Fall 12-31-2022

Fairness Doesn't Have to Be Egalitarian: Evidence From Bargaining Games

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by

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Submitted in partial fulfillment
of the requirements for the degree of
Master of Arts in Economics, Hunter College
The City University of New York

2022

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Acknowledgments

First, I thank the Economics Department's faculty for all the help I received during my studies at Hunter College, especially my advisors Karna Basu, Matthew Baker, and Partha Deb. I am grateful for Partha's invaluable advice and support, Matthew's belief in my ideas, and, most of all, Karna's unwavering guidance. In addition, I have greatly benefited from conversations with Kenneth McLaughlin.

At Hunter College, I had the opportunity to learn and work with people who would become dear friends. I thank Azka Imran, Jin Kim, and Fatima Khan. I must also thank Michele Cafasso separately. He was an integral part of my journey at Hunter.

Lastly, I thank Angelina for all the love and support over the years. Without her, I would not have been able to accomplish all I have done.

Abstract

Both theoretical and empirical research in economics show that people take fairness and reciprocity into account in bargaining situations. In ultimatum games, proposers offer non-negligible amounts, and responders reject low offers. However, notions of fairness can change through two different channels: a societal mechanism of property rights and a psychological mechanism of mental accounting operations. When an individual has exerted effort to generate the surplus to be shared, thereby earning a natural, though not legal, claim over the surplus, this informal property right influences their perceptions of fairness. Individuals also categorize earned and allocated money into different accounts, thereby once again changing their perception of fairness. The effect of these two distinct mechanisms is a change in the individual's reference point of what constitutes a fair allocation. In this paper, I incorporate these fairness reference points into a social comparison model and derive predictions for equilibrium behavior. I collect questionnaire data to test the model's predictions, and I find that individuals change their fairness reference points depending on who exerted effort to generate the surplus. Therefore, people have a dynamic notion of fairness.

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1. Introduction

Bargaining is ubiquitous in our lives. A bargaining situation arises where as few as two individuals decide how to share a surplus. It happens everywhere around the world – be it a local at Istanbul's Spice Bazaar haggling over the price of paprika or a traveler in France looking for the best deal on a hand-carved oak armoire. The stakes vary from being inconsequential, in a situation where the people decide how to split an apple pie, to significant, in a situation where a buyer and a seller of a house negotiate over the price of the house. Bargaining need not happen between just individuals. For example, a firm and a labor union bargain over wages and benefits, and national governments engage in international negotiation.

Bargaining situations contrast with perfect competition, where there are many participants. The ideal conditions in perfect competition (many buyers and sellers, no participants can set prices, homogeneous products, and well-defined property rights) are absent in bargaining. In fact, many conditions antithetical to perfect competition are present in bargaining situations. People negotiate with one another over many goods and services that do not have substitutes, making it difficult for buyers and sellers to know what is a fair and reasonable price. So, people will negotiate because prices are not fixed. Moreover, property rights in numerous bargaining situations are complex. It is challenging to answer questions that are often unequivocal in perfect competition, such as "who owns the land?" and "what do I have to pay?"

The questions lead to another set of questions like, "what factors determine the outcome of negotiations?", "how should the parties involved divide the gains from cooperation?" and "what aspects are important to determine ownership?" Thus, bargaining is a rich area of economic research – one of great practical importance – because questions in bargaining situations are meaningful, and the answers have a pervasive impact on our lives. Economists and other social scientists have used laboratory experiments to answer the above questions in bargaining situations.

Since the sixties, researchers have used simple games in laboratory experiments to analyze people's bargaining decisions. They examine how people make decisions in games such as the ultimatum and dictator games. The ultimatum game is a simple two-player, take-it-or-leave-it bargaining game. In the game, two players must decide how to split a fixed amount of sum of money. The proposer is endowed with money and then makes an offer to the responder, the other player. If the responder accepts the offer, the money is split per the proposal. However, if the responder rejects, both players receive nothing. Both players know the consequences of the responder accepting and rejecting the offer. The dictator game is a simple variant of the ultimatum game, in which only the dictator has a choice. The dictator decides how much of a given sum of money to share with the recipient. Both the ultimatum and the dictator game serve as illuminating tools for understanding what variables determine the outcome of negotiations.

Standard game theory, with self-interested agents, predicts that people in both games will offer either zero or as close to zero as possible. Nevertheless, experimental evidence shows that people do not play the predicted theoretical outcome in either game, at least not immediately or without altering the rules of the game (Güth, Schmittberger, and Schwarze 1982; Roth et al. 1991; Forsythe et al. 1994). In many situations, the proposer offers a non-negligible amount of the surplus. Moreover, an astonishing fact is – contrary to standard economic theory – fairness is essential in explaining how players behave. This fact, among many others, has led researchers to develop new theories and conduct additional experiments to understand better what other factors people consider when making decisions in economic games. People are only sometimes self-interested because kinship, anonymity, and culture influence their decisions. Other factors like fairness, altruism, and reciprocity substantially explain people's behavior in bargaining situations.

Unlike classical utility theory, which assumes that people only have preferences over material resources allocated to them, models of social preferences assume that people also care about the material resources allocated to others. A theory of inequity aversion is a type of social preference model that assumes people dislike inequity. Using the idea that some individuals care about the egalitarian distribution of payoffs, the previously puzzling results begin to make sense. Loewenstein, Thompson, and Bazerman (1989) ask subjects to ordinally rank outcomes that differ in the distribution of payoffs between the subject and someone else. They find that subjects exhibit a robust aversion to inequality. Fehr and Schmidt (1999), in their model of inequity aversion, assume that subjects experience inequity if they are worse off in material terms than others, and they also experience inequity if they are better off in material terms than others. Their model predicts cooperative behavior in bargaining situations, i.e., significant offers in the ultimatum game, but the model predicts uncooperative behavior in competitive markets.

The inequity aversion model is undoubtedly complex. However, it is fundamentally a framework about fairness and notions of fairness. For example, when you see someone worse off than you, it may seem unfair that they have less than you. Conversely, when you observe someone better off than you, it may seem unfair that they have more than you. Therefore, perceptions of inequity are closely tied to notions of fairness.

Notions of fairness must depend on what people consider an equitable distribution in the first place. What constitutes an equitable distribution depends on the origin of the surplus, i.e., whether the experimenter endows the surplus or one of the players earns the surplus. Therefore, when someone works for the surplus, all observers may change their notion of an equitable distribution (Cherry 2001; Cherry, Frykblom, and Shogren 2002; Oxoby and Spraggon 2008; Dannenberg et al. 2012; Ogawa et al. 2012; Carlsson, He, and Martinsson 2013; Lee and Shahriar 2017). In other words, what reference point people use to designate fair outcomes can change.

Property rights are not well-defined in bargaining games. However, they still serve as a lens to understand how reference points of fairness can update. For example, Hoffman et al. (1994) describe property rights as guarantees for the holders of those rights. They say that these rights grant assurance to the rights holder to act within guidelines defined by the right. Also, there is a guarantee against reprisal, an act of retaliation. Moreover, property rights are a way for society to legitimize the actions of the rights holder. Property rights can be interpreted as a way to define what is fair and acceptable. Even though property rights function in that manner in the economy, it needs to be clarified how subjects will perceive property rights in a bargaining experiment. Thus, in the context of economic experiments, it may be more appropriate to use the term *perceived property rights*.

The discussion on how reference points of fairness change based on people's actions leaves an open question, "how do people evaluate an outcome based on a reference point?" Kahneman and Tversky (1979) answer this question in their seminal work on prospect theory. They assume that an outcome is viewed relative to a reference point, with outcomes above the reference point coded as gains and outcomes below the reference point coded as losses. Further, they assume people experience loss aversion, the idea that negative deviations from the reference point hurt more than a commensurate positive deviation feels pleasurable. Prospect theory explains seemingly unusual patterns in the real world: individuals holding losing stocks longer than winning stocks, cab drivers' tendency to work longer hours on low-wage days than on high-wage days, and the popularity of lotteries with large potential payoffs (Camerer 2011).

The literature discusses how individuals change their behavior in bargaining games depending on who exerted effort to generate a surplus; however, it does not concentrate on the role of reference points in bargaining games (Lee and Shahriar 2017; Oliver 2021). In this paper, I study the role of inequity aversion, loss aversion, and perceived property rights in simple bargaining games. I build a model that integrates these considerations, and I use the model to examine the dynamic nature of reference points. Finally, I analyze questionnaire data to test the predictions of the model. I find some sensible results as well as some surprising ones.

I modify the Fehr and Schmidt (1999) model to accommodate a value function with reference points and loss aversions, i.e., the value function proposed by Kahneman and Tversky (1979). I assume people evaluate an outcome based on their perception of value (standard reference-dependent utility) from a gain or a loss and the difference in the gain or loss across players (reference-dependent inequity aversion). I postulate that when people exert effort, not only will this affect the worker's reference points but the reference points of other people that observe the endeavor.

Reference points can change through different channels. The mechanism can be external, societal-based, like the property rights perspective mentioned above, or the mechanism can be internal, psychologically based. This psychological frame-

work presumes that different sources of wealth and income are used differently, i.e., windfall income is spent more readily than earned income, because different forms of income appear in different mental accounts (Thaler 1985, 1990; Keeler, James, and Abdel-Ghany 1985; Thaler 1994; Arkes et al. 1994; Keasey and Moon 1996). Thaler (1999) describes mental accounting as the set of cognitive operations used by individuals to organize, evaluate, and keep track of financial activities. Individuals can use the set of cognitive operations to alter their reference points, i.e., a less stringent reference point may be used for windfall income than earned income. In the mental accounting framework, I posit that it is only sometimes credible to assume that other people will update their reference point due to changes in your circumstances or actions. For example, suppose you receive both windfall income and earned income. Someone else observing this situation may not be inclined to perform cognitive operations to classify your different sources of income.[1] Therefore, they may not update the reference points.

My model predicts many intuitive and expected results. For example, in the dictator game, if the dictator works, she desires to keep more of the surplus to herself. Conversely, if the dictator observes that the recipient has worked, she desires to share more of the surplus with the recipient. My model generates results that explain much of the behavior observed in bargaining games when people earn the surplus, but my model also has some unanticipated predictions. For example, if the proposer works in the ultimatum game, the proposer may offer more than when she has not worked. On the one hand, the proposer's notion of a fair distribution is more tilted in her favor. On the other hand, the proposer is more sensitive to the possibility of an offer being rejected because she is loss averse. Thus, these settings create an ambiguous prediction of the proposer's final decision.

The data for the experimental predictions comes from two questionnaires. The questionnaires elicited strategies from respondents in modified versions of the ultimatum and dictator games. The respondents' strategies in the altered ultimatum and dictator games clarify how information plays a role in changing reference points. For example, a proposer may update her reference point to one which favors the responder who exerts the effort, which generates the surplus once the proposer becomes aware that the responder has worked.

The questionnaires reveal conventional patterns as well as some unusual ones. In both the dictator games and the ultimatum games, most players respect the perceived property rights earned by others. Responders in the ultimatum game almost unanimously increase their minimum acceptable offer if the proposer is aware that they have worked (more than 10% of respondents change their demand to the entire pie). Similarly, most responders in the ultimatum game decrease their minimum acceptable offer from the equitable demand if the proposer has worked and they are sure of this fact. Some proposers tend to offer less if the responder is aware

[1] This statement is plausible unless other people are compensated for this bookkeeping, i.e., a paid (mental) accountant, which I suppose most of us are not.

that they have worked for the surplus. An unusual pattern emerges in this situation as other proposers share more of the surplus. When the proposer becomes certain that the responder has worked, most proposers offer more (approximately 40% of respondents change their offer to three-quarters and the entire pie).

In conclusion, perceptions of fairness influence the equilibrium outcome in bargaining experiments. Moreover, perceptions of fairness also influence bargaining situations in the real world. An employee may only receive what she perceives to be a sufficient raise if the employer recognizes the employee's efforts. When one firm wants to acquire another firm, the negotiations may fail because there is a misalignment of what each side perceives to be a fair transaction. Nations disputing over territory may never find a solution due to dissension about what is a fair division for each side. In all three scenarios, the actors in the negotiation do not have similar views of circumstance because their perceptions of fairness are not the same. However, if the actors recognize that others may not share the same reference points, they may be able to reconcile reference points to reach an amicable agreement.

2. Literature Review

There has been a considerable amount of experimental research focused on other-regarding preferences. The experiments motivated various theoretical models created to make sense of the data. The two theory papers that significantly influenced this literature are Fehr and Schmidt (1999) and Bolton and Ockenfels (2000). These papers showed how other-regarding preferences over income inequality could explain a wide range of experimental results. Succeeding experimental literature has added to the understanding of other-regarding preferences.

Likewise, there has been a vast amount of research on incorporating human cognition into economics. Historically, actors in economic models are assumed to have limitless computational capabilities, and to be self-interested, optimal, and rational. Nevertheless, rationality is limited when humans make decisions. Kahneman and Tversky (1979) incorporate their psychological insights into economics by assuming actors in models have limits on computational capabilities. In other words, by assuming the actors to be human.

2.1. Early experimental evidence

Güth and Kocher (2014) mention the ultimatum game as an important workhorse in behavioral economics and psychology research because the game is a valuable tool for studying questions in bargaining situations. However, researchers find early experimental evidence did not concur with positive theoretical predictions. Güth, Schmittberger, and Schwarze (1982) were the first to conduct experiments using the ultimatum game. Standard economic theory predicts that the proposer keeps nearly all of the pie, and the responder accepts the smallest positive amount (Rubinstein

1982). The experiments find that the modal offer is half the pie. Evidence from other games like the Dictator Game, the Mini-Ultimatum Game, the Third Party Punishment Game, the Gift Exchange Game, the Trust Game, and the Power to Take game also play an important role in challenging the self-interest hypothesis. Subsequent research finds that experimental outcomes that differ from equilibrium predictions are commonplace.

One possible explanation for the disparity between theory and empirical results is the players' fairness concerns. Hoffman and Spitzer (1985) report on a previous experimental study conducted by Hoffman and Spitzer (1982). They explain the experimental design as "bargains struck between two subjects with opposing payoff functions and full information of one another's payoffs. By a flip of a coin, one participant could choose a noncooperative outcome unilaterally: the winner of the coin toss could choose an outcome that gave him $12 and left the other subject nothing, whether or not the loser agreed. However, if the two subjects cooperated, they could obtain from the experimenter $14, which could be split between the subjects in any mutually agreed-on manner. (p. 259)" Game theory predicts that the subjects will cooperate and that the division will be $13 to $1 in favor of the coin toss winner. According to the theory, the winner of the coin flip should not settle for less than $12. The authors find that although all the subjects chose the joint profit-maximizing outcome, they divided the rewards $7 to $7. Therefore, each coin flip winner agreed to take $5 less than the $12 that would have otherwise been obtained without the other subject's cooperation.

Fairness is an essential consideration for players in economic experiments, but fairness alone does not reconcile with the experimental evidence. For example, Forsythe et al. (1994) propose that if players give away money only because of a desire to be fair, the distributions of offers in dictator and ultimatum games with equal pies would be identical. However, the authors reject the fairness hypothesis as players are more generous in the ultimatum game than in the dictator game. Moreover, a fraction of players are pure gamesmen in dictator games, but there are no pure gamesmen in ultimatum games.

Hoffman et al. (1994) conclude that observed other-regarding behavior in games is not due to concerns of fairness but concern about how others will perceive the decisions. They find that the presence of the experimenter, who is aware of players' outcomes, can significantly reduce the incidence of self-regarding behavior. The authors and other researchers find that legitimizing a sense of entitlement and property rights leads to the first mover being less influenced by the possibility of punishment by a counterpart.

Legitimizing different aspects in a laboratory experiment affects the behavior of subjects. Hoffman et al. (1994) show there is a sense of legitimacy for the first mover if they had scored high on a quiz to earn that role. By legitimizing the role, the player feels entitled to be the first mover. In other words, the player believes

they have the right to be the first mover. Hoffman et al. (1994) write that property rights are a set of guarantees for the rights holder. First, property rights allow the rights holder to act within the guidelines defined by the right. Secondly, there is a guarantee against reprisal which might be used to ensure cooperative behavior. Also, the right can be viewed as a way society legitimizes the action of a rights holder. In other words, when property rights are recognized and accepted, what action is fair and acceptable can be agreed upon. Therefore, the moment a role in an experiment is legitimized, the rights holder may feel a sense of entitlement over the role and act accordingly afterward in the experiment.

Studies that induced self-serving behavior by legitimizing the roles in bargaining games find a narrowing disparity between theory and empirical evidence. For example, Güth and Tietz (1985, 1986) study the effect of providing entitlements over the endowment by auctioning the roles of proposers and responders in the ultimatum game. In their experiment, subjects were first informed about the rules of a sealed-bid section-price auction. Then once the subjects were accustomed to bidding in the auction, they participated in bidding for positions in the ultimatum game. They observe that by auctioning off the roles of proposer and responder, there were very few equal splits but a division of about a third of the pie. Similarly, in ultimatum and dictator game experiments, Hoffman et al. (1994) study the effect of earning the right to be the first mover. They find that if a player earns the right to be the first mover by scoring high on a quiz, and that right is stated in the instructions as being earned, then first movers behave in a more self-regarding manner.

Several studies examining how players act over earned and allocated money find a similar effect to legitimizing roles. Property rights created by legitimizing assets play a crucial role in players' revealed preferences over outcomes (Oxoby and Spraggon 2008). Some subjects in the study participated in an earnings stage prior to the dictator game to create a sense of asset entitlement. First, in the baseline treatment, on average, dictators allocate receivers 20 percent of the pie. Second, dictators allocate the theoretically predicted 0 percent in the dictator earnings treatment. Third, in the receiver earnings treatment, some offers exceed 50 percent. Undoubtedly, the legitimacy created by earning money is important in determining players' choices in the dictator game.

Similarly, Ogawa et al. (2012) examine how earned income and work performance affect the dictator's allocation of the surplus. They conduct modified dictator game experiments wherein a dictator or a recipient works before the dictator allocates the surplus. They, however, refer to the allocation process as a donation. Unlike a setting similar to a trust game, the recipients' performance does not affect the dictators' endowments. Ogawa et al. determine that the dictators' behavior not only depends on how the income was received but also on how the dictators perceive a situation to be fair or equitable.

Another possible interpretation of property rights is that earning wealth psy-

chologically affects people. Cherry (2001) use mental accounting to explore other-regarding behavior. Cherry explains, "The transition of mental accounting to bargaining requires the assumption that people are consumers at the bargaining table." (Cherry 2001, p 606) This psychological framework introduces the idea that people act differently over money from different sources where people have a different willingness to consume various forms of wealth (Thaler 1985, 1990). Moreover, other studies show that people are more likely to spend an unexpected windfall that is small relative to their regular income (Keeler, James, and Abdel-Ghany 1985; Thaler and Johnson 1990; Arkes et al. 1994; Keasey and Moon 1996). In this study, some subjects earned money by participating in a market for money lotteries before the dictator game session began. Therefore, some subjects will bargain over earned money while others will bargain over unearned money.

In the non-earnings treatment, Cherry (2001) finds that the mean offer was 31 percent of the initial unearned allocation, which is inconsistent with game-theoretic predictions. Seventy-four percent of dictators offered a positive amount, with 14 percent offering an equal split. This result contrasted with the bargains over earned wealth, where only 24 percent of dictators made a positive offer, with no dictators offering an equal split. The mean offer drops nearly by half, to 16 percent. Therefore, bargaining over earned money decreased the frequency of off-equilibrium behavior and reduced the size of the remaining positive offers.

Cherry, Frykblom, and Shogren (2002) find results similar to the previous study. The experimental design is similar to the previous study, with a notable inclusion of a double-blind earnings treatment. In the baseline treatments, the theoretically predicted offer of zero occurred in less than 20 percent of the offers. On the other hand, if an earnings session occurred before the bargaining session, then zero offers were made over 70 percent of the time. The double-blind earnings treatment results in zero offers over 95 percent of the time. As the authors explain, "Such hard-nose behavior by dictators stands in stark contrast to previous work that reports only 20-60 percent of observed behavior adheres to subgame perfection." (Cherry, Frykblom, and Shogren 2002, p 1220). Therefore, the experimental evidence presented motivated several theoretical models to explain the observed behavior across different experiments within the rational choice framework (Fehr and Schmidt 2006).

2.2. Theories of other-regarding preferences

Three categories of models have been proposed to explain the behavior observed in experiments. First, models of social preferences assume that people not only have a self-interested desire to maximize their own payoffs but are also concerned about the payoffs of others. Models of interdependent preferences assume that people may be of different types, such as altruistic and spiteful types, and that each person's preferences depend on the type of other people (Levine 1998; Rotemberg 2008; Gul and Pesendorfer 2016). Finally, models of intention-based reciprocity assume that people care about the intentions of others (Rabin 1993; Dufwenberg and Kirchsteiger

2004; Falk and Fischbacher 2006; Charness and Dufwenberg 2006).

Classical utility theory assumes that people have preferences over material resources that are allocated to them. In contrast, models of social preferences assume that people may also care about the material resources allocated to others (Fehr and Schmidt 2006). There are several different approaches to social preferences. The altruism hypothesis is that some people derive utility from the well-being of other people. An alternative hypothesis states that people are not only affected by the amount of money they have but also by their relative standing to others (Loewenstein, Thompson, and Bazerman 1989). Envy and jealousy are, therefore, disutility from the well-being of other people. The two hypotheses assume that the utility function is monotonic regarding the well-being of others. In contrast, inequity aversion models assume that people care about the egalitarian distribution of payoffs for everyone, in addition to their own payoff (Bolton and Ockenfels 2000).

Andreoni and Miller (2002) use a series of modified dictator game experiments to examine altruistic preferences. They modify the original dictator game by allowing each subject to choose from a menu of choices with different endowments and prices for payoffs. First, they check for violations of the General Axiom of Revealed Preferences and find that most players behave consistently. Thus, most of the players passed this rationality check. Second, they sort the subjects into three groups. Andreoni and Miller find that 30 percent of subjects behave in a way to equalize monetary payoffs between players. Furthermore, they found that 20 percent of subjects maximized the weighted sum of the monetary payoffs. On the other hand, nearly 50 percent of subjects behaved perfectly selfishly, not offering any amount to the other player. Andreoni and Miller conclude that there is not one notion of fairness or inequality aversion that all people follow. Due to individual heterogeneity, a model that may predict well in the aggregate may not predict individuals' behavior.

Rather than altruistic preferences explaining the observed behavior in experiments, an alternative hypothesis is that people in bargaining situations are influenced by absolute and relative money (Bolton 1991). Bolton defines absolute money as cash and relative money by the disparity between absolute measures. In his experiment, Bolton finds that players desire fairness for themselves. Nevertheless, players do not regard fairness concerns for others in the experiment. This approach is consistent with the behavior in particular bargaining games. A similar, envy-based approach of Kirchsteiger (1994) can explain the evidence of experiments, specifically the evidence of an equal share of the pie.

The preceding theories of social preferences assume that the utility function is monotonic with respect to the payoffs of others. In contrast, inequity aversion models assume that a player considers other players' payoffs and the relative distribution between other players and themselves. Fehr and Schmidt (1999) formulate a model of inequity aversion to reconcile the inconsistent behavior of people in competition

markets, bilateral bargaining situations, and voluntary cooperation games. A single model can explain the lack of exploitation of power in a bilateral bargaining situation and the exploitation of power in competitive markets and voluntary cooperation games.

Fehr and Schmidt have a few assumptions in their model. First, subjects enter the laboratory as equals, so the reference group is the set of subjects playing against each other, and the reference point is the equitable outcome. Second, there are purely selfish subjects and subjects who dislike inequitable outcomes. "They experience inequity if they are worse off in material terms than the other players in the experiment, and they also feel inequity if they are better off." (Fehr and Schmidt 1999, p. 822) Third, subjects experience greater loss from inequity to their material disadvantage than from inequity to their material advantage.

Using the assumptions mentioned earlier, the Fehr and Schmidt (FS) model proposes several results for the ultimatum game. It shows that there are no offers greater than half the surplus, and offers of half the surplus are always accepted, while low offers are likely to be rejected by the responder. Bolton and Ockenfels (2000) present a similar model of inequity aversion that yields similar results for two-player games. Unlike the Fehr and Schmidt (FS) model, the Bolton and Ockenfels (BO) model allow for nonlinear preferences. Another difference is that the FS model can be sensitive to changes in the distribution of payoffs over other individuals, which is not the case under BO.

Hybrid models incorporate elements from different approaches to modeling social preferences. By combining altruistic preferences and inequity aversion, Charness and Rabin (2002) find that subjects in their experiment are concerned with increasing social welfare and being motivated by reciprocity. Erlei (2008) combines elements from Fehr and Schmidt (1999) and from Charness and Rabin (2002) to conclude that heterogeneity of preferences is essential in explaining deviations of laboratory behavior from standard game theoretical predictions. Cox, Friedman, and Gjerstad (2007) incorporate the player's emotional state to determine whether preferences are altruistic or spiteful. Benabou and Tirole (2006) propose a theory that combines different degrees of altruism and greed with concerns for social reputation or self-respect.

2.3. Recent experimental evidence

Following Fehr and Schmidt (1999) and Bolton and Ockenfels (2000), plenty of experimental research has contributed to the literature on other-regarding preferences. What much of the recent literature has in common is modifying existing laboratory experiments to generate new insights into people's behaviors. For example, Fellner and Güth (2003) allows the cost of rejection to vary. At the same time, other researchers have examined property rights in games by varying experimental conditions, such as how the surplus is generated and where the experimental tokens are physically located.

According to Fellner and Güth (2003), threat power is the ability to impose a significant loss on someone else at a relatively low cost to themselves. Using a modified ultimatum game, the authors find that threat power is crucial. Responders only punish when they can do so at a relatively low cost to themselves. So, proposers anticipate this and refrain from offering low amounts in case of substantial threat power.

Leliveld, van Dijk, and van Beest (2008) create three variations of the ultimatum game: giving, splitting, and taking ultimatum games. This experimental design can be used to examine property rights. The authors allow subjects to bargain over experimental tokens. With the giving variation, the property is allocated to the proposer, and the tokens are located near the proposer. However, in the taking variation, the property is allocated to the responder, and the tokens are located near the responder. Lastly, in the splitting variation, the property is allocated to both players, and tokens are located between both players. They find that the allocations to the responder are the highest in the taking variation and lowest in the giving variation.

Dannenberg et al. (2012) use simple experimental games to analyze if individual inequality aversion depends on whether the endowment in the games is a windfall income or earned income. More specifically, the study examines the predictive power of the inequity aversion model proposed by Fehr and Schmidt (1999) when the source of money is controlled for. Using within-subjects tests, they find that the Fehr & Schmidt model has minimal explanatory power. When subjects earn their endowment, the model's explanatory power stays the same. Instead, the model performs best when low unearned stakes are used. They conclude that other forces, such as risk aversion, may overrule the implications of inequality aversion.

Carlsson, He, and Martinsson (2013) conduct dictator experiments to investigate the influences of windfall and earned endowment on behavior in the laboratory and the field. They find a substantial difference in behavior between using windfall and earned endowments in both settings. In addition, the subjects consider how the endowment is obtained and are much less equitable when the endowment is earned.

Lee and Shahriar (2017) examine the proposers' earned income on the responders' decision to accept offers. In their experiment, the proposers earn income by exerting effort and receive unearned income from the experimenter. Furthermore, in the experiment, offers and minimum acceptable offers are integers between \$0 and \$20. Their results show that the minimum acceptable offer decreases as the proposers' earned income increases. Specifically, as the proposers' earned income rises from \$5 to \$10 to and \$15, the average minimum acceptable offer falls from \$6.89 to and \$6.46 to \$6.11. In other words, as the fraction of earned-income rises, the responder tends to accept a lower offer.

Bediou et al. (2012) examine whether people switch between equality and equity. Pairs of participants first produced a common surplus, which was distributed in an ultimatum game. Proposers that produced less than half the share offered an

equal amount. On the other hand, when proposers produced more than 50 percent, their offers were somewhere between equality and equity. Likewise, responders prefer equal splits when their production is low but equitable splits when their production is high. Similarly, Franco-Watkins, Edwards, and Acuff (2013) examines how effort affects perceptions of fairness and allocation during bargaining situations. Participants who expend effort placed a more considerable monetary value on their effort and compensated themselves and others accordingly. In contrast, participants relied on egalitarian fairness norms when no effort was involved.

Barber IV and English (2019) also examine norms in ultimatum games. Their design involved three different types of endowments: subjects earn money by answering questions under a time constraint, subjects win money via a lottery, and subjects are exogenously provided wealth. They find that when subjects earn wealth, the modal responses do not show not an even split. Moreover, higher earners are more likely to keep their original earnings than lower earners. However, some low earners keep less than half for themselves.

2.4. Prospect theory

Thaler (2000) makes some predictions about the future of economics, a discussion regarding moving from Homo Economicus to Homo Sapiens. From a figurative economic human, one who is self-interested, optimal, and rational, to a real human, one who regards others and is not always optimal or rational. Thaler summarizes a small amount of economic history by recalling economics in the first half of the 20th century as resembling a social science. Following the mathematical revolution that started in the 1940s, economic models came to include "hyperrational" agents. The assumption of rationality lent itself to producing elegant economic models. However, empirical studies have questioned the assumption of rationality.

Understanding the bounds of rationality demands a better understanding of human cognition, which requires principles from psychology to be considered. Kahneman and Tversky (1979) propose a positive theory of decision-making under uncertainty that challenges the traditional view in economics that decision-makers are rational, expected utility maximizers. Before prospect theory, expected utility theory was the prominent theory explaining how people choose among risky alternatives. Von Neumann and Morgenstern (1947) proposed a set of axioms that formalized expected utility theory. This theory asserts that decision-makers choose the prospect that maximizes their expected utility. Under expected utility theory, the shape of the utility function captures the decision maker's risk preferences. Decision makers are risk-averse if the utility function is concave and risk-seeking if the utility function is convex.

Like expected utility theory, prospect theory assumes that the decision maker evaluates each alternative and selects the alternative with the highest subjective valuation (Chiu and Wu 2011). Prospect theory, however, differs from expected utility theory in many substantial ways. One difference is that prospect theory uses the

value function as opposed to the utility function used in the expected utility theory.

Three psychological principles shape the value function. For the first principle, reference dependence, Thaler writes, "The value function shows changes in material well-being on the horizontal axis, rather than the levels as in expected utility theory because humans (and other species) have a strong tendency to adapt to their environment and react only to perceived changes. The vertical axis shows happiness resulting from these changes." (Thaler 2000, p.137) For example, a $2,000 payment is seen differently if a worker was expecting a $1,000 payment or a $3,000 payment. The payments will be viewed as a $1,000 gain in the first scenario but a $1,000 loss in the second scenario. The second principle, diminishing sensitivity, is an idea from the psychology of perception where people display diminishing marginal sensitivity to both gains and losses. For example, the difference in value between a gain of 10 and a gain of 20 is greater than the difference between a gain of 1,010 and 1,020. The third principle, loss aversion, states that losses hurt about twice as much as gains make us feel good. For example, the pain associated with a loss of $100 feels worse than the pleasure associated with a gain of $100.

Boun My et al. (2018) develop a theoretical framework that combines the inequity aversion model of Fehr and Schmidt (1999) with loss aversion according to Kahneman and Tversky (1979). This framework allows them to study individuals' preferences for reducing advantageous inequality in the distribution of gains and losses. They find that the amount of payoff that subjects are willing to sacrifice to increase the payoff of others is smaller under a loss frame than under a gain frame. The results suggest that in the ultimatum game, the proposer offers a higher payoff when they bargain about the division of losses due to strategic considerations, not because of the direct effect of framing on their preferences.

Other studies have explored how framing outcomes as losses or gains affect behavior in ultimatum games. Leliveld et al. (2009) find that proposers increase their offers in games where outcomes are framed as losses. As a result, fairness becomes more important, and self-interest becomes less important than in a situation where outcomes are framed as gains. Zhou and Wu (2011) find that in the ultimatum game, rejection rates to unfair offers were higher in the loss than in the gain domain. Furthermore, they find that subjects associate unfairness with a loss and fairness with a gain, with stronger associations leading to higher rejection rates in the ultimatum game. Neumann, Schosser, and Vogt (2017) find that proposers demanded less in the loss domain and reached an agreement with responders more frequently.

3. Theoretical framework

Individuals are averse to outcomes that are seen as inequitable. An individual evaluates the fairness of an outcome based on a neutral reference point. This outcome is evaluated based on social comparisons – in other words, the relative material payoffs

are important in determining an individual's happiness and behavior. In a laboratory experiment, it is simpler to define the reference groups and reference outcomes for people; the reference group will be the set of subjects in the experiment, and the reference point is the egalitarian outcome. These assumptions are laid out in the Fehr and Schmidt (1999) model, which yields robust equilibrium predictions; however, the model does not allow for reference points to change. Therefore, I incorporate the value function of Kahneman and Tversky (1979) into the Fehr and Schmidt (1999) model; this modification allows reference points to change.

3.1. A Simple Model of Inequity Aversion

Loewenstein, Thompson, and Bazerman (1989) find the importance of relative payoffs. Subjects were asked to ordinally rank outcomes that differ in the distribution of payoffs between the subject and another individual. The evidence shows that subjects display a robust aversion to disadvantageous inequality. Subjects rank outcomes in which other people earn more than themselves lower than an outcome with equal material payoffs. Similarly, subjects exhibit an aversion to advantageous inequality. However, the effect of aversion to disadvantageous inequality seems to be weaker than an aversion to advantageous inequality.

A good starting point would be to review the original model and its prediction for the dictator game and the ultimatum game. The two person Fehr-Schmidt model is given by:

$$U_i(x_i, x_j) = x_i - \alpha_i \max\{x_j - x_i, 0\} - \beta_i \max\{x_i - x_j, 0\}, \quad i \neq j, \qquad (1)$$

where x_i and x_j represent the monetary payoffs to player i and player j respectively. The second term measures the utility loss from disadvantageous inequality, and the third term measures the utility from advantageous inequality. Fehr and Schmidt assume that $\beta_i \leq \alpha_i$ and $0 \leq \beta_i < 1$. The assumption $\alpha_i \geq \beta_i$ captures the idea that subjects experience greater displeasure from inequality that is to their disadvantage. Therefore, subjects experience loss aversion in a social comparison setting, negative deviations from the reference outcome hurt more than a commensurate positive deviation seems pleasurable. The assumption $\beta \geq 0$ rules out the existence of subjects who like to be better than others.

In the dictator game, only player 1, the dictator, has a choice to make. The dictator has to decide what share $s \in [0, 1]$ of a given surplus to give to player 2, the receiver. So, for any given share, s monetary payoffs are given by $x_1 = 1 - s$ and $x_2 = s$ for players 1 and 2, respectively. For the dictator game, the standard self-interest model predicts that player 1 will offer $s = 0$, unlike the Fehr-Schmidt model that predicts player 1 offers $s = 0.5$ if $\beta_1 > 0.5$ and $s = 0$ if $\beta_1 < 0.5$. When $\beta_1 > 0.5$, player 1 will never offer $s > 0.5$ because an offer of $s = 0.5$ always leaves her with higher utility. An offer of $s < 0.5$ will never occur because player

1 can be better off by decreasing the disutility from advantageous inequality. On the other hand, when $\beta < 0.5$, for any $s > 0$, player 1 can increase her utility by decreasing the share offered since the increase in x_i is larger than the increase in $\beta(x_i - x_j)$.

The ultimatum game is a two-player game where a proposer and responder bargain about the distribution of a fixed-size surplus. Player 1, the proposer, has to decide what share $s \in [0, 1]$ of the surplus to give to player 2, the responder. Unlike in the dictator game, player 2 has a choice to make and can accept or reject s. In the case of acceptance, the proposer receives monetary payoffs $x_i = 1 - s$, while the responder receives $x_j = s$. However, in the case of rejection, both players receive a monetary payoff of zero. Under the standard model, the responder accepts any $s \in (0, 1]$ and is indifferent between accepting and rejecting $s = 0$. It follows that the responder accepts the unique subgame perfect equilibrium in which the proposer offers $s = 0$. The responder with Fehr-Schmidt preferences will accept any offer $s \geq 0.5$, reject if $s < s'(\alpha_j) \equiv \frac{\alpha_j}{1+\alpha_j} < 0.5$, and accept $s > s'(\alpha_j)$. If the proposer knows the preferences of the responder, then the proposer will offer $s^* = 0.5$ if $\beta_i > 0.5$, $s^* \in [s'(\alpha_j), 0.5]$ if $\beta_i = 0.5$, and $s^* = s'(\alpha_j)$ if $\beta_i < 0.5$ in equilibrium.[2]

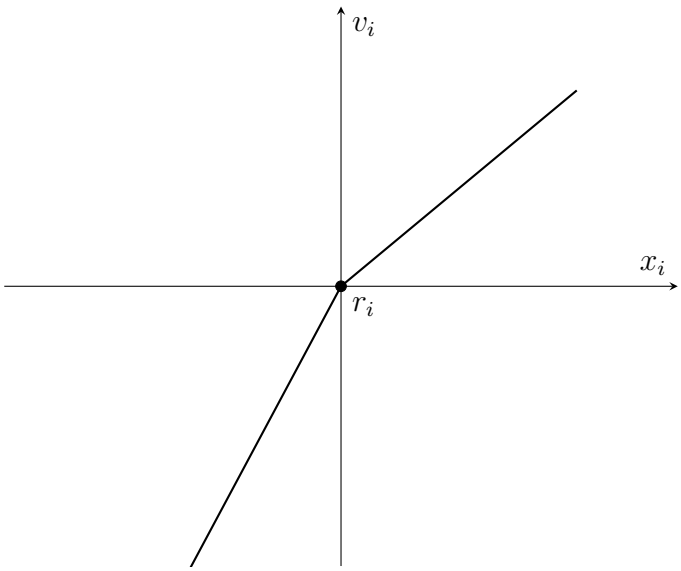
3.2. Allowing reference points to change

Fehr and Schmidt (1999) discuss the influence of the social context, the saliency of particular individuals, and the social proximity among individuals in determining reference groups and outcomes. Determining the relevant reference group and the relevant reference outcome for a set of individuals is multifaceted. Nevertheless, by restricting attention to individual behavior in experiments, the reference groups and outcomes are much simpler to define. Subjects do not know anything about each other, and they are allocated roles randomly, i.e., they enter the laboratory as equals. So, a natural reference group is the set of subjects in the experiment, and the reference point is the egalitarian outcome. In other words, people will believe that all subjects in the experiment deserve equal monetary compensation.

The assumption that reference point is the equitable outcome requires subjects to perceive each other as equals throughout the entire time in the laboratory. But during the experiment, subjects may alter their reference group and outcome. In the original model, the amount of the surplus retained by the proposer and obtained by the responder is framed as monetary payoffs; however, this framing could be nuanced. The nuance lies in the origin of the surplus, whether the money is earned or the experimenter endows the money. Presumably, if you feel some ownership over the pie, you will establish a reference point at a level you feel you deserve. This feeling could raise your reference point when you have worked for money. Conversely, you may lower your reference point when the other player has worked for the money.

[2] See Fehr and Schmidt (1999) for a detailed treatment and for the case in which the proposer does not know the responder's preferences.

Figure 1. A value function that exhibits loss aversion when $\gamma_i > 1$.



This twist on the original model makes the reference point different from the equitable outcome. Furthermore, payoffs can be framed as a loss when the monetary payoff is less than one's reference point and a gain when the monetary payoff exceeds one's reference point. Kahneman and Tversky (1979) argue that three psychological principles – reference dependence, diminishing sensitivity, and loss aversion – play an important role in decision making. First, reference dependence is the idea that people tend to adapt to their environment and react only to perceived changes. Second, diminishing sensitivity is an idea from the psychology of perception where people display diminishing marginal sensitivity to gains and losses. Last, loss aversion is the idea that the displeasure from a loss is greater than the pleasure from a commensurate gain.

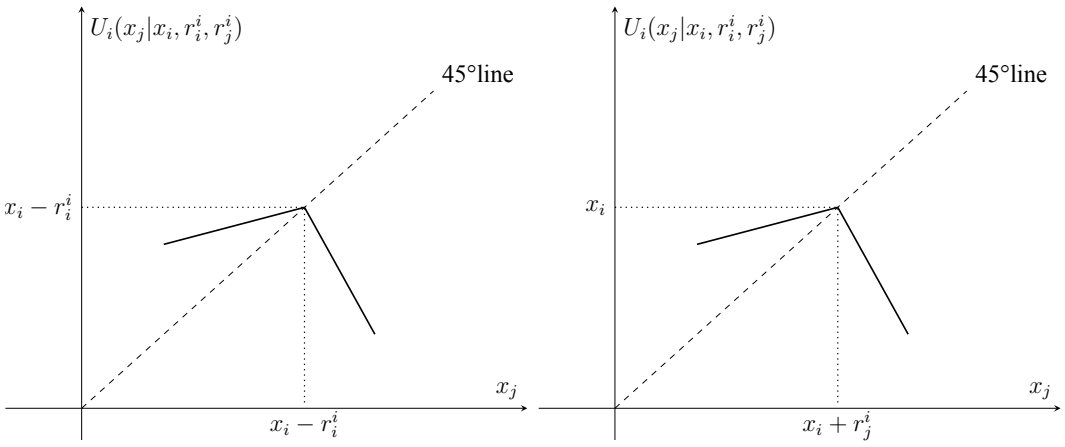
The psychological principles come together in the value function. Figure 1 illustrates the value function in equation 2 of player i as a function of x_i and r_i. For the sake of clarity, I will drop diminishing sensitivity. The value function is defined on deviations from the reference point and steeper for losses than for gains (when $\gamma_i > 1$). Any payoff x_i is evaluated relative to the player's reference point r_i (in a sense, her psychological sense of where things stand) using the following function:

$$v_i(x_i, r_i) = \begin{cases} x_i - r_i & \text{if } x_i \geq r_i \\ \gamma_i(x_i - r_i) & \text{if } x_i < r_i \end{cases} \tag{2}$$

3.3. A simple model of perceived inequity aversion

To build the framework, I replace the simple payoffs in the Fehr and Schmidt (1999) model with a value function that minimally reflects loss aversion in the manner of Kahneman and Tversky (1979). The modified utility function for player i is:

Figure 2. Preferences with perceived inequity aversion



(a) $r_i^i > 0$ and $r_j^i = 0$ (b) $r_i^i = 0$ and $r_j^i > 0$

$$\begin{aligned} U_i(x_i, x_j, r_i, r_j) = v_i(x_i, r_i) &- \alpha_i \max\{v_j(x_j, r_j) - v_i(x_i, r_i), 0\} \\ &- \beta_i \max\{v_i(x_i, r_i) - v_j(x_j, r_j), 0\} \end{aligned} \tag{3}$$

where $v_i(x_i, r_i)$ denotes the value perceived by player i for a monetary payoff x_i at reference point r_i defined in equation 2. Similarly, $v_j(x_j, r_j)$ denotes the value perceived by player j for a monetary payoff x_j at reference point r_j. However, it is important to note that r_j is what player i believes to be the reference point of player j. The second term measures the utility loss from *perceived disadvantageous inequity*. Likewise, the third term measures the utility loss from *perceived advantageous inequity*. I assume that $\gamma_i > 1$ and $\gamma_j > 1$ for $v_i(x_i, r_i)$ and $v_j(x_j, r_j)$ respectively. The assumption that $\beta_i \leq \alpha_i$ and $0 \leq \beta_i < 1$ will remain from the original model.

It will be helpful to introduce additional notation to indicate who perceives the reference point to account for the fact that different players may perceive a reference point differently. So, let r_i^i denote reference point i perceived by player i and r_j^i denote reference point j perceived by player i. The utility function for player i can be rewritten with superscripts denoting who is perceiving the reference point,

$$\begin{aligned} U_i(x_i, x_j, r_i^i, r_j^i) = v_i(x_i, r_i^i) &- \alpha_i \max\{v_j(x_j, r_j^i) - v_i(x_i, r_i^i), 0\} \\ &- \beta_i \max\{v_i(x_i, r_i^i) - v_j(x_j, r_j^i), 0\}. \end{aligned} \tag{4}$$

Then r_i and r_j can be used to indicate the reference point if both players i and j perceive it the same, i.e., if $r_i^i = r_i^j$ then r_i can be used for simplicity.

Figure 2 illustrates the utility of player i as a function of x_j for a given income x_i in two cases: panel (a) $r_i^i > 0$ and $r_j^i > 0$ and panel (b) $r_i^i = 0$ and $r_j^i > 0$. Given

her monetary payoff x_i, player i's utility function obtains a maximum at $x_j = x_i - r_i^i$ and $x_j = x_i + r_j^i$ for panels (a) and (b) respectively.

In two-player bargaining games, the players' reference points are influenced by the origin of the surplus. I postulate that if the surplus being split is unearned, both players' reference points are at 0. Neither player i nor player j have worked for the endowment, so the players will not experience a loss if they receive nothing, which rules out $r_i, r_j > 0$. Similarly, $r_i, r_j < 0$ is not sensible since there is no reason for a player to lower their reference point. The utility loss from disadvantageous inequality is greater than the utility loss from advantageous inequality in both cases.

Either player in the game can earn the surplus being divided. Suppose player i has worked for the endowment without loss of generality. The extent to which player i adjusts r_i^i may reflect mental accounting tendencies. This internal, psychological mechanism may cause a rise in the reference point because earned income is less likely to be spent than windfall income (Keeler, James, and Abdel-Ghany 1985; Thaler and Johnson 1990; Arkes et al. 1994; Keasey and Moon 1996). An assumption required is that spending – in the context of a bargaining game – is sharing more of the pie with the other player. The unwillingness to part with the earned income can be attributed to a higher reference point for earned income than unearned income.

At the same time, another reason player i adjusts r_i^i may instead reflect property rights. This external, societal mechanism may cause a rise in the reference point because what is perceived to be fair has been adjusted (Hoffman et al. 1994). Property rights guarantee the rights holder the ability to act within the guidelines defined by the right. Also, there is a guarantee against reprisal. Moreover, property rights act as an instrument through which society legitimizes the action of a rights holder. Although it is clear that property rights grant the rights holder in the economy certain liberties, it needs to be evident in a bargaining experiment how subjects perceive property rights. Therefore, it may be more apt to use the term *perceived property rights*, at least in economic experiments. When the perceived property right is recognized and accepted by the players, what action is fair and acceptable can be informally agreed upon. Therefore, r_i may rise for both player i and player j. A similar outcome can occur when player j works for the endowment, and the extent to which player i increases r_j^i reflects her respect for other person's property rights.

4. Perceived inequity aversion in bargaining games

In this section, I apply the new perceived inequity aversion model to the dictator game and the ultimatum game. In the dictator game, I find some intuitive results. In the ultimatum game, I find some intuitive and counter-intuitive results.

In the dictator game, I follow the convention that player i is the dictator, and player j is the recipient. Similarly, in the ultimatum game, player i is the proposer,

and player j is the responder. The rules specify that player i can offer share $s \in [0, 1]$ to player j where s the bargaining surplus is normalized to one. So, the share for player i is denoted by $1 - s$, and the share for player j is denoted by s.

4.1. Model applied to the dictator game

The dictator game is a game involving two players in which only the dictator has to decide. The dictator has to decide what share $s \in [0, 1]$ of a given amount of money to give to the other player, the recipient. The standard self-interest model predicts $s = 0$. However, numerous experimental studies present contrasting evidence. Studies find that subjects gave $0 < s < 0.5$ and $s > 0.5$ was never observed (Forsythe et al. 1994; Andreoni and Miller 2002). The Fehr and Schmidt (1999) model predicts $s = 0.5$ and $s = 0$, and by allowing the utility function to be concave, optimal offers of $s \in [0, 0.5]$ can be generated.

Nevertheless, the model cannot account for offers seen when participants in an experiment work for money. For example, Cherry (2001) reveals that when the dictator earns the wealth to be passed onto the recipient, the shares offered fell in the range of $s \in [0, 0.3]$ with less weight on $s = 0.25$ and more weight on $s = 0$. Moreover, Oxoby and Spraggon (2008) find that when the receivers earn the wealth, the offers exceed 50 percent, i.e., $s > 0.5$.

The dictator who was endowed with an unearned surplus will have the following reference points, $r_i^i = r_j^i = 0$. Thus, the model reduces to precisely the Fehr-Schmidt model. Player i offers $s = 0.5$ if $\beta_i > 0.5$ and offers $s = 0$ if $\beta_i < 0.5$.

Proposition 1. Suppose player i worked for the surplus and will have a sense of entitlement over the surplus earned. Assume the dictator has reference points $r_i^i > 0$ and $r_j^i = 0$. Then, the dictator will share:

$$s^* \begin{cases} = \frac{1-r_i^i}{2} & \text{if } \beta_i > 0.5 \\ = 0 & \text{if } \beta_i < 0.5. \end{cases} \tag{5}$$

Proof. Player i does not experience inequity when $x_i - x_j = r_i^i$. To achieve this allocation, player i must share $s = \frac{1-r_i^i}{2}$. If $s \geq \frac{1-r_i^i}{2}$, player i experiences inequity that is to her disadvantage. If $s < \frac{1-r_i^i}{2}$, player i experiences equity that is to her advantage. Given $\alpha_i \geq \beta_i$ and $\beta_i \geq 0$, it is optimal for the dictator to offer $s \leq \frac{1-r_i^i}{2}$.

If $\beta_i > 0.5$, then U is rising in s. So, player i would choose the largest possible value, $s = \frac{1-r_i^i}{2}$ (bounded by own inequity aversion, i.e., α_i). A large value of β_i means the individual is particularly averse to gaps between himself and people below him. If $\beta_i < 0.5$, then U is decreasing in s. Hence, player i would choose the smallest possible value, $s = 0$. If $\beta_i = 0.5$, then U does not depend on s. Thus, any offer between 0 and $\frac{1-r_i^i}{2}$ is possible. ■

Proposition 1 accounts for many of the facts observed in the dictator games where the dictator earns the surplus. It argues that there will be no offers above $\frac{1-r_i^i}{2}$. Furthermore, all offers fall between 0 and $\frac{1-r_i^i}{2}$. The dictator feels entitled to part of the surplus and behaves as if she is splitting the remainder.

For $\beta_i > 0.5$, note that the optimal amount shared s^* is linear in r_i^i and has some intuitive properties. It is decreasing in r_i^i, and it converges to 0 if $r_i^i \to 1$. Furthermore, the lower boundary point of r_i^i has a sensible result, $r_i^i = 0$ yields $s^* = 0.5$. As a dictator loses her entitlement over the surplus, i.e., $r_i \to 0$, she will make offers approaching an equal share. On the other hand, a dictator who has full entitlement over the surplus, i.e., $r_i^i = 1$, is predicted to keep the entire surplus.

Proposition 2. Suppose player j worked for the surplus and will have a sense of entitlement over the surplus. Assume player i respects this, so $r_i^i = 0$ and $r_j^i > 0$. Then, a dictator will share:

$$s^* \begin{cases} = \frac{1+r_j^i}{2} & \text{if } \beta_i > 0.5 \\ = r_j^i & \text{if } \frac{1}{1+\gamma_j} < \beta_i < 0.5 \\ = 0 & \text{if } \beta_i < \frac{1}{1+\gamma_j} \end{cases} \tag{6}$$

Proof. Player i does not experience inequity when $x_i = x_j - r_j^i$. For that to happen, the dictator has to share $s = \frac{1+r_j^i}{2}$, which can be seen as an equitable offer after player j extracts his reference point from the surplus.[3] If $s > \frac{1+r_j^i}{2}$, player i experiences inequity that is to her disadvantage. If $s < \frac{1+r_j^i}{2}$, player i experiences inequity that is to her advantage. It is optimal for the dictator to offer $s \leq \frac{1+r_j^i}{2}$.

If $\beta_i > 0.5$, then U is rising in s. So, player i would choose the largest possible value, $s = \frac{1+r_j^i}{2}$. A large value of β_i means the individual is particularly averse to gaps between herself and people below her. If $\beta_i < 0.5$, then U is decreasing in s. Therefore, player i would choose the smallest possible value, $s = r_j^i$ (bounded by the player j's value function). For $\frac{1}{1+\gamma_j} < \beta_i$, U is increasing in s until $s = r_j^i$. If $\frac{1}{1+\gamma_j} > \beta_i$, then U is decreasing in s. Thus, player i will choose the smallest possible value, $s = 0$. When $\beta_i = 0.5$ or $\beta_i = \frac{1}{1+\gamma_j}$, U is independent of s. ■

Proposition 2 explains the behavior observed in the dictator games where the recipient earns wealth. It argues that all offers fall between 0 and $\frac{1+r_j^i}{2}$. The dictator accepts that part of the surplus belongs to the recipient and behaves as if she is dividing the remainder.

Some sensible results exist for $\beta_i > 0.5$. The optimal offer s^* is increasing in r_j and it converges to 1 if $r_j^i \to 1$. Moreover, the lower extreme reference point has

[3] As any child with a father that will take *just* one bite of their food understands.

expected results, $r_j^i = 0$ yields $s^* = 0.5$. As a dictator believes the recipient has a weak entitlement over the surplus, i.e., $r_j^i = 0$, she will make offers approaching an equal share. Yet, a dictator who believes the recipient has full entitlement over the surplus, i.e., $r_j^i = 1$, is predicted to offer the entire surplus.

A dictator with a relatively small value β_i is not notably averse to gaps between herself and people below her. If $\beta_i > \frac{1}{1+\gamma_j}$, she will not offer the recipient zero rather r_j^i. For large values of γ_j, there need not be a sizable advantageous inequity aversion for the dictator to offer r_j^i. Further, if $s^* = r_j^i$ and $\gamma_j \to \infty$, then $\beta_i \to 0$. Thus, the dictator's lower bound of offers is restricted by the perception of player j's loss aversion γ_j.

4.2. Model applied to the ultimatum game

The ultimatum game is a simple, take-it-or-leave-it bargaining game. The proposer is endowed with a sum of money and has to offer $s \in [0, 1]$ to the responder. The responder may accept or reject this offer. If the responder accepts, the proposer receives $1 - s$, and the responder receives s. If the responder rejects, both players receive nothing. The self-interest model predicts that the responder accepts any $s > 0$ and is indifferent between accepting and rejecting $s = 0$. Thus, in equilibrium, the proposer offers $s = 0$, which the responder accepts.

A robust result, across many experiments, is that majority of the offers to the responders are between $s \in [0.4, 0.5]$. Furthermore, offers $s < 0.2$ are infrequent, and a responder will likely reject such an offer. The Fehr and Schmidt (1999) model is capable of accounting for the facts of the ultimatum game. It shows that there are no offers $s > 0.5$, that offers of $s = 0.5$ are always accepted and that low offers are likely to be rejected.

The model cannot account for offers when the proposer is in a situation where participants exert effort to produce the surplus. When an individual earns the wealth to be split in the ultimatum game, evidence suggests that equilibrium outcomes are influenced by the origin of the surplus (Ruffle 1998; Barber IV and English 2019). How well does my model account for the results in ultimatum games where earned income is a factor?

In the endowment scenario, reference points are not utilized. So, the model reduces to precisely the Fehr-Schmidt model. Player i offers $s = 0.5$ if $\beta_i > 0.5$, offers $s \in [s'(\alpha_j), 0.5]$ if $\beta_i = 0.5$, and offers $s'(\alpha_j)$ if $\beta_i < 0.5$.

Proposition 3. Suppose player i worked for the surplus and will have a sense of entitlement over the surplus. Assume player j recognizes this, then the reference points for both player i and j are $r_i > 0$ and $r_j = 0$. Assume that player i will keep

at least her reference point, i.e., s$\leq r_i^i$. Then, the proposer will offer:

$$s^* \begin{cases} = \frac{1-r_i^i}{2} & \text{if } \beta_i > 0.5 \\ \in [s'(\alpha_j, r_i^i), \frac{1-r_i^i}{2}] & \text{if } \beta_i = 0.5 \\ = s'(\alpha_j, r_i^i) & \text{if } \beta_i < 0.5 \end{cases} \tag{7}$$

Proof. If $s \geq \frac{1-r_i^i}{2}$ is offered, then the utility of the responder from accepting is always positive for $\beta_j < 1$. For $s < \frac{1-r_i^i}{2}$, player j will accept if the utility from acceptance is nonnegative. This is the case only if s exceeds the acceptance threshold

$$s > s'(\alpha_j, r_i^i) \equiv \frac{\alpha_j(1-r_i^i)}{1+2\alpha_j}.$$

A proposer never offers $s > \frac{1-r_i^i}{2}$. An offer of $s = \frac{1-r_i^i}{2}$ will be accepted with certainty and will yield higher utility. If $\beta_i > 0.5$, her utility is strictly increasing in s for all $s \leq \frac{1-r_i^i}{2}$. If $\beta_i = 0.5$, she is indifferent between giving to the responder and keeping it for herself. Thus, she is indifferent between all offers that are acceptable to the responder, i.e., $s \in [s'(\alpha_j, r_i^i), \frac{1-r_i^i}{2}]$. If $\beta_i < 0.5$, her utility is strictly decreasing in s. She wants to decrease s but is constrained by the responder's acceptance threshold. ■

Proposition 3 accounts for many of the facts observed in ultimatum games where the proposer earns the wealth. It argues that all offers fall between $s'(\alpha_j, r_i^i)$ and $\frac{1-r_i^i}{2}$. The proposer interprets that part of the surplus is rightfully hers and behaves as if the responder also perceives this situation.

See that $\lim_{r_i^i \to 1} s'(\alpha_j, r_i^i) = 0$, the point is if player j gives the entirety of the property rights to player i then player j is okay with zero. On the contrary, as $\lim_{r_i^i \to 0} s'(\alpha_j, r_i^i) = \frac{\alpha_j}{1+2\alpha_j}$. In this case, where property rights disappear, as α_j rises, the minimum acceptable share approaches half.

If $\beta_i > 0.5$, the equilibrium share s^* is decreasing in r_i and converges to 0 as $r_i^i \to 1$. Furthermore, the lower boundary point of r_i^i is as anticipated, $r_i^i = 0$ yields $s^* = 0.5$. As a proposer loses her sense of entitlement over the surplus, i.e., $r_i^i \to 0$, she will make offers approaching an equal share. On the contrary, a proposer with full entitlement over the surplus, i.e., $r_i^i = 1$, is predicted to offer zero.

Counter intuitive deviation. Proposition 3 provides an intuitive framework for understanding how the players will change their behavior if the responder respects the proposer's reference points. Consider the situation where the experimenter endows the proposer with money. It is sensible that neither player has a reference point that favors themselves or others. In other words, the reference points are likely to be the egalitarian ones, i.e., $r_i = r_j = 0$. In contrast, suppose that the proposer has

worked for the money and the responder observes this. If the responder respects the proposer's reference point, the results of proposition 3 hold. That is, the responder understands the proposer is deserving of more than an egalitarian division of the money and will be willing to accept an amount that is less than egalitarian.

A responder may not respect the proposer's efforts and update the proposer's reference point. To put it another way, the proposer may feel entitled to more money, but the responder believes an egalitarian split is desirable. The players may leave with nothing since the proposer's offer will not exceed the responder's minimal acceptable offer. Yet, a proposer may offer more than an egalitarian share as insurance, ensuring the responder accepts the offer. Therefore, a proposer that has worked for the surplus may offer more than she would have in the endowment scenario.

Consider a scenario where the proposer has worked for the surplus. Suppose the responder's perception of r_i^j is 0 or h with probabilities p and $1-p$ respectively. In other words, the responder will not respect the proposer's efforts with probability p and respect the efforts with probability $1-p$. Assume that $\beta_i < \frac{1}{2}$. For simplicity, let the proposer have a binary choice between offering s, a small amount, and g, a greater amount. The proposer would ideally offer the greater amount, g, if the responder does not respect her efforts. On the other hand, the proposer would offer a smaller amount, s, if the responder respects her efforts. The idea is s will suffice since the responder understands that the proposer is deserving of a larger proportion of the surplus. If s is offered, a responder accepts if she perceives r_i^j as h and rejects if she perceives r_i^j as 0. If g is offered, a responder always accepts. Now, the proposer's expected utility from s would be greater under the endowment, and the proposer's expected utility from g would be greater (due to loss aversion) after working for the surplus.

In the responder earnings scenario, the reference points from the perspective of player j are $r_i^j = 0$ and $r_j^j > 0$. If player i is aware that the responder has earned the surplus and respects this, then the reference points from the perspective of player i are similar, i.e., $r_i^i = 0$ and $r_j^i > 0$. But if player i is aware that the responder has worked and does not respect this, or is unaware or uncertain, then the reference points from the perspective of player i may be $r_i^i \neq 0$ or $r_j^i \not> 0$. Therefore, the proposer offers more after working for the surplus which is counter intuitive. The proposer offers more precisely because she feels more entitled to the money and fears losing what she has earned. Thus, a loss adverse proposer may offer g as a safeguard against the responder rejecting the offer.

Proposition 4. Suppose player j works for the surplus and will have a sense of entitlement over the surplus. Assume player i respects this, then the reference points for both player i and j are $r_i = 0$ and $r_j > 0$. Assume that player i will offer at least

player j's reference point, i.e., $s \geq r_j^i$. Then, the proposer will offer:

$$s^* \begin{cases} = \frac{1+r_j^i}{2} & \text{if } \beta_i > 0.5 \\ \in [s'(\alpha_j, r_j^i), \frac{1+r_j^i}{2}] & \text{if } \beta_i = 0.5 \\ = s'(\alpha_j, r_j^i) & \text{if } \beta_i < 0.5 \end{cases} \tag{8}$$

Proof. If $s \geq \frac{1+r_j^i}{2}$ is offered, then the utility of the responder from accepting is always positive. For $s < \frac{1+r_j^i}{2}$, player j has a nonnegative utility if s exceeds the acceptance threshold

$$s > s'(\alpha_j, r_j^i) \equiv \frac{r_j^i + \alpha_j(1 + r_j^i)}{1 + 2\alpha_j}.$$

A proposer never offers $s > \frac{1+r_j^i}{2}$. An offer of $s = \frac{1+r_j^i}{2}$ will always be accepted and yield higher utility. If $\beta_i > 0.5$, her utility is strictly increasing in s for all $s \leq \frac{1+r_j^i}{2}$. If $\beta_i = 0.5$, the change in utility that results from a change in s is exactly offset by the growing perceived advantageous inequity between herself and the responder. Therefore, she is indifferent between all offers that the responder will accept, i.e., $s \in [s'(\alpha_j, r_j^i), \frac{1+r_j^i}{2}]$. If $\beta_i < 0.5$, her utility is strictly decreasing in s. She will decrease s enough such that the responder will accept the offer. ■

Proposition 4 explains the facts seen in ultimatum games where the responder earns the wealth. It argues that all offers fall between $s'(\alpha_j, r_j^i)$ and $\frac{1+r_j^i}{2}$ are possible. The proposer understands that part of the surplus belongs to the responder and behaves accordingly.

As $\lim_{r_j^i \to 1} s'(\alpha_j, r_j^i) = 1$, the idea is that if player j feels entitled to the entire surplus then player j has an acceptance threshold of the entire surplus. On the contrary, as $\lim_{r_j^i \to 0}(\alpha_j, r_j^i) = \frac{\alpha_j}{1+2\alpha_j}$. So, there are no property rights in this case. As α_j rises, the minimum acceptable share approaches half.

If $\beta_i > 0.5$, the equilibrium share s^* is increasing in r_j^i and converges to 1 as $r_j^i \to 1$. As a proposer recognizes and respects the property right of player j, she will offer the entire surplus to the responder. Furthermore, the lower boundary point of $r_i^i = 0$ yields $s^* = 0.5$. A proposer who believes the responder has no entitlement over the surplus will offer half the surplus.

5. Methodology

Two elicitation methods, direct- response and the strategy method, are used in experimental economics. The direct-response method is an elicitation method in which

the responder is informed of the action of the first mover and then chooses a response. In comparison, the strategy method is an elicitation method in which the responder makes conditional choices for each possible information set. A question in the literature is whether the strategy method leads to different results than the direct-response method [4]. According to standard game theory, both methods should yield the same results. Nevertheless, some studies find a difference, and others do not.

Although the literature tests for differences in various experimental tasks, I focus strictly on the ultimatum games. Güth, Huck, and Müller (2001) find, with the direct-response method, that responders are marginally less likely to reject unequal offers when proposers have the choice between a lopsided and even split offer and there is no treatment effect with the strategy method. Oxoby and McLeish (2004) find there are no differences in mean offer or mean acceptance rate, but they find there are fewer rejections with the strategy method. Rapoport, Sundali, and Seale (1996) and Armantier (2006) find little difference between the two methods. Given that there is no conclusive answer on whether the two methods always lead to different results, I employ the strategy method in this paper. The strategy method helps gather data on scenarios infrequently reached in play, yielding greater observations than with direct response. Moreover, this method induces more strategic considerations for the responder. Since the responder is unaware of the offer, the responder has to decide her minimum acceptable offer based on what type of person the proposer is perceived to be.

6. Data

I use data from two questionnaires to examine the effects of perceptions of fairness on players' choices during bargaining games. The questionnaires contain data about Hunter College students' risk tolerance, degree of loss aversion, and demographic characteristics. While there are disadvantages to the questionnaire data relative to financially incentivized experiments, the patterns that emerge in the questionnaires should be apparent in future experimental evidence.

6.1. Classroom questionnaire

For the first questionnaire study, 104 students in an Introduction to Economics course at Hunter College participated. This questionnaire study was designed to see the general strategies of subjects in different bargaining situations.

Students were informed about what the questionnaires were for and the types of questions they would see. The students were asked to sign consent forms if they were willing to participate. On the questionnaires, the students were asked to answer

[4] See Brandts and Charness (2011) for a survey on the literature on the strategy versus the direct-response method.

Table 1. Summary statistics of offers and demands in classroom questionnaire

	Mean	SD	Min	Median	Max
Dictator game					
Endowment	0.45	0.14	0	0.50	1
Proposer earnings	0.27	0.19	0	0.25	0.75
Recipient earnings	0.70	0.25	0	0.75	1
Ultimatum game offers					
Endowment	0.45	0.14	0	0.50	1
Proposer earnings: responder unaware	0.32	0.18	0	0.28	0.75
Proposer earnings: responder aware	0.33	0.20	0	0.25	1
Responder earnings: proposer unsure	0.46	0.16	0	0.50	1
Responder earnings: proposer sure	0.69	0.23	0	0.75	1
Ultimatum game demands					
Endowment	0.47	0.19	0	0.50	1
Proposer earnings: responder uncertain	0.46	0.17	0	0.50	1
Proposer earnings: responder certain	0.29	0.22	0	0.25	1
Responder earnings: proposer unaware	0.59	0.22	0	0.50	1
Responder earnings: proposer aware	0.69	0.25	0	0.75	1

standard demographic questions and questions about risk preferences, choices over prospects, and mental accounting tendencies. Next, the students were informed about the structure of the dictator game and the ultimatum game, specifically the different ways the endowment can be determined (allocated by the experimenter, earned by the first mover, or earned by the second mover). Then they were asked to imagine if they had worked for income, i.e., thirty minutes of data entry or thirty minutes helping organize a storage room. The purpose of this was to simulate the earned income treatment.

After the preliminary questions were answered and the earned income situation primed, the students were asked to give their strategies in different dictator game scenarios. The questions proposed were to elicit how much of a $20 endowment they would offer. Moreover, this answer changes when the endowment is determined by the experimenter's allocation, the dictator's effort, or the receiver's effort. Lastly, the students moved on to different ultimatum game scenarios where their strategies as both the proposer and responder were elicited. I refer to the strategies of the proposer as offers and the strategies of the responder, the minimum acceptable offer, as demands. Like the dictator game questions, the ultimatum game questions asked how much of a $20 endowment they would offer (and demand) in different scenarios. A notable difference between questions in the two games is that the ultimatum game questions had scenarios of incomplete information. That is, some scenarios involved one of the players being unaware or uncertain of the actions of the other.

The three ways the surplus can be determined classify the dictator game scenarios: the endowment scenario, the dictator earnings scenario, and the recipient earnings scenario. The first category is the endowment scenario when the experimenter allocates the sum of money. The dictator must decide how much of this surplus to offer the recipient. The second category, the dictator earnings treatment, is when the money is earned by the dictator rather than the experimenter providing the money. Likewise, the dictator must decide how much to offer the recipient. The third category, the recipient earnings treatment, is when the recipient earns money. Afterward, the dictator must decide how much of this earned surplus to offer (or return) to the recipient. Like the dictator game, the three ways the surplus can be determined also classify the ultimatum game offers: the endowment scenario, proposer earnings scenario, and the responder earnings scenario. These scenarios elicit the amount each student offers in different scenarios, i.e., the amount of the surplus that will be offered as the proposer.

Lastly, the ultimatum game demand scenarios[5] follow a similar structure and can be divided into three categories. These categories elicit the minimum acceptable offer for each student in different scenarios, i.e., the amount of the surplus that needs to be offered to accept as the responder. First, the endowment scenario is when the experimenter provides the sum of money to the proposer, and the responder has to state a minimum acceptable offer. Second, the proposer earnings scenario has two variations: one in which the responder is uncertain that the proposer has worked and another in which the responder is certain that the proposer has worked. Lastly, the responder earnings scenario has two variations: one in which the proposer is unaware that the responder has worked and another in which the proposer is aware that the proposer has worked.

6.2. Online questionnaire

For the second questionnaire study, 60 undergraduate and graduate economics students at Hunter College participated in an online questionnaire.

Participants were informed about the nature of the study. If they were willing to participate, they signed an electronic consent form. The respondents answered demographic questions and questions on risk tolerance and loss aversion. The participants were then randomly assigned different variations of the ultimatum game,

[5] It is important to note that there is an inconsistency in framing the incomplete information scenarios across the ultimatum game offers and ultimatum game demands. For instance, the question posed in the ultimatum game offer is, "You have worked for the $20, and the responder is unaware of this." At the same time, the exact question posed by the responder in the ultimatum game offer is, "You are unsure if the proposer has worked for the $20 (perhaps, the money was from the experimenter). What is your minimum acceptable offer?" The proposer is presented with a scenario where the responder is unaware of the effort she has exerted. At the same time, the responder is presented with a scenario where she is uncertain that the proposer has worked. This difference in word choice may cause the players to form an inaccurate belief about the other players. While it may be true, inaccurate beliefs should not be significant enough to alter the general patterns in the data.

Table 2. Mean statistics in online questionnaire

	Offers			Demands	
	Endowment	Earnings (unaware)	Earnings (aware)	Endowment	Earnings
Age	24.1	29.5	30.6	27.5	23.1
Female	0.11	0.44	0.40	0.64	0.71
Employed	0.89	0.88	0.90	0.91	0.86
Risk tolerance	5.11	6.13	5.90	5.36	6
Loss aversion	25.6	3.18	7.70	20.1	17.5
Decision	0.46	0.47	0.39	0.47	0.29

[a] The endowment indicates when the experimenter provides the surplus to the proposer. The earnings scenario refers to when the proposer exerts effort to generate the surplus. Employed is a dummy-variable that indicates if the respondent is currently employed or has been in the past 12 months. Risk tolerance is the respondent's self assessment of risk, 1 being risk seeking and 10 being risk averse. The coefficient of loss aversion is defined as the ratio between $-U(-1)$ and $U(1)$.

where the bargaining scenario varied based on the day of the month they were born. The participant decides either the proposer or the responder in the ultimatum game. One bargaining scenario is the endowment, where the experimenter endows the proposer with the surplus. Another scenario is where the proposer exerts effort to build the surplus, but the responder is unaware of the effort. Lastly, the scenario where the proposer exerts effort to build the surplus and the responder is aware of this fact.

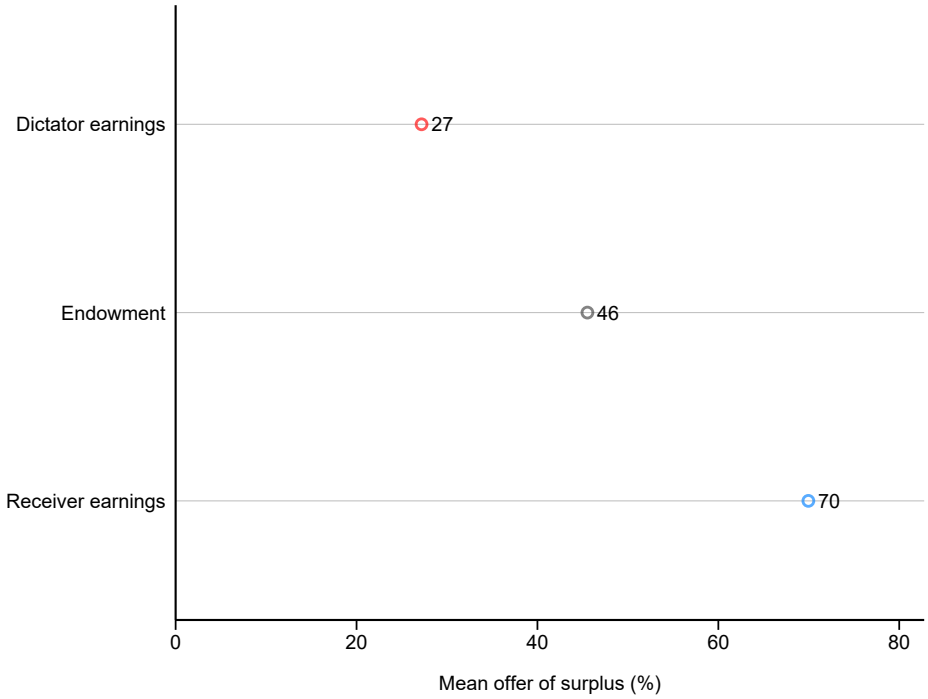
7. Results

First, in the classroom questionnaire, I present the means and distributions in different dictator game scenarios. Next, the focal points are the means and distributions of offers and demands in different ultimatum game scenarios. Afterward, I discuss how the information in games plays a role in perceptions of fairness. Lastly, I will discuss the offers and demands in the online questionnaire.

Since all participants in the classroom questionnaire provided strategies in every scenario, this design lends itself to a unique within-subject view. Fairness, reciprocity, and perceived property rights can be observed because the data contains how the subject would behave regarding both bargaining demands and offers. See table 1 for summary statistics of offers and demands in all scenarios.

An important caveat is that neither questionnaire used financial incentives. Furthermore, the classroom questionnaire results should primarily be interpreted as general patterns in the bargaining games.

Figure 3. Mean offers in dictator game scenarios



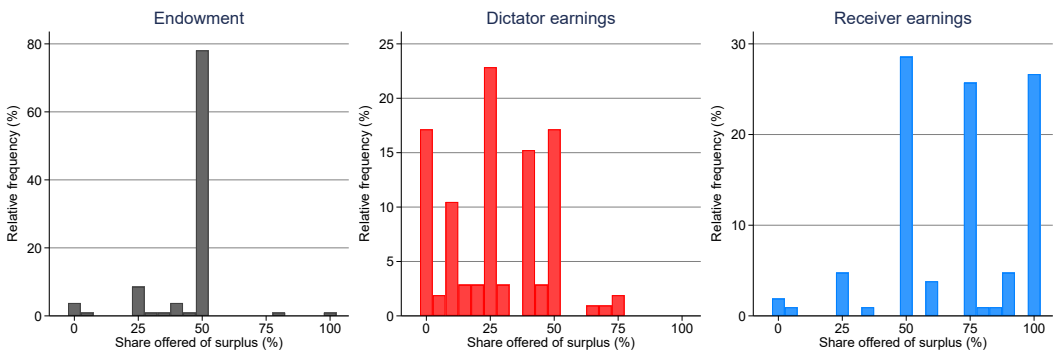
7.1. Classroom questionnaire results

Unlike in the ultimatum game, the players in the dictator game have no strategic concerns. This statement is easy to see for the recipient as she does not make a decision. While the proposer has the decision to make, the decision ought to be based on many factors – none of which are strategic. Thus, it seems sensible to start the data analysis with the results from the dictator game.

Figure 3 displays the mean offers in the three dictator game scenarios: the dictator earnings scenario, the endowment scenario, and the receiver earnings scenario. The average offer in the endowment is 46 percent of the surplus. In stark contrast, participants in the dictator earnings scenario offered only 27 percent. Using the fact that the dictator has exerted effort to generate the surplus, the dictator compensates herself accordingly by keeping more of the share. Conversely, the average offer is 70 percent of the surplus in the receiver earnings scenario.

In Figure 4, the distributions in the dictator game scenarios are shown. Equitable offers account for nearly 80 percent of all offers in the endowment scenario. Given that the equitable outcome is the reference point of the players, this statement is not surprising. Moreover, most of the remaining offers are less than half the pie which is to be expected as well. The dictator earnings scenario is right-skewed, implying that the mean offer is greater than the median offer. The most frequent offer is a quarter of the pie which accounts for 23% of offers, followed by zero for 17%

Figure 4. Distributions in dictator game scenarios



of offers, followed by half the pie being offered for another 17% of offers. Furthermore, over 96 percent of all offers are equal to or less than half the pie. This fact shows that dictators perceive reference point i as greater than 0, i.e., $r_i^i > 0$. In other words, the dictator has a sense of entitlement over the pie.

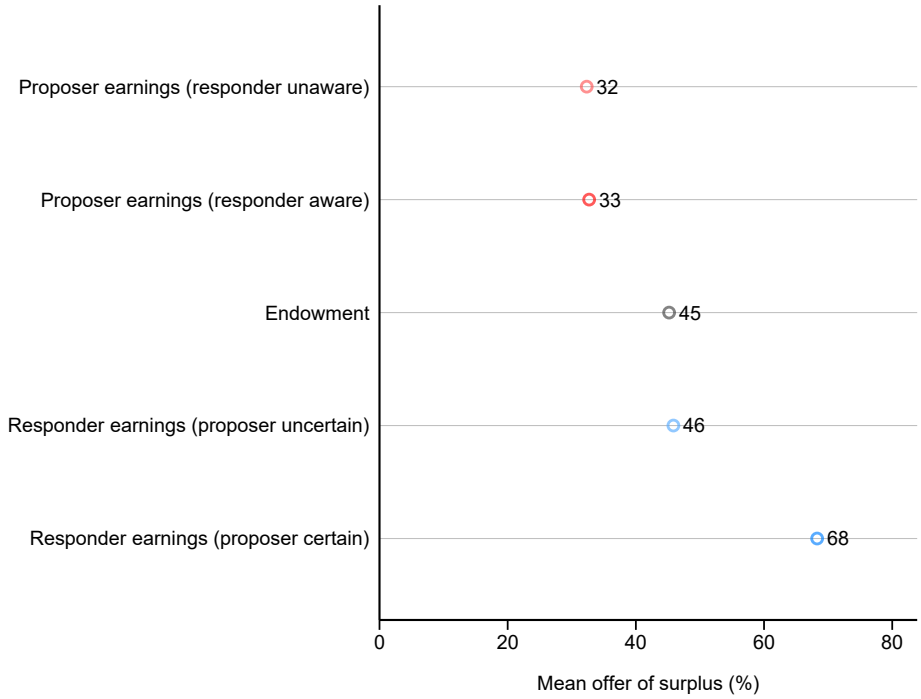
On the contrary, the receiver earnings scenario is left-skewed, implying the median offer is greater than the mean offer. The most frequent offer is half the pie which accounts for 29% of offers, followed by the whole pie being offered in 27% of offers, and three-quarters of the pie being offered for 26% of offers. Also, over 92 percent of all offers are greater than or equal to half the pie. In this scenario, dictators perceive reference point j as greater than 0, i.e., $r_j^i > 0$.

Moving from the dictator game to the ultimatum game offers, strategic considerations are now involved for both players. In the ultimatum game's direct response method, the responder's strategic considerations are limited. The responder is informed of the offer, then decides whether to accept or reject the offer. While this may be true for the direct response method, the strategy method induces greater strategic concerns for the responder. This statement is supported by the idea that the responder is not presented with an offer. Instead, the responder must decide what her minimum acceptable offer is and what type of person the proposer is.

Figure 5 displays the mean offers in different ultimatum game scenarios. The average offer in the endowment scenario is 46 percent of the surplus. Analogous to the nontrivial offer in the endowment scenario of the dictator game, although this offer is also not predicted by the standard models, the offer is in line with the experimental literature. When the proposer works for the surplus, the variations where the responder is unaware of this fact and aware of this fact have similar average offers. Therefore, on average, proposers keep their offer the same depending on what the responder knows about the origin of the surplus.

At the same time, this is not the case when the responder works for the surplus. The variation where the proposer is uncertain has an average offer of 46 percent,

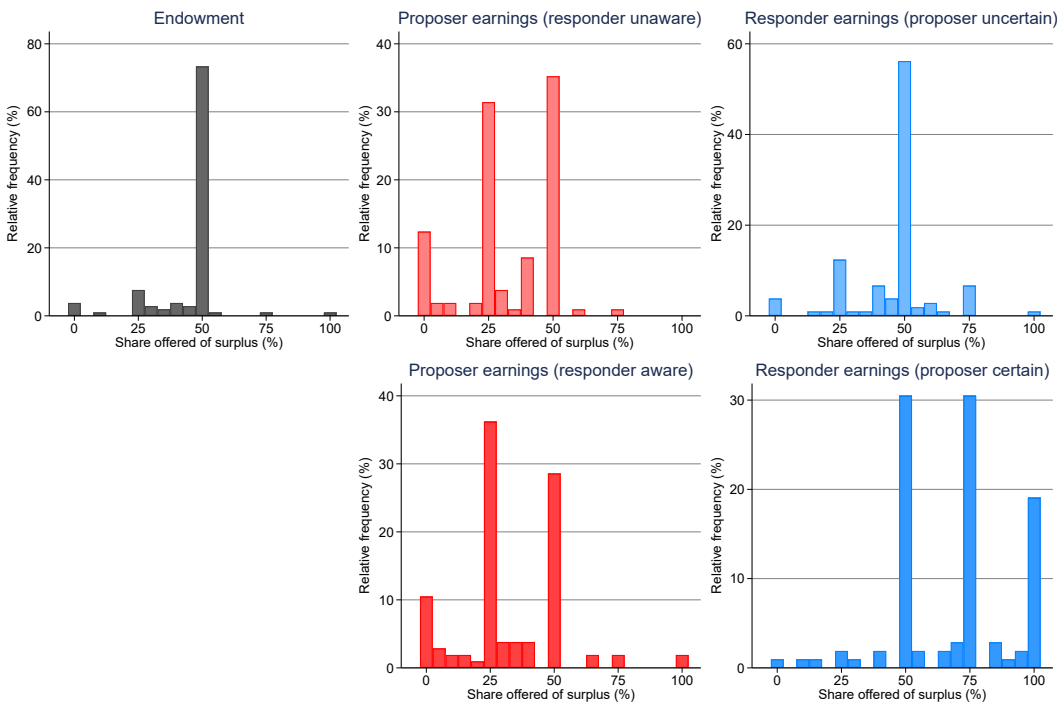
Figure 5. Mean offers in ultimatum game scenarios



nearly the same as the endowment scenario. In comparison, the variation where the proposer is sure has a starkly different average offer of 68 percent. In conclusion, although the difference in the information known to the players in the proposer earnings scenario did not lead to a noticeable difference in average offers, this is not true for the difference in average offers in the responder earnings scenario.

The distribution of offers in ultimatum game scenarios is presented in Figure 6. Equitable offers account for approximately 73% of all offers in the endowment scenario. Since the equitable outcome is the reference point for the players, this result is expected. Like the dictator game endowment, most of the remaining offers (24%) are less than half the pie. Both the proposer earnings scenarios are right-skewed. In the variation where the responder is unaware that the proposer has worked for the surplus, the most frequent offer is half of the pie, which accounts for 35% of offers, followed by a quarter of the pie for 31% of offers, followed by zero for 12% of offers. The three most frequent offers in the variation where the responder is aware that the proposer has worked expect the order to be different. In this variation, the most frequent offer is a quarter of the pie which accounts for 36% of offers, followed by half the pie being offered for 29% of offers, followed by zero for 10% of offers. The responder earnings scenario in Figure 6 contrasts the proposer earnings scenario. Unlike the proposer earnings scenario, where the information variation had subtle differences, the variation in the responder earnings scenario has noticeable differences. When the responder has worked, but the pro-

Figure 6. Distributions of offers in the ultimatum game

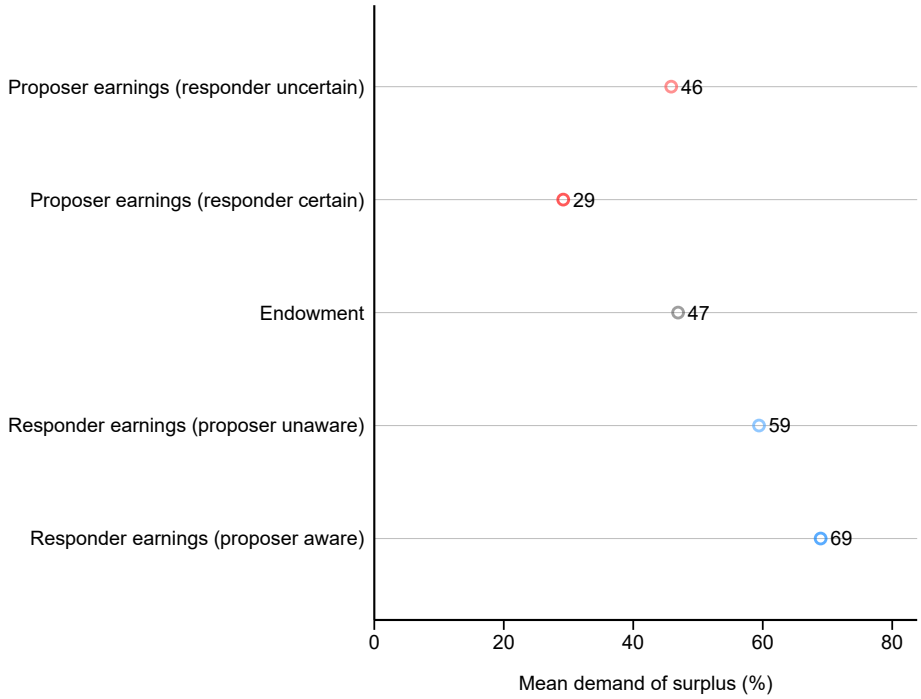


poser is certain, over 92% of offers are at least half the pie. On the other hand, when the responder has worked but the proposer is uncertain, only 70% of the offers are at least half the pie. Moreover, when there is certainty, half the surplus and three-quarters of the surplus are offered 30% of the time, and the entire pie is offered 19% of the time. When proposers are uncertain, half the pie offers account for 56% of offers and offers greater than three-quarters of the pie only account for 8% of the offers. This fact means that the most frequent offer is equitable when proposers are uncertain. Nevertheless, more equitable offers are more frequent when proposers are certain. This change in offers distribution is discussed in more detail below and can be seen on the right panel of Figure 12.

Most of the discussion up to this point has been focused on what subjects would offer as the dictator in the dictator game and as the proposer in the ultimatum game. This section focuses on the other side of the bargaining situation, what the subjects demand as the responder in the ultimatum game.

Figure 7 shows the mean demands in different ultimatum game scenarios. The average demand in the endowment scenario is 46 percent of the surplus. As in the case of the offers in the dictator game endowment and the offers in the ultimatum game endowment, the average demand is typical. When the proposer works for the surplus, the variation where the responder is uncertain of this fact, and certain of this fact has different results. For example, when the proposer works for the surplus

Figure 7. Mean demands in ultimatum game scenarios

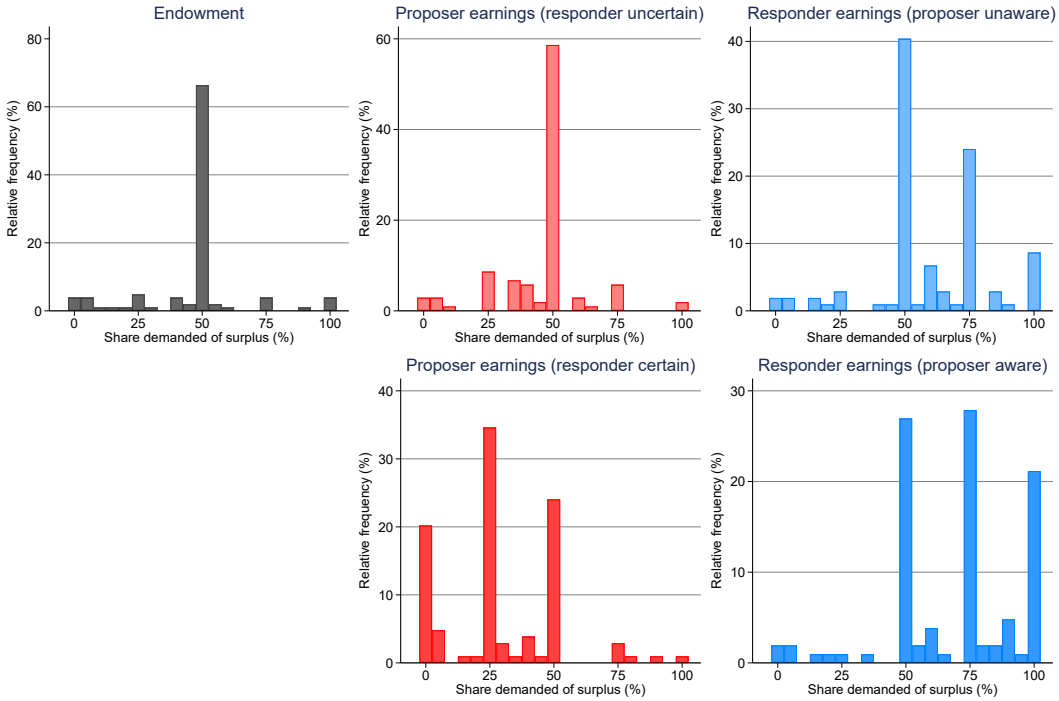


and the responder is uncertain whether or not the proposer has worked, the average demand is 46 percent of the surplus. On the other hand, when the responder is sure that the responder worked for the surplus, the average demand is 29 percent of the surplus. Therefore, when the responder is sure that the proposer worked, the average demand is 17 percent points lower than when the scenario where the responder was uncertain.

Likewise, the variations in the responder earnings scenarios have different average offers as well. For example, the average demand is 59 percent of the surplus when the responder has worked for the surplus but the responder is unaware of this. On the other hand, when the proposer is aware that the responder has worked, the average demand is 69 percent. Thus, when the proposer becomes aware that the responder has worked for the surplus, there is a 10 percentage points increase in the average amount demanded.

The distribution of demands in ultimatum game scenarios is presented in Figure 8. Equitable demands account for approximately 66% of all demands in the endowment scenario. Because the inequitable outcome is the reference point for the players, this result is not surprising. As in the case of the offers from the dictator game and the ultimatum game, most of the remaining demands (22%) fall on the bottom half of the distribution. Therefore, over 88% of respondents in the endowment scenario demand less than or equal to half the pie.

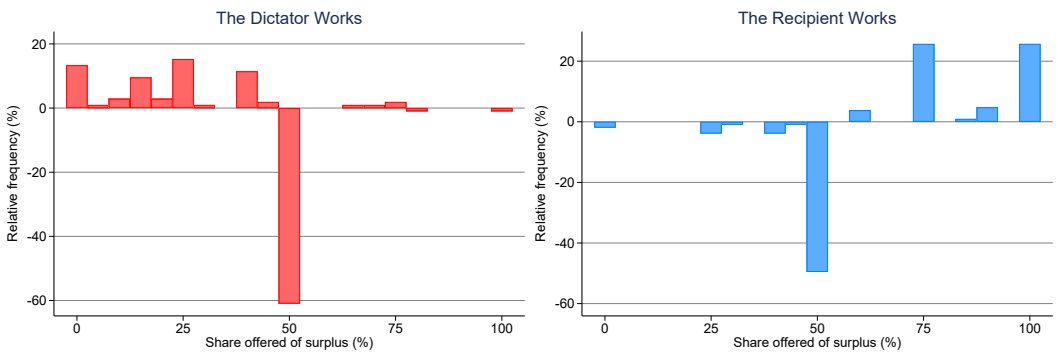
Figure 8. Distribution of demands in ultimatum game scenarios



When the proposer earns the surplus, the two variations have different distributions. When the proposer earns the surplus, but the responder is uncertain of this fact, the mode demand (58%) is the equitable reference point. Notably, no other shares account for more than 9% of the demands. However, when the proposer earns the surplus, and the responder is sure of this, the mode demand (35%) is a quarter of the pie. Half the pie is demanded by 24 percent of respondents. So, there is a 23 percent drop in equitable demands once the responder is confident that the proposer has worked. This drop can be attributed to the responder respecting the property right earned by the proposer. Thus the most common demand becomes a quarter of the pie. Moreover, there is a significant change for the respondents that demanded nothing, from 3% to 20%, when the responder is sure.

The variations within the responder earnings scenarios in Figure 8 also have different distributions. When the responder works for the surplus, but the proposer is unaware, the mode demand is the equitable reference point, making up 40 percent of the demand. Approximately 90 percent of all respondents required at least half the pie. Conversely, when the responder works for the surplus and the proposer is aware of this fact, the most common demand is three-quarters of the pie which accounts for 28 percent of demands. Similar to the scenario where the proposer is unaware, over 90 percent of respondents demanded over half the pie. The notable difference is the frequency of entire pie demands. When the proposer is unaware, less than

Figure 9. Change in the offers in the dictator game relative to the endowment



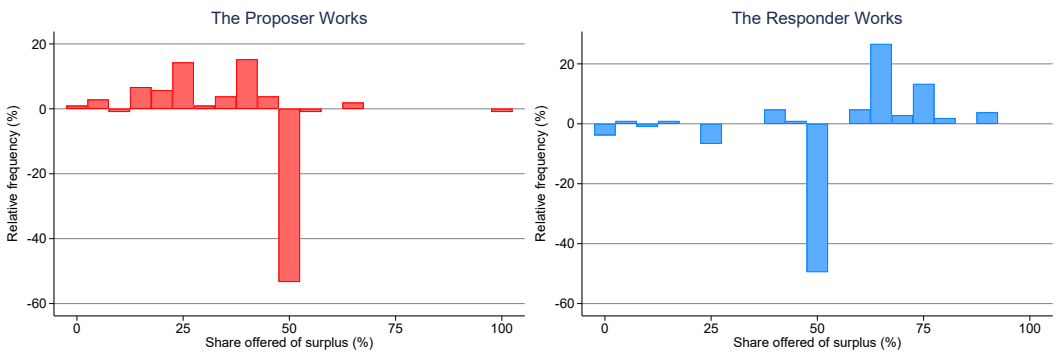
10% of respondents demanded the entire pie. Nevertheless, when the proposer is aware, 21% of respondents demanded the entire pie. The increase can be seen as some people feeling entitled to the property they earned, combined with the fact that the proposer is aware now. In the model, this may be a situation where once it is made known to the proposer that the responder has worked, the proposer perceives reference point j as greater than 0, i.e., $r_j^i > 0$.

The origin of the surplus affects the distribution of offers in the dictator game. Figure 9 displays the change in the distribution of offers by the dictator in different earnings scenarios relative to the endowment scenario. In particular, the left panel represents the difference in the values of the vertical axis (relative frequency of offers) for the distribution of offers in the dictator earnings scenario and the distribution of offers in the endowment scenario. When the dictator works for the surplus rather than the experimenter endowing it, 50% of respondents change their offer from the equal share to an offer that is less than half the surplus. Thus, many respondents change their reference point to one that is partial towards themselves, i.e., $r_i^i > 0$.

When the recipient works for the surplus, many dictators respect this effort and offer more to the recipient. The right panel in Figure 9 represents the difference in values of the vertical axis for the distribution of offers in the responder earnings scenario and the distribution of offers in the endowment scenario. In the other scenario, when the recipient works for the surplus instead, the experimenter endows the surplus. Over 40% of the respondents changed their offer from an equal share to an offer that favors the responder. In addition, many respondents change their reference point to one that favors the recipient, i.e., $r_j^i > 0$. Therefore, whether the dictator works or the recipient works, on average, dictators share the surplus in a manner that compensates either their or the recipient's effort.

Whether the source of the surplus was earned or windfall influences the distribution of offers in the ultimatum game. Figure 10 shows the change in the distribution of offers by the proposer in different earnings scenarios with respect to the

Figure 10. Changes in the offers in the ultimatum game relative to the endowment



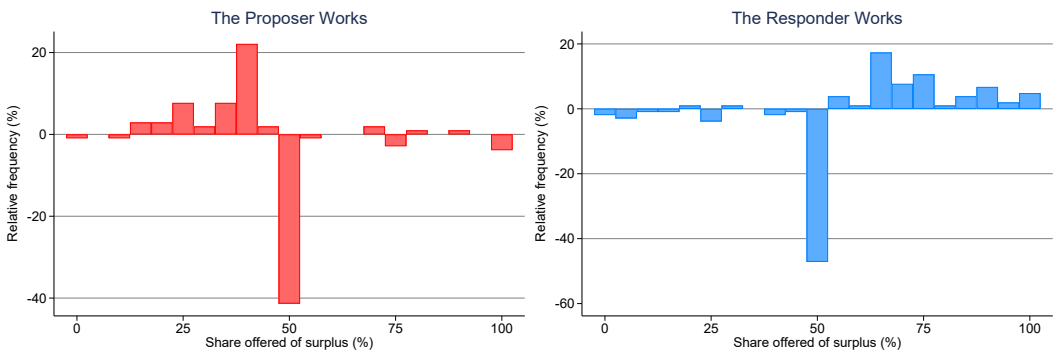
endowment. For instance, the left panel represents the difference in the values on the vertical axis (relative frequency of offers) for the distribution of offers for the average distribution of offers in the proposer earnings scenario and the distribution of offers in the endowment scenario. When the proposer works for the surplus rather than the experimenter endows it, 40% of the respondents change their offer from an equal offer to an offer that is less than half the surplus.

When the responder exerts effort to generate the surplus, proposers act accordingly and offer greater amounts of the surplus to the responder. In Figure 10, the right panel represents the difference in values of the vertical axis for the distribution of offers for the average distribution of offers in the proposer earnings scenario and the distribution of offers in the endowment scenario. If the responder works for the surplus rather than the experimenter endowing it, over 40% of the respondents change their offer from an equal offer to one that favors the responder. On average, the earnings scenarios have similar effects on the offers in both the dictator and the ultimatum games.

How the surplus is determined affects the distribution of demands in the ultimatum game. Figure 11 presents the change in the distribution of demands by the responder in different earnings scenarios relative to the endowment scenario. To illustrate, the left panel represents the difference in the values of the vertical axis for the distribution of demands (relative frequency of offers) for the average distribution of demands in the proposer earnings scenario and the distribution of demands in the endowment scenario. When the proposer works for the surplus rather than the experimenter endowing it, nearly 50% of the subjects change their demand from the egalitarian demand to one that is partial to the proposer. Hence, many respondents in this situation change their reference point to themselves, i.e., $r_i^i > 0$.

If the responder works to bring about the surplus, the responders act correspondingly and demand more. In Figure 11, the right panel represents the difference in the value of the vertical axis for the distribution of offers for the average distribution of demands in the responder earnings scenario and the distribution of demands

Figure 11. Change in demands in the ultimatum game relative to the endowment



in the endowment scenario. If the responder works for the surplus rather than the experimenter endows it, about 40% of the respondents change their demand from the egalitarian distribution to one that favors them. So, many respondents alter their reference point to favor themselves, i.e., $r_j > 0$. In short, many responders demand more if they worked and demand less if the proposer worked instead.

A common feature between the changes in distributions in Figures 9, 10, and 11 is that when the effort is exerted to generate the surplus, the strategies given show the respondent compensating the effort appropriately. For instance, when a dictator works for the surplus, she rewards herself for this effort by keeping more of the surplus. Similarly, when a proposer works for the surplus, she compensates herself for the endeavor by offering a smaller share. Moreover, a responder demands less when the proposer has earned the surplus.

However, equally important is that whether the recipient or responder exerts the effort to generate the surplus, the respondents compensate for this effort. For example, a higher offer is typically made when the recipient works in the dictator game. In addition, when the responder works in the ultimatum game, there are greater offers and demands. The crude comparisons between the different scenarios and within different scenarios confirm that, on an aggregate level, individuals change their perceptions of fairness by having updated reference points. However, it needs to be clarified what the impact of being aware or sure about the surplus generation process can have.

Although the previous figures using averages in the ultimatum game distributions were informative, the averages need to illustrate the many nuances in the different earnings scenarios. For example, there is a difference in offers when the responder is unaware that the proposer has worked and when the responder is aware that the proposer has worked (Figure 12). The left panel in the figure represents the difference in the values of the vertical axis (relative frequency of offers) for two situations: when the proposer works but the responder is unaware and when the proposer works and the responder is aware. When the responder becomes certain that

Figure 12. Change in offers in the ultimatum game after revealing information

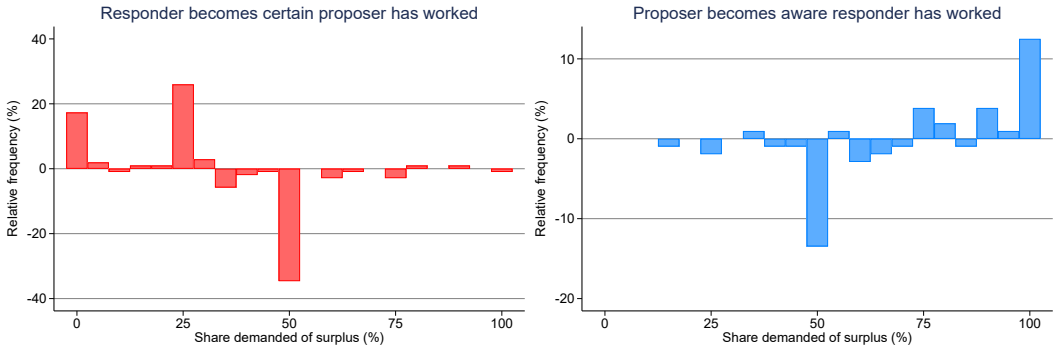
the proposer has worked for the surplus, about 10% of respondents change from approximately equal offers to lower and higher offers. The divergent offers may seem baffling. Nevertheless, a proposer chooses lower offers because they may assume that the responder respects the property right they have earned. Therefore, if both sides of the negotiation share the same views of fairness, i.e., $r_i^i, r_i^j > 0$, then the proposer should keep more for herself.

The higher offers illustrate another set of strategic concerns for the proposer. Suppose that the responder is aware that the proposer has updated their reference point to favor themselves, i.e., $r_i^i > 0$. Furthermore, the responder knows that if the proposer does not obtain a share equivalent to her reference point $1 - s = r_i^i$, the proposer suffers from loss aversion. So, the responder has a credible threat that the proposer may recognize. Therefore, the proposers that offer more are doing it as a form of insurance – they want to ensure that the offer is more likely to be accepted.

Although there is a divergent pattern in offers when the responder becomes aware, a more consistent pattern arises when the proposer becomes certain. The right panel in Figure 12 presents the difference in the values for two other situations: when the responder works but the proposer is uncertain and when the responder works and the proposer is certain. When the proposer becomes certain that the responder has worked, over 30% of respondents change an offer that was equal or less than equal to an offer that favors the responder. Furthermore, over 20% of the respondents offer three-quarters of the entire surplus. Above all, nearly 20% of respondents offer the entire surplus. The consistent rise in offers is unsurprising. Many proposers are simply respecting the property rights earned by the responder, so the proposer has a reference point that favors the responder $r_j^i > 0$. Nevertheless, given that $r_j^i > 0$, the responder suffers from loss aversion if the responder does not obtain a share equivalent to her reference point $s = r_j^i$. The proposer offers a lot due to the responder's proclivity to reject insufficient offers.

If a responder becomes certain that the proposer has worked to generate the surplus, then the responder compensates the proposer accordingly by demanding

Figure 13. Change in demands in the ultimatum game after revealing information



less of the surplus. In Figure 13, the panel shows the difference in values of the vertical axis (relative frequency of offers) for two situations: when the responder is uncertain that the proposer has worked and when the responder is sure that the proposer has worked. When the responder becomes certain that the proposer has worked, almost 40% of the respondents change their demand from an egalitarian demand to a demand that favors the proposer. The change in demand can be explained by the responder's respect for the proposer's property rights, i.e., $r_i^j > 0$ from the perspective of the responder. Therefore, many respondents will only demand less when it is certain that the proposer has worked.

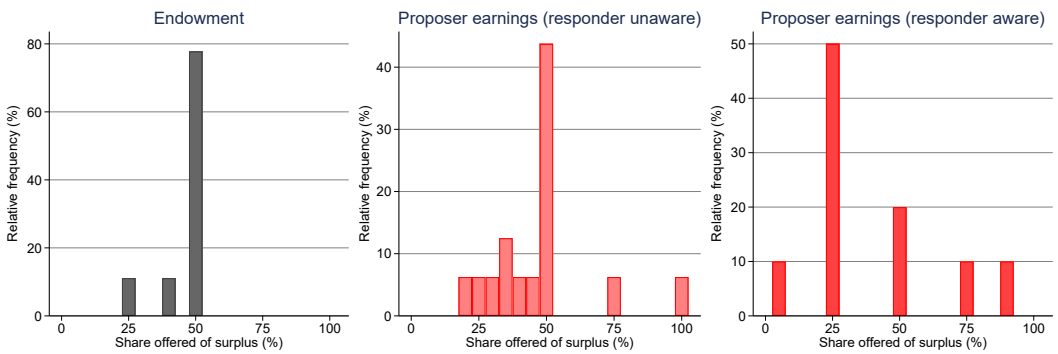
On the other hand, if the proposer becomes aware that the responder has worked, then the responder wishes to be compensated by the proposer. Thus, the responder will demand more of the surplus. The right panel of Figure 13 displays the difference in the value of the vertical axis for two situations: when the proposer is unaware that the responder has worked and when the proposer is aware that the responder has worked. When the proposer becomes aware that the responder has worked, over 15% of respondents change their demand from approximately the egalitarian demand to a demand that favors them. Therefore, not only does the responder have an updated reference point $r_j^j > 0$, but also the responder believes that the proposer has an updated reference point $r_j^i > 0$.

7.2. Online questionnaire results

While the control and treatment groups are relatively well-balanced, there is an unbalance in sex and the loss aversion coefficient. Almost all respondents have been employed or worked in the past 12 months. Moreover, they share a similar level of risk tolerance. The average demands and offers are, at most, half the pie. See table 2 for more on mean statistics of offers and demands.

Like the classroom questionnaire, the online questionnaire distributions indicate that the surplus' origin influences the distribution of the offers. Figure 14 shows the distribution of offers. Over 80 percent of offers are the equitable reference point.

Figure 14. Distribution of offers



Moreover, there are no offers that are more than half the pie.

When the responder is unaware that the proposer earned the pie, the equitable reference point is offered approximately 40 percent of the time. On the other hand, when the proposer earns the pie and the responder is aware, the equitable reference point is offered only 20 percent of the time. Instead, about half the offers are a quarter of the pie. Notably, there are zero offers and offers equal to or greater than three-quarters of the pie. The offers of zero may signify that the proposer believes that the responder will respect the property rights that she earned, i.e., $r_i^j > 0$. Additionally, offers equal to or greater than three-quarters of the pie may show that the proposer believes that the responder may choose conflict precisely because she has worked for the surplus. Therefore, higher offers are made as insurance to avoid conflict with the responder.

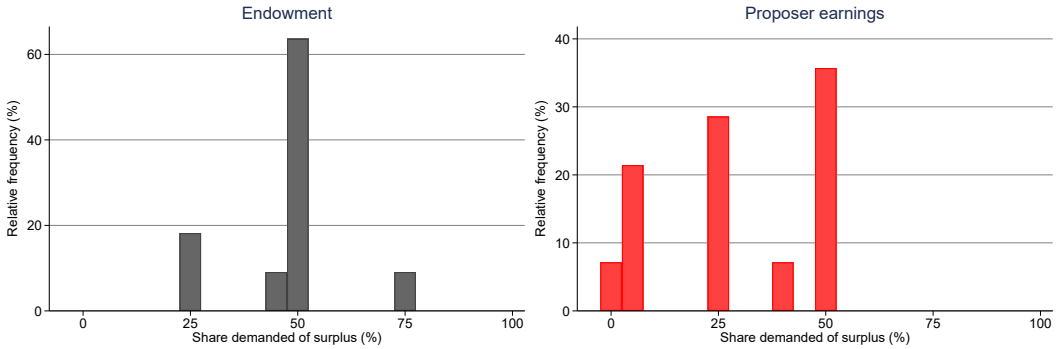
How the surplus is determined affects the distribution of demands. For example, when the experimenter endows the surplus, over 60 percent of responders demand half the pie. In other words, responders believe she is entitled to the pie as much as the proposer (left panel in figure 15). Some demands are a quarter of the pie. Since the strategy method is employed in this questionnaire, those who demanded a quarter likely wanted to avoid conflict. That is to say; they decreased their minimal acceptable offer to increase the likelihood that their demand would be accepted.

While some responders demanded three-quarters of the pie in the endowment scenario, there are no demands greater than half when the proposer works for the pie. Some demands are less than 10 percent, with some responders demanding zero.

8. Conclusions

This paper provides evidence that people care about the payoffs of others and how they stand relative to others. Moreover, people are influenced by notions of fairness, and these notions of fairness can change. The value function can be seen as

Figure 15. Distribution of demands



an internal fairness evaluation by the agent. However, by incorporating the value function into the social comparisons function, then there is also an external evaluation of fairness that occurs. In other words, it is what people believe to be fair for themselves and what is fair for others. Both factors matter in the decision-making process. It is important to capture both ideas to understand how people make decisions in complicated bargaining scenarios. The model predicts that when there are mutually agreed upon reference points, the equilibrium outcome in the ultimatum game and dictator game favors the individual who has exerted effort.

There are many possible extensions. What other ways can we change the notion of fairness for people? What is essential in determining fairness? What happens when there are more than two players? What are the predicted outcomes in other economic games?

The model can be extended to account for negative reference points. What is the interpretation of a negative property right or a negative reference point? Could other players view someone with a negative reference point as undeserving? Negative reference points may capture beliefs about inheritance, nepotism, and corruption.

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Appendix

Classroom: Dictator game questions

- The experimenter gives you $20, how much will you offer the recipient?
- You worked for the $20, how much will you offer the recipient?
- The recipient has worked for the $20, how much will you offer the recipient?

Classroom: Ultimatum game offers questions

- The experimenter gives you $20, how much will you offer the responder?
- You have worked for the $20 and the responder is unaware of this. How much will you offer the responder?
- You have worked for the $20 and the responder is aware of this. How much will you offer the responder?
- You are unsure if the responder has worked for the $20 (perhaps, the money was from the experimenter). How much will you offer the responder?
- The responder has worked for the $20. How much will you offer the responder?

Classroom: Ultimatum game demand questions

- The experimenter gives the proposer $20, what is your minimum acceptable offer?
- You have worked for the $20 and the proposer is unaware of this. What is your minimum acceptable offer?
- You have worked for the $20 and the proposer is aware of this. What is your minimum acceptable offer?
- You are unsure if the proposer has worked for the $20 (perhaps, the money was from the experimenter). What is your minimum acceptable offer?
- The proposer has worked for the $20. What is your minimum acceptable offer?

Online: Proposer - endowment

> As part of an experiment, you have been assigned the role of proposer in a simple, take-it-or-leave-it bargaining game.
>
> In the game, two players must decide how to split a sum of money. The proposer receives the money from the experimenter. The proposer then makes an offer to the responder. If the responder accepts, the money is split per the offer. If the responder rejects, both players receive nothing.
>
> You receive $20 from the experimenter. As the proposer, how much of this will you offer the responder? (Enter a number between 0 and 20)

Online: Responder - endowment

> As part of an experiment, you have been assigned the role of responder in a simple, take-it-or-leave-it bargaining game.
>
> In the game, two players must decide how to split a sum of money. The proposer receives the money from the experimenter. The proposer then makes an offer to the responder. If the responder accepts, the money is split per the offer. If the responder rejects, both players receive nothing.
>
> The proposer receives $20 from the experimenter. As the responder, what's the minimum offer that you would accept? (Enter a number between 0 and 20)

Online: Proposer - proposer earnings & responder not told

> As part of an experiment, you have been assigned the role of proposer in a simple, take-it-or-leave-it bargaining game.
>
> In the game, two players must decide how to split a sum of money. The proposer receives the money from the experimenter. The proposer then makes an offer to the responder. If the responder accepts, the money is split per the offer. If the responder rejects, both players receive nothing.
>
> In this experiment, you have assisted the experimenter with a data entry task. You received $20 for your efforts. The responder was not told that you assisted the experimenter. As the proposer, how much of this will you offer the responder? (Enter a number between 0 and 20)

Online: Proposer - proposer earnings & responder told

> As part of an experiment, you have been assigned the role of proposer in a simple, take-it-or-leave-it bargaining game.
>
> In the game, two players must decide how to split a sum of money. The proposer receives the money from the experimenter. The proposer then makes an offer to the responder. If the responder accepts, the money is split per the offer. If the responder rejects, both players receive nothing.
>
> In this experiment, you have assisted the experimenter with a data entry task. You received $20 for your efforts. The responder was told that you assisted the experimenter. As the proposer, how much of this will you offer the responder? (Enter a number between 0 and 20)

Online: Responder - proposer earnings & responder told

> As part of an experiment, you have been assigned the role of responder in a simple, take-it-or-leave-it bargaining game.
>
> In the game, two players must decide how to split a sum of money. The proposer receives the money from the experimenter. The proposer then makes an offer to the responder. If the responder accepts, the money is split per the offer. If the responder rejects, both players receive nothing.
>
> In this experiment, the proposer assisted the experimenter with a data entry task. The proposer received $20 from the experimenter for their efforts, and must now offer a portion of this to you. As the responder, what's the minimum offer that you would accept? (Enter a number between 0 and 20)