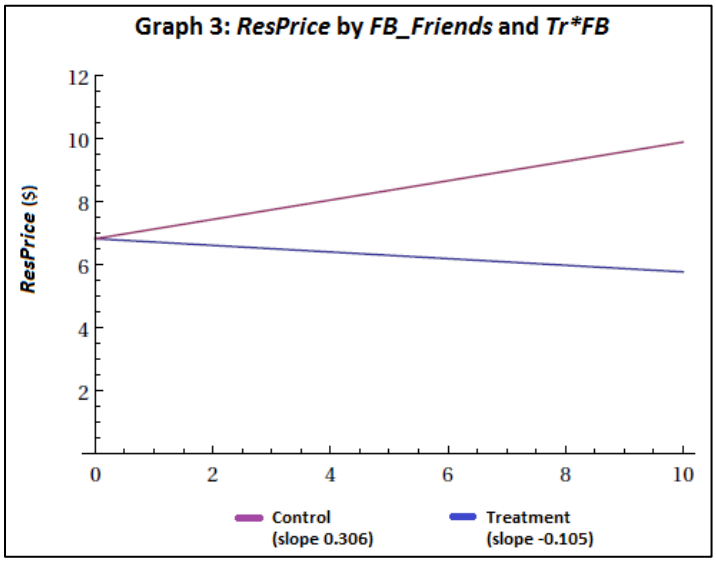
By the same logic present in the previous section, the slope of the blue control line was taken directly from regression Table 3 and is equal to -1.735. The slope of the violet line is equal to 0.213 by adding the coefficients α_2 and α_3. Taking these values from Table 3 gives us [-1.735 + 1.948] which equals 0.213.

Therefore, increasing social capital (in the form of increasing the qualitative role a person has in his or her organization) again leads to a larger and larger gap in reservation price between the Control and Treatment groups. Again we see effects in opposite directions as social capital

increases; however this time having a computer as a partner induces decreasing reservation prices as social capital increases. In general, increasing the role in an organization that an individual in the control group has by one will decrease his or her reservation price by $1.74 on average. Increasing the role in an organization that an individual in the treatment group has by one will increase his or her reservation price by $0.21 on average.

These results are what I expected to see from my hypotheses and are in line with Blount (1995) results. However, I also expected that all of the variables present in my study would affect reservation price in the same direction. It is odd that some variables lead to increases in reservation price for the treatment group while others lead to decreases in reservation price. Perhaps the small sample size in my study and the high collinearity of the variables I used can explain this effect.

iii. Number of Facebook Friends



Graph created using Wolfram Alpha software

Graph 3 displays the regression line given by *FB_Friends* on an individual's reservation price (violet line), and comparing it to the regression line given by the interaction term *Tr*FB* on reservation price (blue line). The constant term of 6.818 in regression Table 3 still represents the y-intercept in this graph. The violet line with a positive slope of 0.306 represents the effect on

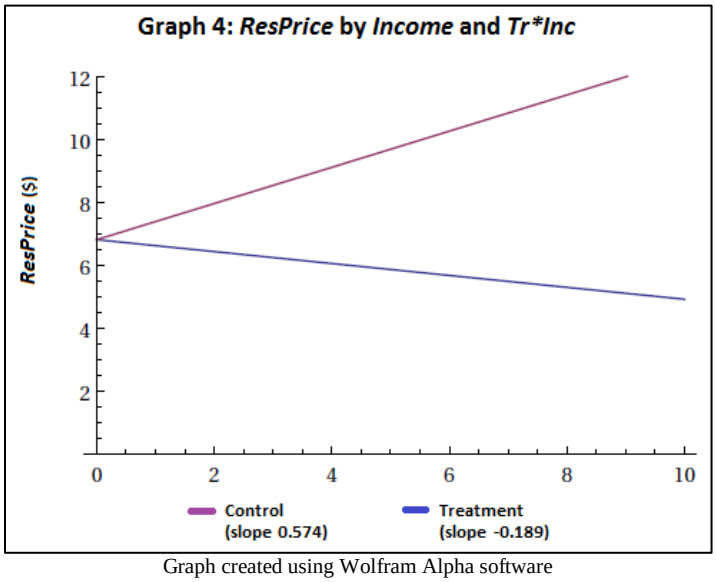
reservation price of increasing the number of Facebook friends an individual has by one hundred, when they are in the *control* group. The blue line with a negative slope of -0.105 represents that same effect, but when the individual is in the *treatment* group. The slope of each of the lines was derived by isolating the effect of *FB_Friends*, *Treatment*, and *Tr*FB* on *ResPrice* as before:

$$ResPrice_i = \beta_0 + \beta_1 Treatment + \alpha_2 FB\_Friends + \alpha_3 Tr*FB$$

By the same logic present in the previous section, the slope of the violet control line was taken directly from regression Table 3 and is equal to 0.306. The slope of the blue treatment line is equal to -0.105 by adding the coefficients α_2 and α_3. Taking these values from Table 3 gives us [0.306 + (-0.411)] which equals -0.105.

Therefore, increasing social capital (in the form of increasing the number of Facebook friends) again leads to a larger and larger gap in reservation price between the Control and Treatment groups. With Facebook friends, having a computer as a partner is correlated with increasing reservation prices as social capital increases. In general, increasing the number of Facebook friends that an individual in the control group has by one hundred will increase his or her reservation price by $0.31 on average. Increasing the number of Facebook friends that an individual in the treatment group has by one hundred will decrease his or her reservation price by $0.11 on average. These results are similar to those from the *Orgs* variable, and are again the opposite of what Blount (1995) found.

iv. Income



Graph created using Wolfram Alpha software

Graph 4 displays the regression line given by *Income* on an individual's reservation price (violet line), and comparing it to the regression line given by the interaction term *Tr*Inc* on reservation price (blue line). The constant term of 6.818 in regression Table 3 still represents the y-intercept in this graph. The violet line with a positive slope of 0.574 represents the effect on reservation price of increasing household income by approximately $25,000, when a person is in the *control* group. The blue line with a negative slope of -0.189 represents that same effect, but when the individual is in the *treatment* group. The slope of each of the lines was derived by isolating the effect of *Income*, *Treatment*, and *Tr*Inc* on *ResPrice* as before:

$$ResPrice_i = \beta_0 + \beta_1 Treatment + \alpha_2 Income + \alpha_3 Tr*Inc$$

By the same logic present in the previous section, the slope of the violet control line was taken directly from regression Table 3 and is equal to 0.574. The slope of the blue treatment line is equal to -0.189 by adding the coefficients α_2 and α_3. Taking these values from Table 3 gives us [0.574 + (-0.763)] which equals -0.189.

Therefore, increasing social capital (in the form of increasing household income) again leads to a larger and larger gap in reservation price between the Control and Treatment groups. With household income, having a computer as a partner is correlated with increasing reservation

prices as social capital increases. In general, increasing the household income of a respondent in the control group by $25,000 corresponds to an increase in his or her reservation price by $0.57 on average. Increasing the household income of a respondent in the treatment group corresponds to a decrease in his or her reservation price by $0.19 on average. These results are similar to those from the *Orgs* and *FB_Friends* variables.

v. Sharing the Nobel Prize and Influence

Two more noticeable results from this experiment are the coefficients from Table 3 on *Nobel* and *Tr*Inf.* The coefficient on *Nobel* is equal to -2.887 and is statistically significant, but its counterpart (*Tr*Nob*) was not. This would graphically look similar to previous graphs, but with the Control line having a slope of -2.887 and the Treatment line having a slope of 0. It would appear that the *Nobel* variable only has an effect in the control group when one's partner is a random number generator.

The coefficient on *Tr*Inf* is equal to 2.288 and is statistically significant, but its counterpart Influence was not. This, too, would graphically look similar to previous graphs, but with the Control line having a slope of 0 and the Treatment line having a slope of 2.288. *Influence* seems to have the opposite problem of *Nobel*, in that it seems it only has an effect on the Treatment group. However, perhaps this result is the consequence of a small sample size. A larger sample size might reveal that *Nobel* has a significant effect on the Treatment group, and *Influence* has a significant effect on the Control group after all.

V. Conclusions

Overall, the net effects of social capital on individuals who were assigned the random number generator as a partner were positive. Specifically, the aggregate net effect on reservation price of an increase in one unit of each social capital variable is a positive $0.45 for the Control group (not including *Nobel*). Conversely, the net effects of social capital on individuals

bargaining with another human being were negative. Specifically, the aggregate net effect on reservation price of an increase in one unit of each social capital variable is a negative -$0.50 for the Treatment group (not including *Influence*).

Individuals with the lowest amounts of social capital tend to behave similarly regardless of whether they are facing a computer opponent or a human opponent, which may indicate that perhaps these individuals are not affected by social pressures, either because they do not recognize them or because they do not care. However, those with the largest stores of social capital behave very differently depending on who or what their opponent is. This could indicate that individuals with high social capital are more skilled at analyzing situations and pay more attention to who their opponents are, which may explain why they have higher stores of social capital in the first place. It could be that they have become practiced at navigating social situations and alter their behavior accordingly.

Contrary to what I expected to observe, it appears that individuals with high levels of social capital are not concerned with preserving the status quo and punishing those who are uncooperative. Instead, it seems that they are more tolerant of unfair offers from other human partners than people with less social capital would be. One explanation for this could be that because these individuals are relatively "rich" in social capital, they are less concerned with their ending monetary payout. In other words, they get less marginal utility from a gain in the bargaining game outcome than someone who has less social capital. Or, perhaps as suggested by Winter and Zamir (2005), if we considered the outcomes of repeated ultimatum bargaining games, these individuals would end up with a higher aggregate payout in the end because they accepted more offers and established positive, cooperative relationships with the other players.

Another interesting observation comes from the fact that respondents with high levels of social capital tend to have higher reservation prices when they face a random number generator

as their opponent. As mentioned earlier, my original hypothesis was for subjects to be willing to accept lower offers from a random number generator because there are no competitive or social aspects to consider, and because the results in Blount (1995) supported this hypothesis. However, one possible reason for this behavior could be that my description of the random number generator was not entirely clear and that some subjects misunderstood the concept. Another explanation (which is more of a stretch), is that perhaps subjects were acting out of distrust towards computers or being pessimistic about the true "randomness" of the number generator.

While my study attempts to elicit reservation prices and social capital measures for individual subjects, there are a few areas of this study that could be improved in future research. First, despite my greatest efforts at making the survey appear like a realistic bargaining game, reservation prices may be more accurately extracted by offering subjects real stakes with real money. Second, it would have been more realistic to observe the ultimatum game by having subjects actually bargain with each other face-to-face rather than by filling out a survey on paper. Next, as mentioned earlier, some parts of the survey may have been unclear to respondents and could be further clarified for future work. Also, as mentioned several times, my sample size was relatively small for this experiment and results may be more significant with more observations. Finally, some of the variables included in the survey (such as *Role* and *Sim_to_UCSD*) were relatively subjective. Because they recorded ordinal rankings of people's responses, there may not be a clear unit-to-unit relationship between those variables and an individual's reservation price. Further and more advanced statistical analysis is required to more precisely understand these variables and their relationship to reservation price.

Overall, this study indicates that social capital does, in fact, play a role in the formation of utility functions. The model I have proposed provides a fairly accurate picture of the empirical data collected, and motivates the hypothesis that social capital can be utilized to fill in the gaps

that monetary payoffs alone cannot explain in the ultimatum bargaining game. All things considered, while the results were not in line with what I had expected, they are interesting nonetheless and hopefully encourage further study into how social capital can play a more poignant role in economics.

VI. Appendix A

i. Survey Instruction Sheet

Bargaining Game Behavioral Study

In this survey, you will be participating in a fictitious bargaining game.

You will be randomly assigned to be either Player 1 or Player 2. Your responses will then be compared to a **randomly selected** partner to determine the outcome of the game.

If you are chosen to be Player 1, you will be responsible for dividing $10 between yourself and Player 2. Whatever division you choose will be considered your offer in this game.

If you are chosen to be Player 2, you will be responsible for either accepting Player 1's offer or rejecting it. If you accept Player 1's offer, the game ends and the offer that was agreed to will be the payout to each player. If you reject Player 1's offer, the game ends and each player walks away with $0.

The survey should take approximately 5 minutes to complete and is **completely anonymous**. Please **do not** print your name or any other information that is not strictly asked for.

If you are not comfortable completing this survey, you may opt out at any time by not filling out the survey or not filling out any questions you are uncomfortable with. This survey is not a required part of the course and you will receive no course credit for completing the survey. Conversely, you will not have any points deducted for not participating.

If you have any questions or concerns about this survey, you may call the Human Research Protections Program Office at (858) 455-5050 to inquire about your rights as a research subject or to report research-related problems.

Thank you for participating in this experiment!

ii. Survey Version 1: Player 1 Treatment Group

You have randomly been chosen to be Player 1.

You will be paired randomly with a Player 2 from this class.

As a reminder, you will divide $10 between yourself and Player 2. Player 2 will either accept or reject your offer. If the offer is accepted, the game ends and you earn the $10 minus whatever your offer was. Player 2 earns what you offer them. If the offer is rejected, the game ends and you both will earn $0.

How much do you offer Player 2 (circle one)?

$0 $1 $2 $3 $4 $5 $6 $7 $8 $9 $10

Please turn the page over to continue the survey.

iii. Survey Version 2: Player 2 Treatment Group

You have randomly been chosen to be Player 2.

You will be paired randomly with a Player 1 from this class.

As a reminder, you will be responsible for either accepting Player 1's offer or rejecting it. If you accept Player 1's offer, the game ends and the offer will be the amount of money you earn. If you reject Player 1's offer, the game ends and each player earns $0.

Because you will be paired with someone in the class who is currently taking the survey with you, you must choose whether you would accept or reject each of the 11 possible offers. One way to make your choices is to accept until you've identified the row where you would no longer be willing to accept, if ever, at which point you would switch to reject.

Would you accept or reject an offer of (circle one in each case) from another student in the class:

$10	Accept	OR	Reject?
$9	Accept	OR	Reject?
$8	Accept	OR	Reject?
$7	Accept	OR	Reject?
$6	Accept	OR	Reject?
$5	Accept	OR	Reject?
$4	Accept	OR	Reject?
$3	Accept	OR	Reject?
$2	Accept	OR	Reject?
$1	Accept	OR	Reject?
$0	Accept	OR	Reject?

Please turn the page over to continue the survey.

iv. Survey Version 3: Player 2 Control Group

You have randomly been chosen to be Player 2.

Your responses will be paired with a random number generator acting as Player 1.

The random number generator will output a number between $0 and $10, each with equal probability. That number will represent an offer: how much money you would receive out of $10 if you were to accept.

You must decide whether to accept or reject the offer. If you accept the offer, it will become the amount of money that you earn. If you reject the offer, you will not receive any money.

Because we will be using the random number generator after the survey has been completed, you must choose whether you would accept or reject each of the 11 possible offers. One way to make your choices is to accept until you've identified the row where you would no longer be willing to accept, if ever, at which point you would switch to reject.

Would you accept or reject an offer of (circle one in each case) from a random number generator?

$10	Accept	OR	Reject?
$9	Accept	OR	Reject?
$8	Accept	OR	Reject?
$7	Accept	OR	Reject?
$6	Accept	OR	Reject?
$5	Accept	OR	Reject?
$4	Accept	OR	Reject?
$3	Accept	OR	Reject?
$2	Accept	OR	Reject?
$1	Accept	OR	Reject?
$0	Accept	OR	Reject?

Please turn the page over to continue the survey.

v. Survey: Social Capital Segment

1. Do you participate in any on-campus organizations? Check all that apply.
   - ☐ Fraternity or Sorority
   - ☐ NCAA athletics team
   - ☐ UCSD Club athletics team
   - ☐ Intramural athletics team
   - ☐ Academic or Honors program
   - ☐ Religious-affiliated organization
   - ☐ Professional/Career Preparation organization
   - ☐ Community service organization
   - ☐ Other: _____

2. What is your **highest** degree of participation in any organization? Circle one.
   a. Leadership position (eg president, vice president, board member)
   b. Very active (attend majority of events and meetings)
   c. Somewhat active (attend select events and meetings)
   d. Not active (rarely attend events and meetings, if at all)

3. Roughly how many Facebook friends do you have? _____

4. Which of the following activities have you undertaken? Check all that apply.
   - ☐ I have voted in an election at least once.
   - ☐ I have contacted an elected official at least once.
   - ☐ I have volunteered to work in an election campaign.
   - ☐ I have taken part in a protest, march, or demonstration.
   - ☐ None of the above.

5. What is your family's average annual income range? Circle one.
   a. Less than $50,000 per year
   b. $50,000 to $75,000 per year
   c. $76,000 to $100,000 per year
   d. $101,000 to $125,000 per year
   e. Greater than $125,000 per year
   f. Prefer not to state

6. If you suddenly needed $100, how many people outside of your immediate family could you turn to? _____

7. On a scale of 1-5 (with 5 being most similar), how similar do you think other UCSD students are to you? _____

8. If you faced the following alternatives, which one would you prefer most? Select one.
   a. Being the **sole** winner of the Nobel Prize **once** in your lifetime.
      OR
   b. Being the **co-winner** of the Nobel Prize **twice** in your lifetime with one other person.

9. How much influence do you think you have in making UCSD a better university to attend? Circle one.
   a. A lot

b. Some
c. Not very much
d. None

References

Abreu, D., & Gul, F. (2000). Bargaining and reputation. *Econometrica, 68*(1), 85-117.

Blount, S. (1995). When Social Outcomes Aren't Fair: The Effect of Causal Attributions on Preferences. *Organizational Behavior and Human Decision Processes, 63*(2), 131-144.

Bolton, G. E., & Ockenfels, A. (2000). ERC: A theory of equity, reciprocity, and competition. *American Economic Review, 90*(1), 166-193.

Camerer, C. F., & Thaler, R. H. (1995). Ultimatums, dictators and manners. *Journal of Economic Perspectives, 9*(2), 209-219.

Cameron, L. (1995). *Raising the stakes in the ultimatum game: Experimental evidence from indonesia* Princeton, Department of Economics - Industrial Relations Sections, Princeton, Department of Economics - Industrial Relations Sections.

Goette, L., Huffman, D., & Meier, S. (2006). *The impact of group membership on cooperation and norm enforcement: Evidence using random assignment to real social groups* Federal Reserve Bank of Boston, Working Papers: 06-7.

Goldstone, R. (2001). *Ultimatum Game* [PowerPoint slides]. Retrieved from http://cognitrn.psych.indiana.edu/rgoldsto/complex/ultimatum.ppt.

Guth, W., Schmittberger, R., & Schwarze, B. (1982). An experimental analysis of ultimatum bargaining. *Journal of Economic Behavior and Organization, 3*(4), 367-388.

Guth, W., & Tietz, R. (1990). Ultimatum bargaining behavior: A survey and comparison of experimental results. *Journal of Economic Psychology, 11*(3), 417-449.

Henrich, J. (2004). *Foundations of human sociality: Economic experiments and ethnographic evidence from fifteen small-scale societies* Oxford and New York: Oxford University Press.

Hoffman, E., McCabe, K. A., & Smith, V. L. (1996). On expectations and the monetary stakes in ultimatum games. *International Journal of Game Theory, 25*(3), 289-301.

Kahneman, D., Knetsch, J. L., & Thaler, R. H. (1986). Fairness and the assumptions of economics. *Journal of Business, 59*(4), S285-S300.

Larrick, R. P., & Blount, S. (1997). The claiming effect: Why players are more generous in social dilemmas than in ultimatum games. *Journal of Personality and Social Psychology, 72*(4), 810-825.

Measuring the dimensions of social capital. (2011). Retrieved January 24, 2014, 2014, from http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTSOCIALDEVELOPMENT/EXTTSOCIALCAPITAL/0,,contentMDK:20305939~menuPK:994404~pagePK:148956~piPK:216618~theSitePK:401015,00.html

Ochs, J., & Roth, A. E. (1989). An experimental study of sequential bargaining. *American Economic Review, 79*(3), 355-384.

Ozdaglar, A. *Extensive Form Games II* [PDF document]. Retrieved from http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-254-game-theory-with-engineering-applications-spring-2010/lecture-notes/MIT6_254S10_lec13.pdf

Rubinstein, A. (1980). *Perfect equilibrium in a bargaining model (now published in econometrica, vol.50, (1982), pp. 97-100.)* Suntory and Toyota International Centres for Economics and Related Disciplines, LSE, STICERD - Theoretical Economics Paper Series.

Sampson, R., & Laub, J. (1999). Crime and deviance over the lifecourse: The salience of adult social bonds. In F. Scarpitti & A. Nielsen (Eds.), *Crime and criminals: Contemporary and classical readings in criminology* (pp. 238-246). Los Angeles: Roxbury Press.

Sampson, R., & Laub, J. (2005). A life-course view of the development of crime. *Annalsof the American Academy of Political and Social Sciences, 602*, 12-45.

Telser, L. G. (1995). The ultimatum game and the law of demand. *Economic Journal, 105*(433), 1519-1523.

Walsh, A., & Hemmens, C. (2008). *Introduction to Criminology: A Text/reader*. Los Angeles: Sage.

Watson, J. (2013). In Repcheck J. (Ed.), *Strategy: An introduction to game theory* (3rd ed.). New York City, New York: W. W. Norton and Company.

Winter, E., & Zamir, S. (2005). An experiment with ultimatum bargaining in a changing environment. *Japanese Economic Review, 56*(3), 363-385.