

Impact of Social Motives on Bilateral Negotiations: Can Power Change Perceptions of Fairness?*

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Abstract

Power, a fundamental characteristic of social interactions, characterizes one's ability to influence others. Fairness, inherently a type of social preference, impacts distributive decision-making. How does power shape the perceptions of fairness in economic interactions? While previous research finds that power holders tend to take more, it remains unclear whether they are driven by selfish motives to exploit weaker counterparts or act upon the belief that powerful individuals deserve more. With an innovative modified ultimatum game, we analytically and experimentally study how bargaining power interplays with fairness consideration to affect bilateral negotiations. To separate strategic concerns from social motives, we concentrate on behaviors by the responder, whose fairness preferences are elicited in response to shifts in power. We find strong evidence that changes in power can modify what is perceived as a fair outcome. However, such an effect does not arise intrinsically. Instead, it is driven by adaptive behaviors, and more specifically, the experience of interacting with a player who has incentives to respond strategically to power changes. Furthermore, we identify that common knowledge about the relative power of players involved in a relationship is necessary for power to influence distributive behaviors.

Key words: power; fairness; behavioral economics; social preferences

1. Introduction

When the Amazon-Hachette contract came up for renegotiation in April 2014, Amazon acted more aggressively than before to ask for higher revenue split and lower e-book prices from Hachette.¹ To pressure the publishing giant further, Amazon removed preordering of Hachette titles and delayed their deliveries to customers. These actions prompted public outrage and complaints of unfairness from writers and readers. What were the motives behind Amazon's behavior? With significant growth over the past two decades, Amazon had shifted the balance of power in the book industry. So was it using that growth to squeeze publishers? Or was it attempting, as Amazon claimed, to collect its fair share of the business?

To answer these questions is difficult since details of the negotiations between Amazon and Hachette were not released. It is not surprising that power, defined as the ability to influence others (Kelley and Thibaut 1978),² impacts distributions. For example, as previous research on buyer-supplier relationships shows, firms that are more dependent on partners tend to accept less favorable terms (Heide and John 1988; Gassenheimer et al. 1998). However, it is not clear how power works and when it does not. In particular, is the effect of power on distributive decisions driven by solely economic motives, i.e., self-interests to exploit the weaker party? Or do social motives such as fairness, i.e., beliefs that the more powerful party deserves more, also play an important role?

To address clearly the above questions, we adopt the experimental approach, namely, the ultimatum game (see Camerer 2003 and Roth 1995a for reviews), to study bilateral

¹ <https://www.vanityfair.com/news/business/2014/12/amazon-hachette-ebook-publishing>

² In this study, we focus on "outcome power" under the rational choice framework. According to Dowding (1996), it is the ability of individuals or groups to (help) bring out desired outcomes, for example, by changing the likelihood that a given action will lead to a given outcome.

bargaining. We first strive to test if direct causal relationship can be established between power and perceptions of fairness by disentangling possible explanations such as strategic concerns and risk preferences. Next, we intend to identify conditions necessary for power to influence distributive behaviors. To achieve these research goals, we have to overcome two crucial hurdles: how to measure perceptions of fairness; and how to manipulate power and isolate its effect.

To meet the first challenge, we modify the standard ultimatum game by having the responder indicate a binding *acceptance threshold* – the minimum amount that she is willing to accept, at the same time as the proposer determines the offer. We demonstrate analytically that this acceptance threshold is a function of what the responder considers a fair outcome. To tackle the second issue, we introduce a *probability condition* to the game, which indicates the likelihood with which the responder's threshold applies. This design allows the standard dictator and ultimatum games to be nested as two extreme cases. Manipulations of the probability condition modify the magnitude of the power distance between the two players. Our theoretical analysis shows that, unlike the offer determined by the proposer, the threshold decision is not confounded by any strategic concerns. Hence, focusing on the responder behavior (i.e., choices of threshold under different probability conditions) in the game enables us to draw a conclusion about the relationship between power and fairness.

Following such experimental design, we conduct a series of laboratory experiments. First, the Baseline experiment is constructed to best approximate the modified ultimatum game described above. The experiment consists of two decision rounds in which the same responder experiences a high versus a low probability condition respectively. Information

about the specific probability assigned to a responder in each round is announced publicly. We also include a post-game questionnaire as the manipulation check. We observe that, thresholds under the two probability conditions do not generate any statistical difference, although the proposer does offer significantly more to the responder with a higher likelihood to execute her threshold. This contrasts with subjects' answers in the survey: they think the high probability condition increases the responder power and tend to agree that the "more powerful" responder should receive more.

These subjects' statements do not seem to translate into actions in the Baseline. To bridge the gap that possibly exists between the subjects' behaviors and their stated preferences, we introduce the Experience experiment, in which a training session is added prior to the paid game of the Baseline. More specifically, subjects are required to finish eight practice rounds to experience both roles across the two probability conditions, and observe corresponding decision feedbacks after each practice round. With additional experience, we find significantly higher thresholds, as well as offers, under the high probability condition. This result, combined with that in the Baseline, implies that changes in power can modify one's fairness perceptions, yet learning is required for the exercise of power.

To identify further the condition under which changes in power effectively influence distributive decision-making, we design the treatment of Asymmetric Information, in which the proposer does not know the specific probability assigned to the matched responder. Under this treatment, the proposer no longer differentiates offers since the economic incentive for him to act strategically has been removed by the lack of information. Consequently, the responder behaves indifferently between the two

probabilities conditions, independent of the training session. This result suggests that learning is developed through interactions with players who have economic incentives to respond to power shifts, and that common information regarding how power is distributed within a relationship is necessary for it to take an effect on negotiations.

The following section reviews relevant literatures to our research. Section 3 models and analyzes behaviors under our modified ultimatum game. Next, we discuss the experimental design, implementation and results of the Baseline experiment in Section 4. Experience and Asymmetric experiments are examined in Sections 5 and 6, correspondingly. Section 7 concludes the study.

2. Related Literature

While classic economic theory asserts decision makers are selfish, it is now well established with evidence from the laboratory that people may also care about the welfare of others. Camerer 2003 and Roth 1995a provide thorough reviews for this literature. Particularly in the dictator game and the ultimatum game, many individuals are willing to sacrifice monetary payoffs to avoid deviations from what they view as a fair outcome. The perception of fair outcome can be affected by a number of factors, which includes for example, players' efforts and contributions (Cappelen et al., 2007), skills (Cappelen et al., 2010), intentions (Bolton et al., 2005; Charness and Rabin, 2002), emotional state (Cox et al. 2007) relationships (Ho and Su, 2009, Charness et al. 2007), group size (Stahl and Haruvy, 2006) and roles in the game (Mallucci and Cui, 2016).

Preferences for fairness, as Kahnemen et al. 1986 argue, can have significant impacts on decisions of profit-maximizing firms. In the business literature, empirical studies document many supporting cases in industries such as automobiles, consumer goods,

semiconductors and telecommunications (Dyer 1997; Kumar et al. 1995; Scheer et al. 2003). Theoretical and laboratory studies also incorporate concerns for fairness to analyze its effect on contract negotiations and channel relationships (Bolton and Alba 2006; Chen and Cui 2013; Cui et al. 2007; Cui and Mallucci 2016; Davis and Leider 2018; Ho et al. 2014; Katok et al. 2012; Loch and Wu 2008).

The desire to achieve power and to benefit from having it is one of the most important social motivations of human behavior and business decision-making (Iyer and Villas-Boas 2003; Winter 2007). In social and behavioral sciences, power has been studied extensively. In this stream of research, subjects are usually primed to have different power status. And “powerful” individuals are found to be more egocentric (Galinsky et al. 2008; Guinote 2007; Keltner et al. 2003), reluctant to delegate decision rights (Fehr et al. 2013), pay less attention to others (Fiske 1993; Galinsky et al. 2006; Gruenfeld et al. 2008; Overbeck and Park 2001; Schmid et al. 2009), display higher degrees of moral hypocrisy (Lammers et al. 2010) and tend to give less in bargaining (Blader and Chen 2012; Draganska et al. 2010; Tripp 1993). These results suggest that power can change how people perceive themselves and others possibly due to the fact that power increases social distance (Lammers et al., 2011).

Under bilateral bargaining settings (e.g., between upstream and downstream channel members, between employers and employees, and between sellers and buyers, etc.), only a limited number of studies use an incentive compatible approach to investigate how power, reflected by roles, sequence of moves or channel structures, affects distributions. For example, Hsu (2008) conducts a series of two-person public good experiments, in which players act simultaneously, sequentially, or as dictators. The study concludes that

strategic concerns explain overall behavior better than fairness motives. Rustichini and Villeval (2014) compare participants' stated preferences with their actual decisions within the dictator, ultimatum, and trust games. They find that one's perception of fairness is a compromise between self-image and monetary payoffs, and that power affects the extent to which a subject adjusts this judgment. In a convex ultimatum game, where the responder has the option to shrink the size of the pie, Andreoni et al. (2003) observe that offers by the proposer are more aggressive than those in the traditional game. They argue that the option by the responder in the convex game reduces the risk of the proposer for making more selfish offers, and thus robs bargaining power from fair-minded responders. Cui and Mallucci (2016) find that exogenous factors, such as the structure of a distribution channel and the roles of the channel members, influence perceptions of fairness more than endogenous decisions, such as the amount invested by each party. Since channel structure and roles in their game not only affect the power differentials but also modify the incentives of channel members, behavioral changes due to strategic motives cannot be excluded from the study.

A more direct approach to modify power balance in the ultimatum game is taken by Suleiman (1996). The study introduces an exogenous discount factor that shrinks the shares of both players in case of responder rejections. Higher discount rates give more power to the responder, but also increase the cost of punishing the proposer. Our approach differs in that the likelihood for the responder's threshold to apply alters the incentives for the proposer only (who would act upon expected payoffs given the probability) but not for the responder. The game design of Suleiman (1996) is adopted by Handgraaf et al. (2008) to provide evidence that, while in general more powerful players reduce allocations to less

powerful players, the effect can be reversed if feelings of social responsibility towards powerless players are evoked.

Outside the confines of bilateral bargaining games (see Roth 1995b for a detailed review), a large experimental literature examines the distributional effects using multilateral bargaining games with alternating offers (Baranski 2016; Bowen et al. 2017; Diermeier and Morton 2005; Diermeier and Gailmard 2006; Frechette et al. 2003; Frechette et al. 2005a,b,c, 2012; Frechette 2009; McKelvey 1991). In this literature, researchers examine how distribution of proposal and veto powers influence resource allocations. Frechette et al. (2005b) are most relevant to our study. Experiments are designed systematically to manipulate *nominal* power (i.e., power that has no consequences for the game equilibrium) versus *real* power (i.e., power that affects the game equilibrium). They find that nominal power alone does not affect behaviors of the agents, yet changes in real power (with or without changes in nominal power) can affect the negotiation outcomes. Applying concepts from Frechette et al. (2005b), we can say that our probability manipulation affects both the *real* and *nominal* powers of the proposer, but only the *nominal* power of the responder. As the theoretical analysis in the next section shows, the proposer's optimal actions vary with the probabilities whereas the responder's optimal actions do not.

3. A Modified Ultimatum Game

3.1. General Game Settings

In a traditional ultimatum game, a proposer and a responder split a fixed amount of money (E). The proposer moves first and proposes an allocation (p). Next, the responder decides whether to accept or reject the offer. In this study, we modify the standard ultimatum game

as follows. First, we ask the responder to indicate the minimum amount that she is willing to accept, which is referred to as the binding *acceptance threshold* (t). We propose to use this continuous variable (ranging from 0 to the total endowment) instead of the 0/1 response to measure the responder behavior. Second, we require the two players to make decisions simultaneously rather than sequentially. The proposer decides an offer and the responder chooses an acceptance threshold without observing each other's decision. As our analysis shows later, the threshold, unlike the offer, can characterize the fairness preference of the responder without any confounding effect from strategic concerns. Such a clean measure is crucial for us to map connections between incentives, perceptions and behaviors.

To manipulate power, we propose to use a *probability condition* (π), which determines the likelihood with which the responder's threshold applies. This variation provides a convex combination of the standard dictator and ultimatum games. When the probability equals 0, our game reverts to the dictator game, in which the responder has no chance to execute her threshold but to accept whatever is proposed. All bargaining power thus goes to the proposer. When the probability is 1, players are confronted with an ultimatum game, in which the responder's threshold is compared with the proposer's offer to determine the final payoffs. The possibility of rejections empowers the responder; however, as a second mover, she is always less powerful than the proposer. Probability manipulations between the two extreme cases enable us to shift the power differential between the two players without qualitatively changing their relationship. Figure 1 provides an illustration of the game structure using one of the treatments.

[Insert Figure 1 Here]

To understand implications by these modifications, we develop a formal utility model to analyze theoretically the incentive structures of each player under the above game settings.

3.2. Theoretical Analysis

Similar to Fehr and Schmidt (1999), Bolton and Ockenfels (2000), and Cappelen et al. (2007), we define fairness consideration as the aversion to inequality between the received pecuniary payoff and the perceived equitable outcome. The utility functions for the responder (u_r) and the proposer (u_p) under the modified ultimatum game are given accordingly by:

$$u_r = \begin{cases} p - \alpha (m_k E - p)^+ - \beta (p - m_k E)^+ & \text{if } p \geq t \\ \pi * 0 + (1 - \pi) * [p - \alpha (m_k E - p)^+ - \beta (p - m_k E)^+] & \text{if } p < t \end{cases} \quad (1)$$

$$u_p = \begin{cases} E - p - \alpha_p [n_k E - (E - p)]^+ - \beta_p [(E - p) - n_k E]^+ & \text{if } p \geq t \\ \pi * 0 + (1 - \pi) * \{E - p - \alpha_p [n_k E - (E - p)]^+ - \beta_p [(E - p) - n_k E]^+\} & \text{if } p < t \end{cases} \quad (2)$$

where

- p is the offer of the proposer,
- t is the acceptance threshold,
- E is the fixed amount of money to split,
- π is the probability with which the threshold t applies,
- $0 < m_k < 1$ is the share of outcome perceived as fair by the responder,
- $0 < n_k < 1$ is the share of outcome perceived as fair by the proposer,
- $0 < \beta < 1$ measures the sensitivity to advantageous inequality by the responder,
- $\alpha \geq \beta$ measures the sensitivity to disadvantageous inequality by the responder,

- $0 < \beta_p < 1$ measures the sensitivity to advantageous inequality by the proposer,
- $\alpha_p \geq \beta_p$ measures the sensitivity to disadvantageous inequality by the proposer.

Under Equations (1) and (2), the first scenario captures the utility when rejections will never occur, and the second scenario describes the expected utility when rejections will arise with probability π . Since both players act concurrently, there exist multiple Nash equilibria in this game. Using risk dominance selection criteria, we can refine the equilibria to identify a unique equilibrium that subjects would converge upon in the experiment. It is straightforward to demonstrate that such an equilibrium consists of the pair (p^*, t^*) where

$$t^*(\alpha) = \frac{\alpha}{1+\alpha} m_k E, \text{ and} \quad (3)$$

$$p^*(\alpha) = \begin{cases} \frac{\alpha}{1+\alpha} m_k E & \text{if } \pi \geq \frac{(1-\beta_p)\alpha}{1+\alpha} \frac{m_k}{1-\beta_p+\beta_p n_k} \\ 0 & \text{if } \pi < \frac{(1-\beta_p)\alpha}{1+\alpha} \frac{m_k}{1-\beta_p+\beta_p n_k} \end{cases}. \quad (4)$$

with $\frac{\alpha}{1+\alpha} m_k + \frac{\alpha_p}{1+\alpha_p} n_k < 1$.³ All detailed proofs are provided in the Appendix A.

In general, any pair (\tilde{p}, \tilde{t}) such that $\frac{1+\alpha_p-\alpha_p n_k}{1+\alpha_p} E = \bar{p} \geq \tilde{p} = \tilde{t} \geq \underline{t} = \frac{\alpha}{1+\alpha} m_k E$ would constitute a Nash equilibrium. Suppose the proposer chooses \tilde{p} , any t such that $\tilde{p} \geq t \geq \underline{t}$ will yield $u_r(\tilde{p}) \geq 0$, whereas any t such that $t > \tilde{p}$ will yield $u_r = 0$. Therefore, $t = \tilde{t} = \tilde{p}$ is weakly preferred by the responder. If the responder plays \tilde{t} , given that the proposer's utility decreases in p when $\bar{p} \geq p \geq \tilde{t}$ and becomes 0 if otherwise, the proposer will strictly prefer $\tilde{p} = \tilde{t}$. Intuitively, decision makers would converge to the pair (p^*, t^*) specified in Equations (3) and (4), because the responder is indifferent between accepting

³ This restriction implies that there is enough money in the initial endowment to satisfy both players. It is always satisfied, for example, when $m_k + n_k \leq 1$.

and rejecting the offer at t^* . Since there is uncertainty on the proposer's action, choosing any other equilibrium thresholds that are greater than t^* would introduce the risk of rejecting an offer that yields positive utility. Therefore, t^* delivers the highest expected utility for the responder. Once t^* is selected, the only feasible equilibrium is the one outlined in Equation (4).

We make several observations on the solution of acceptance threshold in Equation (3). First, t^* does not depend on the probability π in any way, so there exists no pecuniary incentive for the responder to choose the threshold according to the probability. Intuitively, this happens because the threshold only matters when payoffs are allocated according to the traditional ultimatum game. Second, t^* is not influenced by any fairness concerns by the proposer (i.e., n_k , α_p and β_p) but is positively correlated with α , the responder's sensitivity to disadvantageous inequality, and $m_k E$, her perceived fair outcome of the game.⁴ When the responder is solely self-interested (i.e., $\alpha = \beta = 0$) or entirely selfless (i.e., $m_k = 0$), the acceptance threshold will be zero ($t^* = 0$). However, for players in between, we expect any change in their fairness preferences (by α and/or m_k) to be reflected in the acceptance threshold. Hence, observations on threshold constitute a clean measure for fairness considerations by the responder. These results are summarized in the following proposition:

PROPOSITION 1: A responder will modify her acceptance threshold if and only if her preferences for fairness are changed.

⁴ For clarification purpose, we refer to the product of $m_k E$ as the responder's (perceived) fair outcome or fair share interchangeably. Parameters such as $\alpha_{(p)}$ and $\beta_{(p)}$ are used for the responder's (proposer's) sensitivities to fairness. According to the previous literature (Fehr and Schmidt 1999; Bolton and Ockenfels 2000; Cappelen et al. 2007), perceptions, concerns or preferences for fairness are defined more broadly: they are influenced by the perceived fair outcome and/or a player's sensitivity to fairness.

The most significant implication of Proposition 1 is that it rules out the possibility for the responder to react, out of economic incentive, to the probability condition. In contrast, the proposer may behave strategically. According to Equation (4), the offer solution p^* depends on π indirectly: the proposer would make a positive offer only when the probability for the threshold to apply passes a certain level. The proposer's offer is also directly influenced by α and m_k .

PROPOSITION 2: There exists a breakpoint in π for the proposer to make a non-zero offer, which is positively correlated with the responder's preferences for fairness.

As the theoretical analysis of the modified ultimatum game reveals, the probability manipulations control the ability of the responder to influence the outcomes of the game (i.e., her power). Such an effect is only placed upon the economic incentive of the proposer (through the breakpoint in π), while the incentive structure of the responder remains independent from the probability condition (and its variations). Furthermore, in making simultaneous decisions, the responder merely cares about her own fairness preferences, whereas the proposer also takes into account those of the other player. We thus conclude that 1) the responder's power can be varied by the probability with which her acceptance threshold applies; and 2) the acceptance threshold can elicit the responder's fairness considerations cleanly.

4. The Baseline Experiment

The main purpose of the Baseline experiment is to test whether there exists a causal relationship between power and perceptions of fairness. In other words, when a player experiences changes in her power, would she modify her belief about what is a fair amount

to take? To answer the question, we use a within-subject design in which responders face different levels of π , and then correlate it with observations on t . Since the threshold is demonstrated to be a better measure than the offer for fairness, we design the experiment such that more independent observations on the responder behavior can be collected.

4.1. Experimental Design and Implementation

The experimental settings of the Baseline closely reflect the theoretical model presented in the previous section. For the key manipulation of the power differential between the two players, we apply two levels of probability: low ($\pi = 10\%$) versus high ($\pi = 90\%$). The experiment consists of 2 rounds of a one-shot game. In the beginning, participants are randomly assigned the role of either a proposer or a responder, which is kept for the entire experiment. A responder will experience the low probability in one round, and the high probability in the other round. For ease of discussion, we will refer to responders with $\pi = 10\%$ as “Responder A” and those with $\pi = 90\%$ as “Responder B.” In each round, players are randomly matched and the proposer knows whether he is playing with a Responder A or B for the round. Decisions on how to divide an endowment of 100 experimental “pesos” are then made jointly: offer as the proposer and threshold as the responder. Game results are provided only at the end of the second round: a random draw according to the probability condition is used to determine whether the threshold applies, and the final split of the endowment in each round.

We completed 5 experimental sessions for the Baseline. There were between 12 and 18 players per session, for a total of 78 participants, and no one was allowed to participate more than once. Table 1 lists the numbers of participants and observations for all treatments in this study. To control for reputation building, we used the standard anonymous matching

procedure such that no one in the experiment would meet the same opponent in the same role more than once. Moreover, subjects did not receive feedback on decisions of other players or outcomes of the game until the end of the experiment. Finally, to control the correlation between observations, we partitioned the participants in each session into two or three cohorts. Players in a subgroup never met participants in another subgroup during the experiment. This results in a total of 11 independent cohorts in the Baseline treatment.

[Insert Table 1 Here]

The procedure used to determine the pairing of subjects also merits a note. We assigned two players in each cohort to play the role of proposer and the remaining four (or six) players to be responders. We then randomly pick one proposer for each responder and one responder for each proposer. The matching algorithm is devised such that responder would always play one round as Responder A and one as Responder B but with random sequence. It is not guaranteed that the proposer would encounter both types of responders over the 2 rounds. Because of this asymmetric pairing method, we collected data from 56 responders and 22 proposers.

The game was programmed using z-Tree (Fischbacher 2007). Subjects were undergraduates at a Midwest university in the United States. They were voluntarily recruited from a university-wide subject pool. Upon arrival to the lab, subjects were randomly assigned to a computer with instructions to review (sample instructions are provided in Appendix B). The experimenter read the instructions aloud to ensure common knowledge and addressed any questions. Subjects answered a set of questions checking their understanding of the instructions and received feedback on their answers. The game then started. Payoffs from the experiment were calculated by converting the pesos that each

individual accumulated from both rounds to dollars at a fixed rate, on top of a show-up fee. Subjects were asked to fill out a survey before receiving the cash payment. An experimental session lasted 30-45 minutes, and on average, subjects earned about \$12.

4.2. Experimental Results

Results from previous studies in the literature suggest that powerful people tend to take more (Blader and Chen 2012; Draganska et al. 2010; Tripp 1993). Thus, we expected to observe higher thresholds from Responder B ($\pi = 90\%$). However, to our surprise, we did not find such results in the Baseline.

Overall, acceptance thresholds of the responder were slightly over 30% of the endowment. Difference between the two probability conditions is not significant by comparing either within subjects (p-value from paired t-test = 0.756) or between subjects (p-value from unpaired t-test = 0.793). On the other hand, proposers offered an average of 43 pesos to Responder B but only 20 pesos to Responder A. Comparisons are statistically different even with relatively small numbers of observations (p-values <0.05). Thus, proposers tend to respond strategically to the power condition of the responder: increase offers to more powerful opponents in anticipation that they would ask for more, although it turned out they did not. Corresponding results are summarized in Table 2 and Figure 2-A.

[Insert Table 2 Here]

[Insert Figure 2 Here]

The above results seem to suggest that perceptions of fairness by responders are not affected by the power change they experienced in the game. However, before we can reach this final conclusion, it is necessary to verify that our manipulation of power was successful

in the experiment. In a post-game survey, we designed a series of questions to verify that subjects indeed understood the game. Details are provided in Table 3 and Table 4.

[Insert Table 3 Here]

[Insert Table 4 Here]

In one set of questions, subjects reported their agreements on a scale from 1 (strongly disagree) to 7 (strongly agree) with respect to descriptions of the power relationships between different players. Subjects reported stronger agreement with the statement that the proposer is more powerful than Responder A, compared to the statement that the proposer is more powerful than Responder B (5.97 vs. 4.24, $p < 0.01$). Subjects were also in support of the claim that Responder B is more powerful than Responder A ($5.53 > 4$, $p < 0.01$). Moreover, we questioned subjects on which type of responder they would prefer to be or be matched with if they were to play the game again. The majority of subjects wanted to face Responder A as the proposer (76.92%), and yet wanted to be Responder B for themselves (69.23%). Lastly, we surveyed subjects on their opinions about which player “should” get more in the game.⁵ We found that subjects favored the claim that the proposer should get more than Responder A over the claim that the proposer should get more than Responder B (4.19 vs. 3.32, $p < 0.01$). And they tended to disagree with that Responder A and B should get the same amount ($3.19 < 4$, $p < 0.01$).

Results from the manipulation checks are robust to roles that subjects played in the experiment. Hence, it is evident that the probability condition successfully modified the power distance between players, and subjects clearly understood that. However, this raises another question: subjects’ fairness preferences reported in the questionnaire are not

⁵ We phrased all statements using the word “should” with the intent to avoid an explicit reference to “fairness” to minimize contamination from extraneous concepts, such as equality, which are sometimes associated with the expression.

consistent with their decisions (on the threshold) observed in the incentive-compatible game.

There are several reasons for such an inconsistency. First, the presence of payments for the actual game might make a difference. With real cash, subjects tend to behave more conservatively, and thus lower thresholds in the high probability condition to avoid risk of rejections. Second, it is possible that decision makers are hindered by cognitive limitations from elaborating the best response strategies given their modified beliefs. Third, even if the best response strategy can be identified, individual heterogeneity makes it hard for subjects to arrive at the same equilibrium among multiple candidates. Lastly, players can be certain about their own preferences and best response strategies, but not sure about the other players' preferences and strategies. It is difficult to separate these different explanations. However, all of the above can be alleviated, to some extent, by learning.

In the Baseline, to approximate the nature of a one-shot game, feedbacks are displayed until subjects finish both rounds. Even though proposers recognize the power differences between Responder A and B and react strategically, responders cannot observe such behaviors. Within the short duration of the game, players barely have any chance to learn. It brings us to question whether the gap between revealed and stated preferences would be bridged if learning opportunities were to be provided. This leads to the design of the Experience experiment.

5. The Experience Experiment

5.1. Experimental Design and Results

In this treatment, we add a trial session that lasts for 8 rounds prior to the game discussed in the Baseline. To encourage full experience, each subject plays 4 rounds as the proposer,

2 rounds as Responder A and another 2 rounds as Responder B. At the end of each trial round, subjects receive feedback that summarizes parameter settings, decisions and outcomes for both parties. These trial decisions do not influence subjects' final cash payments from the real game. We expect the treatment to help reveal the process that how responders learn to adjust their fairness perceptions and behaviors (thresholds) in response to changes in power (probability) conditions.

We conducted 5 sessions of the Experience treatment, with 10 independent cohorts and 80 new participants (60 responders and 20 proposers) from the same subject pool. During the 2-round paid game, subjects were paired with players from a different cohort than the ones they met in the trial session. All other controls as well as the post-game survey were executed in accordance with the Baseline.

First, we look at the proposer's behavior. Consistent with observations in the Baseline, proposers offer significantly more to Responder B than to Responder A (45.33 vs. 20.42, p -values < 0.001 by both paired and unpaired t -tests). Comparing the two treatments, additional experience from the trial session does not affect how the proposer treats the two types of responders notably. On the other hand, with trial experience, the average threshold demanded by Responder B is now significantly higher than that by Responder A (36.07 vs. 25.57) by both within and between-subject comparisons (p -values < 0.01). In contrast with the Baseline, Responder A seems to learn from the experience to reduce its threshold significantly (25.57 vs. 32.82, $p < 0.05$), whereas Responder B tends to increase its threshold but the difference is not statistically significant (36.07 vs. 31.89). These results are summarized in Table 2 and illustrated in Figure 2-B.

To further explore the learning behaviors, we look at how thresholds and offers evolve over time. Figure 3 plots these two variables under different probability conditions over eight periods of the trial session (numbered as -7 to 0), plus the two paid periods of the game (numbered as 1 and 2). We find that, in response to our power manipulation, offers exhibit a significant difference from the very first round ($p < 0.01$) and such a difference persists throughout most of the rounds (see Table 5). On the other hand, players seem to be experimenting with thresholds, as they appear to first converge and then quickly diverge from round -3 onward. Formal statistical tests reveal that the difference in thresholds between the probability conditions is significant for the first 2 trial rounds ($p < 0.01$ and $p < 0.05$), but then reduces to be not significant for the next 2 rounds. A similar pattern can also be found after round -3. It is interesting to note that the timing for these behavioral changes coincides with subjects' training experience: to maximize learning, every 2 rounds subjects were assigned a different probability and at round -3 subjects switch roles.

[Insert Figure 3 Here]

[Insert Table 5 Here]

Significant threshold differences are found in the first 2 unpaid trial rounds and in the last 2 paid game rounds. We speculate that the first difference reflects subjects' initial responses when their fairness beliefs are modified by power. Analysis of the survey lends some support for this conjecture. Similar to what was reported in the Baseline, subjects favor the claim that the proposer should get more than Responder A, compared with the claim that the proposer should get more than Responder B (4.91 vs. 3.81, $p < 0.01$). The second difference suggests that learning experience can help converge the stated preferences to incentive-compatible actions. Responders learn to adjust their thresholds

accordingly, especially *after* they had put themselves in the shoes of the other player (i.e., after round -3).

To summarize, responders in the Baseline indicate the same level of thresholds, although they agree that more powerful responders should get more. In the Experience treatment, responders assigned to the high probability condition ask for a significantly larger amount. In other words, with additional experience, subjects behave in line with their stated preferences. Since no direct pecuniary incentive exists for the responder to react to the power manipulation, behavioral responses to power shift should be attributed to changes in perceptions of fairness by decision makers. The comparison between the two treatments leads us to believe that power “can” modify perceptions of fairness; however, for such an effect to influence distributive behavior, learning is required. To draw a firm conclusion of such, we need to rule out a number of alternative explanations.

5.2. Discussion of Alternative Explanations

Risk Aversion. In our game, the larger the threshold, the higher the chance it is rejected under the same probability condition; as for the same threshold, it is more likely to be executed under the high probability condition than the low one. Therefore, assuming the same amount is offered, we would then anticipate a conservative responder to lower her threshold in the high probability condition. This contradicts what we found in the paid rounds of the Baseline and the Experience treatments: proposers differentiate their offers similarly under both treatments but responders react to probabilities only under the Experience treatment. If it were the risk attitude that drives the behavior of the responder, we should not have observed this treatment effect on threshold decisions.

Signaling and reputation building. One possible explanation is that experienced responders use the threshold strategically to signal their preferences or to build a reputation. Recall that we did adopt appropriate experimental procedures in the paid periods under both treatments so that this type of behavior should have been controlled. A minor concern may remain that responders in the trial session would still signal in the interest of other responders. However, if a responder were to signal that low offers would not be accepted, she would prefer to do so with the minimum possible cost. For a given threshold, the expected cost for rejection is less when the probability for such a threshold to apply is low. We would then expect tougher signals in the form of higher threshold to be sent under the low probability condition, which again, runs opposite to our findings.

Anchoring. Another possibility is that responders have anchored their decisions on the probability conditions, so that they pick a higher threshold simply because they see a bigger number for probability. The anchoring effect, however, should apply to both the Baseline and the Experience treatment. We would then observe similar difference in threshold between the probability conditions under both treatments rather than only under the Experience treatment.

So far we have provided evidence that power can affect stated as well as revealed preferences for fairness. While the previous set of experiments shows that this transformation of stated preferences into actions happens with experience, it remains unclear what causes the change. One possibility is that responders learn to differentiate the threshold from interactions with the other strategic opponent. Indeed, more powerful responders may ask for more because they learn that a strategic proposer will have an

incentive to offer more than when the responder is weaker. We design the next set of experiments to investigate the validity of this explanation.

6. Asymmetric Information Experiments

In the Baseline and Experience treatments, both the proposer and the responder receive public information about the probability condition before making decisions. We now vary this information structure: the proposer simply knows that there is a 50-50% chance of meeting either a Responder A or Responder B; and only the responders are informed of what specific probability is assigned ($\pi = 0.9$ or 0.1) in each round. In parallel with previous experiments, two additional treatments, called “Asymmetric Information with No Experience” and “Asymmetric Information with Experience,” are created. This concludes our study with a 2 (whether the experience of practice rounds is available or not) x 2 (full vs. asymmetric information on probability conditions) full factorial between-subject design, in addition to the within-subject manipulation of power (high vs. low probability).

We expect the variation on information structure to help us identify the necessary condition for power to impact distribution. In particular, we are interested in understanding if it is sufficient for an individual’s behavior to alter by privately knowing one’s own power change; or all parties involved in the relationship to have to recognize it. Furthermore, comparisons between the two information conditions with experience can help shed light on how subjects learn about the power effect. If learning occurs with both full and asymmetric information, it implies that feedback on responders’ own performance is sufficient. If learning arises only with full information, we can conclude that interactions with the strategic player are necessary.

Using a similar approach, we collected data from another 80 participants for each of the two asymmetric information treatments. We observe that proposers no longer offer different amounts to responders without knowing their specific types. Indistinguishable offers are found under both the experience and the no experience treatments. This implies that incentives for the proposer to behave strategically have been removed by the lack of public information about power distributions. Thresholds by Responders A and B also become inseparable with asymmetric information. Detailed statistics are shown in Table 2 and graphed in Figures 2-C and 2-D.

We again plot offers and thresholds over all rounds under the Asymmetric Information with Experience treatment, but do not observe any marked behavioral trend this time (see Figure 4). A formal analysis shows that the difference in offers never quite reaches significance, while the difference in thresholds was significant briefly at the beginning of the trial session (in round -6, see Table 6).

[Insert Figure 4 Here]

[Insert Table 6 Here]

We thus draw the conclusion that common knowledge about the relative power of players involved in a relationship is required for power to take effect on distributive decisions. It is also suggested that decision makers have to learn from interacting with a strategic player to translate their reshaped preferences for fairness into actions. This result is particularly important for policy makers: to avoid undesirable impact by power, information on power status of corresponding individuals needs to be concealed or obscured.

To further check the importance of information on power, we surveyed subjects about their preferences over the roles to play in the game. More specifically, we asked subjects to indicate which responder (A or B) they want to be when the proposer could or could not see their type. We find that, given full information, the majority of subjects preferred to be Responder B (74.53%). In contrast, with asymmetric information, only 44.65% of subjects wanted to be Responder B, 33.33% of them did not care, and the remaining 22.01% wanted to be Responder A. Please refer to Table 7 for more details.⁶ These results indicate that subjects no longer value power differentials when such information becomes asymmetric.

[Insert Table 7 Here]

7. Conclusion

Using a series of modified-ultimatum experiments, we provide laboratory evidence that changes in power can modify what is perceived as fair. Moreover, we identify conditions under which such perceptions lead to changes in distributive behaviors. We observe that subjects in general agree that players with more power should get more; however, such a belief does not seem to transform into actions inherently. In contrast to the proposer who responds to economic incentives under different probability conditions from the very beginning, the responder has to learn how to benefit from her increased power from strategic interactions over time. These findings contribute to the literature on fairness by improving the understanding of its causes, consequences, and relationship with another important determinant of social interactions – power.

In addition, our study offers a more general framework to establish connections between changes in incentives, changes in perceptions, and changes in behaviors. This is

⁶ A similar pattern can be seen if we break down data by condition.

due to several notable methodological modifications we introduce to the experimental design. First, we have the responder decide the acceptance threshold as the proposer determines the offer. Under this simultaneous game without reputation building, we demonstrate analytically that our manipulation of power, through changes in probability with which the responder's threshold applies, should have consequences only for the proposer's actions. This distinction allows us to attribute changes in responder behavior to fairness considerations instead of strategic incentives. Furthermore, our study complements and expands the previous research on nominal vs. real power by Frechette et al. (2005b). In particular, under a bilateral bargaining setting, changes in one player's nominal power alone can change her distributive decisions so long as changes in real power affect the other player. Second, using the probability condition, we create a convex combination of the ultimatum game and the dictator game. The power distance between the two parties can then be manipulated continuously without altering the incentives of the responder. This approach generates more direct and cleaner measure of power effect than priming of power status (Tripp 1993; Blader and Chen 2012), or comparisons across different roles (Rustichini and Villeval 2014), and different games (Hsu 2008). Since the proposer always dominates the responder in our experiments, despite the power shifts, the significant results that we obtain are likely to be a conservative benchmark of how power influences fairness perceptions, and thus provide solid proof of our theory. Finally, the continuous variable of threshold and subjects' stated fairness preferences that we elicit in addition to their decisions enable us to capture more subtle behavioral responses than the rejection rate commonly studied in the literature. In particular, these measures allow us to

draw distinctions between the effect of power on perceptions of fairness and its impact on distributive behaviors.

Some empirical implications from the study are worth further discussions. First, it suggests the importance to watch out for power dynamics, as one's expectation for what is the "fair" amount to take can change. In the context of bilateral bargaining, this means that individuals, parties or organizations with increased power might refuse deals that would have been accepted before. A failure to anticipate this difference could lead to deadlock and dispute in negotiations (e.g., the battle between Amazon and publishers).

Second, our results indicate that perceptions of power shift alone could potentially lead to different resource allocations. In other words, changes in *beliefs* about the power balance, although one's real power does not vary, can affect demands and expectations of negotiating parties. This implies that firms should evaluate the power of the other party at the table holistically – not just based on its available strategic actions. Furthermore, within an organization, managers should be mindful of institutional changes even when they are nominal. For example, a job title change could empower an employee and thus influence his or her bargaining position.

Finally, we show that while changes of power can modify perceptions of fairness, without opportunities to observe strategic behaviors, they do not necessarily induce any significant behavioral change. This result can be relevant to understand corrupted behaviors – they may not originate from powerful people who demand favors, but are more likely to be triggered by those who offer such favors. The result also lends more supports to a flat organizational structure, which is known to provide greater levels of procedural fairness to employees than the hierarchical one. Obscuring levels of management among

employees, and thus their power differentials, helps reduce differences in employee compensation and benefits and then preserve distributive fairness.

Some limitations remain. First, the current design does not permit us to pinpoint the exact cause of the power influence: whether it is due to changes in the perceived fair share (m_k), and/or changes in one's sensitivities to fairness (α). We do not intend to disentangle empirically the two hypotheses in this study. However, according to the psychology literature, powerful individuals pay less attention to others. Hence, they are likely to be less sensitive to fairness concerns (i.e., lower α). It leads us to believe that the higher demands by more powerful responders in our experiments are driven by an increase in the perceived fair share (i.e., higher m_k). Second, the threshold elicited in our game is similar to the minimum acceptable offers (MAOs) in earlier studies (Blount and Bazerman 1996; Weber et al. 2004). Such a strategy method might lead to higher rejection rates than the direct-response method. However, a survey by Brandts and Charness (2011) finds no treatment effects comparing these two methods in the literature. We do not expect any of our conclusions to be fundamentally altered if the game were to be repeated with the direct-response method.

We would like to highlight some interesting avenues for future research. First, the power conditions in our experiments were assigned by coin toss. Previous research suggests that effects of power and perceptions of fairness may be mediated by certain factors such as emotions or beliefs about others' behaviors (Bosman et al. 2005; Carpenter et al. 2009; Fischbacher and Simon 2010; Ranehill et al. 2015), and perceptions of legitimacy in power differentials (Hornsey et al. 2003; Faravelli 2007). Second, we opted to use the two extreme values of probabilities (0.1 vs. 0.9) in the experiments to

demonstrate the significance of power influence while preserving connections to the literature on fairness. It may be worthwhile to examine behaviors under other probability conditions, for instance, those that are close to the middle point (e.g., 0.4 vs. 0.6), to understand further the shape of the reaction curve to power differentials. Lastly, it would be interesting to look at how power affects fairness considerations under more complex situations that involve, for instance, production or investment (Cappelen et al. 2010; Cui and Mallucci 2016).

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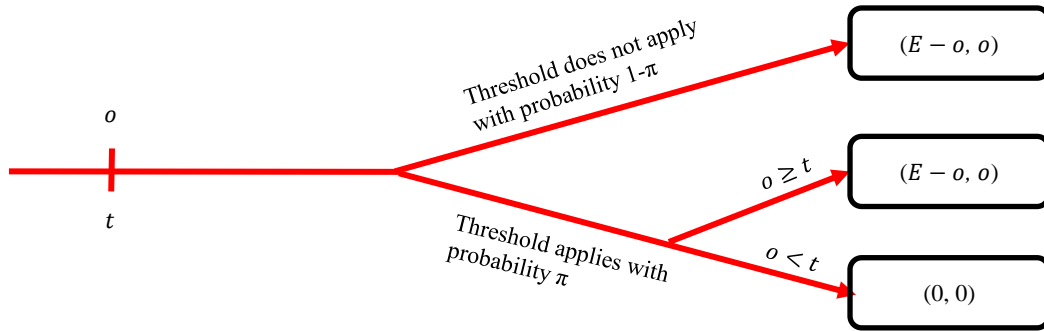
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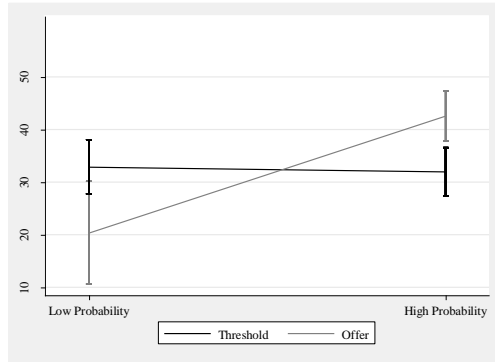
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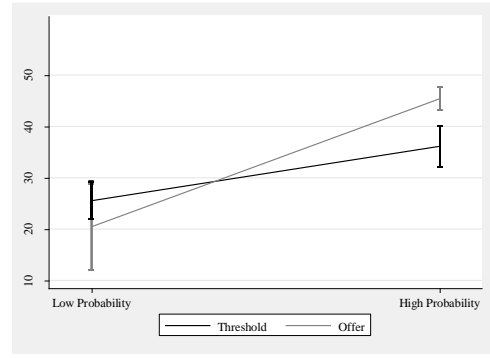


(A) BASELINE TREATMENT

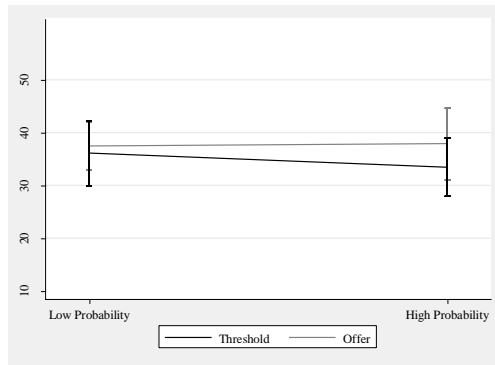
Figure 1. Timing of Game



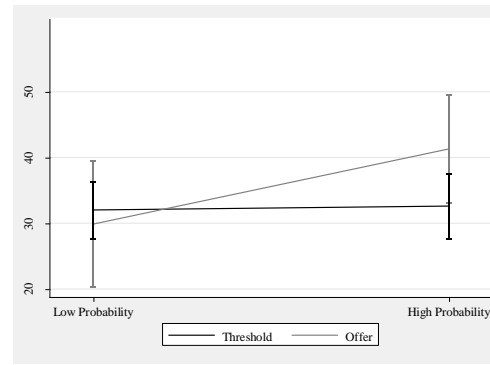
(A) BASELINE



(B) EXPERIENCE

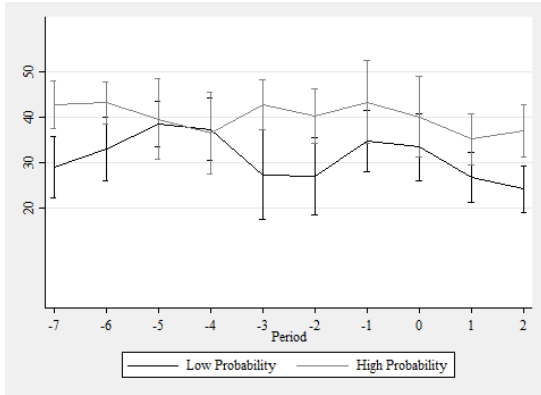


(C) ASYMMETRIC INFORMATION WITH NO EXPERIENCE

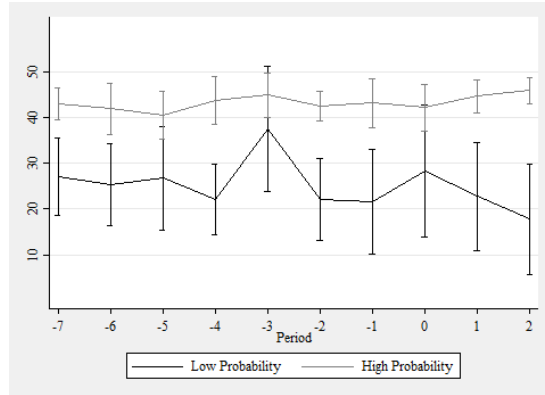


(D) ASYMMETRIC INFORMATION WITH EXPERIENCE

Figure 2. Average Threshold and Offer by Treatment

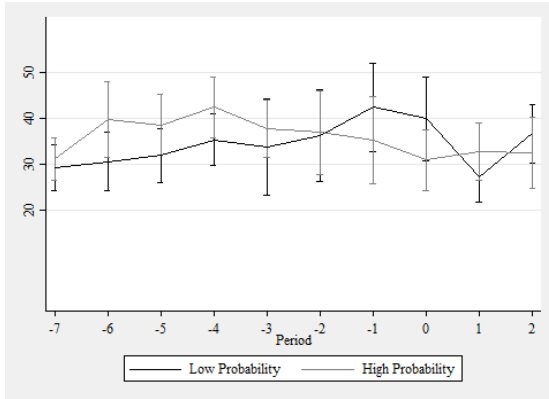


(A) THRESHOLD

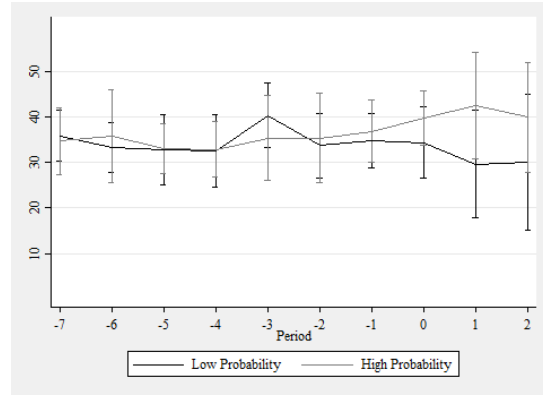


(B) OFFER

Figure 3. Evolution of Decisions Over Time (Mean and 95% Confidence Interval) Under the Experience Treatment (Roles Are Switched At Time -3)



(A) THRESHOLD



(B) OFFER

Figure 4. Evolution of Offers Over Time (Mean and 95% Confidence Interval) under the Asymmetric Information with Experience Treatment (Roles Are Switched At Time -3)

Table 1. Number of (Paid) Observations

		Low Responder Power	Hi Responder Power	Total Observations	Subjects	Paired	Sessions	Independent cohorts
Baseline	Threshold	56	56	112	56	56	5	11
	Offer	24	20	44	22	14	5	11
Experience	Threshold	60	60	120	60	60	5	10
	Offer	19	21	40	20	9	5	10
Asymmetric Information with no Experience	Threshold	56	56	112	56	56	5	12
	Offer	23	25	48	24	15	5	12
Asymmetric Information with Experience	Threshold	60	60	120	60	60	5	10
	Offer	14	26	40	20	8	5	10
Total	Threshold	232	232	464	232	232	20	43
	Offer	80	92	172	86	46	20	43

Table 2. The Effect of Power on Offers and Thresholds

		Low Responder Power	Hi Responder Power	Unpaired test p-value	Paired test p-value
Baseline	Threshold	32.82 (2.64)	31.89 (2.64)	.793	.756
	Offer	20.33 (4.99)	42.55 (2.43)	.000***	.032**
Experience	Threshold	25.57 (1.89)	36.07 (2.02)	.000***	.000***
	Offer	20.42 (4.23)	45.33 (1.15)	.000***	.001***
Asymmetric Information with no Experience	Threshold	36.02 (3.15)	33.39 (2.84)	.537	.358
	Offer	37.39 (2.33)	37.84 (3.44)	.916	.350
Asymmetric Information with Experience	Threshold	32.00 (2.20)	32.58 (2.52)	.862	.806
	Offer	29.93 (4.88)	41.35 (4.21)	.100	.762

Note: *** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level.

Table 3. Power Manipulation Checks

		Obs	Mean	Std. Dev.	Min	Max
Baseline	The Proposer is more powerful than Responder A ($p=0.1$)	78	5.97	1.63	1	7
	The Proposer is more powerful than Responder B ($p=0.9$)	78	4.24	1.98	1	7
	Responder A ($p=0.1$) is less powerful than Responder B ($p=0.9$)	78	5.53	1.66	1	7
Experience	The Proposer is more powerful than Responder A ($p=0.1$)	80	6.08	1.55	1	7
	The Proposer is more powerful than Responder B ($p=0.9$)	80	3.98	1.79	1	7
	Responder A ($p=0.1$) is less powerful than Responder B ($p=0.9$)	80	5.83	1.55	1	7
Asymmetric Information with no Experience	The Proposer is more powerful than Responder A ($p=0.1$)	80	5.65	1.49	1	7
	The Proposer is more powerful than Responder B ($p=0.9$)	80	4.16	1.77	1	7
	Responder A ($p=0.1$) is less powerful than Responder B ($p=0.9$)	80	5.18	1.63	1	7
Asymmetric Information with Experience	The Proposer is more powerful than Responder A ($p=0.1$)	80	5.76	1.90	1	7
	The Proposer is more powerful than Responder B ($p=0.9$)	80	4.09	1.89	1	7
	Responder A ($p=0.1$) is less powerful than Responder B ($p=0.9$)	80	5.03	2.09	1	7
Total	The Proposer is more powerful than Responder A ($p=0.1$)	318	5.86	1.65	1	7
	The Proposer is more powerful than Responder B ($p=0.9$)	318	4.12	1.85	1	7
	Responder A ($p=0.1$) is less powerful than Responder B ($p=0.9$)	318	5.39	1.77	1	7

Table 4. Stated Preferences for Fairness

		Obs	Mean	Std. Dev.	Min	Max
Baseline	The Proposer should get more than Responder A (p=0.1)	78	4.19	2.27	1	7
	The Proposer should get more than Responder B (p=0.9)	78	3.32	1.93	1	7
	Responder B (p=0.9) should get more than Responder A (p=0.1)	78	4.18	2.15	1	7
	Responder A (p=0.1) and B (p=0.9) should get the same amount	78	3.19	1.96	1	7
Experience	The Proposer should get more than Responder A (p=0.1)	80	4.91	2.02	1	7
	The Proposer should get more than Responder B (p=0.9)	80	3.81	1.68	1	7
	Responder B (p=0.9) should get more than Responder A (p=0.1)	80	4.40	1.89	1	7
	Responder A (p=0.1) and B (p=0.9) should get the same amount	80	3.69	1.95	1	7
Asymmetric Information with no Experience	The Proposer should get more than Responder A (p=0.1)	80	4.61	1.55	1	7
	The Proposer should get more than Responder B (p=0.9)	80	4.28	1.47	1	7
	Responder B (p=0.9) should get more than Responder A (p=0.1)	80	3.66	1.71	1	7
	Responder A (p=0.1) and B (p=0.9) should get the same amount	80	3.94	1.61	1	7
Asymmetric Information with Experience	The Proposer should get more than Responder A (p=0.1)	80	4.49	2.11	1	7
	The Proposer should get more than Responder B (p=0.9)	80	3.83	1.78	1	7
	Responder B (p=0.9) should get more than Responder A (p=0.1)	80	3.83	2.02	1	7
	Responder A (p=0.1) and B (p=0.9) should get the same amount	80	3.83	1.96	1	7
Total	The Proposer should get more than Responder A (p=0.1)	318	4.55	2.01	1	7
	The Proposer should get more than Responder B (p=0.9)	318	3.81	1.74	1	7
	Responder B (p=0.9) should get more than Responder A (p=0.1)	318	4.02	1.96	1	7
	Responder A (p=0.1) and B (p=0.9) should get the same amount	318	3.66	1.89	1	7

Table 5. Evolution of Decisions under the Experience Treatment (with Full Information)

Round	Offer			Threshold		
	Low Responder Power	Hi Responder Power	ttest p-value	Low Responder Power	Hi Responder Power	ttest p-value
-7	27.05 (4.31)	43 (1.83)	.002***	29.1 (3.39)	42.75 (2.63)	.003***
-6	25.3 (4.61)	41.9 (2.83)	.004***	33.1 (3.53)	43.20 (2.32)	.022**
-5	26.75 (5.76)	40.5 (2.66)	.037**	38.45 (2.57)	39.60 (4.50)	.826
-4	22.2 (3.93)	43.75 (2.64)	.000***	37.35 (3.46)	36.50 (4.57)	.883
-3	37.55 (6.99)	44.9 (2.48)	.329	27.40 (5.00)	42.75 (2.75)	.011**
-2	22.15 (4.58)	42.5 (1.6)	.000***	27.15 (4.30)	40.25 (3.09)	.018**
-1	21.55 (5.84)	43.15 (2.68)	.002***	34.75 (3.41)	43.35 (4.62)	.143
0	28.25 (7.36)	42.2 (2.6)	.082*	33.50 (3.75)	40.05 (4.51)	.271
1	22.8 (6.01)	44.7 (1.85)	.003***	26.90 (2.78)	35.20 (2.86)	.042**
2	17.78 (6.19)	45.91 (1.49)	.000***	24.23 (2.58)	36.93 (2.91)	.002***

Note: *** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level.

Table 6. Evolution of Decisions under Asymmetric Information with Experience Treatment

Round	Offer			Threshold		
	Low Responder Power	Hi Responder Power	ttest p-value	Low Responder Power	Hi Responder Power	ttest p-value
-7	35.80 (2.86)	34.70 (3.71)	.816	29.25 (2.57)	31.20 (2.38)	.581
-6	33.25 (2.81)	35.85 (5.22)	.663	33.1 (3.53)	39.70 (4.17)	.093*
-5	32.80 (3.88)	32.95 (2.79)	.975	38.45 (2.57)	38.55 (3.38)	.155
-4	32.45 (4.07)	32.90 (3.06)	.930	37.35 (3.46)	42.40 (3.42)	.125
-3	40.30 (3.62)	35.40 (4.74)	.417	27.40 (5.00)	37.75 (3.19)	.526
-2	33.70 (3.58)	35.40 (4.96)	.783	27.15 (4.30)	36.95 (4.66)	.925
-1	34.80 (3.05)	36.85 (3.52)	.662	34.75 (3.41)	35.35 (4.82)	.312
0	34.35 (3.99)	39.85 (3.05)	.280	33.50 (3.75)	31.00 (3.36)	.127
1	29.67 (5.99)	42.50 (5.97)	.216	26.90 (2.78)	32.70 (3.18)	.206
2	30.13 (7.63)	40.00 (6.15)	.326	24.23 (2.58)	32.47 (3.96)	.416

Note: *** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level.

Table 7. Role Preferences

		Responder A (p=0.1)	Responder B (p=0.9)	It does not matter	Obs
Baseline	Suppose the Proposer CANNOT observe your type, what Responder type would you want to be?	19.23%	47.44%	33.33%	78
	Suppose the Proposer CAN observe your type, what Responder type would you want to be?	14.10%	69.23%	16.67%	78
Experience	Suppose the Proposer CANNOT observe your type, what Responder type would you want to be?	17.50%	55.00%	27.50%	80
	Suppose the Proposer CAN observe your type, what Responder type would you want to be?	7.50%	83.75%	8.75%	80
Asymmetric Information with no Experience	Suppose the Proposer CANNOT observe your type, what Responder type would you want to be?	25.00%	38.75%	36.25%	80
	Suppose the Proposer CAN observe your type, what Responder type would you want to be?	10.00%	72.50%	17.50%	80
Asymmetric Information with Experience	Suppose the Proposer CANNOT observe your type, what Responder type would you want to be?	26.25%	37.50%	36.25%	80
	Suppose the Proposer CAN observe your type, what Responder type would you want to be?	11.25%	72.50%	16.25%	80
Total	Suppose the Proposer CANNOT observe your type, what Responder type would you want to be?	22.01%	44.65%	33.33%	318
	Suppose the Proposer CAN observe your type, what Responder type would you want to be?	10.69%	74.53%	14.78%	318

Appendix A: Proofs of Equilibrium Solutions to the Modified Ultimatum Game

Nash Equilibria. First we show the possible equilibria in the simultaneous game. Let's pick a pair (\tilde{p}, \tilde{t}) such that $\bar{p} \geq \tilde{p} = \tilde{t} \geq \underline{t}$. It can be easily shown that any such pair is a Nash equilibrium. If the proposer chooses \tilde{p} , any t such that $\tilde{p} \geq t \geq \underline{t}$ will yield $u_r(\tilde{p}) \geq 0$ for the responder, while any t such that $t > \tilde{p}$ will yield $u_r = 0$. So the responder weakly prefers $t = \tilde{t} = \tilde{p}$. Given the responder plays \tilde{t} , and the proposer's utility is decreasing in p if $\bar{p} \geq p \geq \tilde{t}$ and 0 otherwise, the proposer strictly prefers $\tilde{p} = \tilde{t}$.

Now let us determine the boundaries \bar{p} and \underline{t} . Note that $\tilde{p} = \tilde{t}$ is a slight abuse of notation as \tilde{p} consists of a pair of solution $\tilde{p} = \begin{cases} \tilde{t} & \text{if } \pi \geq \tilde{\pi} \\ 0 & \text{if } \pi < \tilde{\pi} \end{cases}$, where $\tilde{\pi}$ depends on \tilde{t} and is the cutoff probability above which the proposer makes a positive offer.

Determine \bar{p} . Given the utility function for proposer in Equation (3), the maximum feasible proposal the proposer is willing to make needs to keep the utility of the proposer positive. As such $\bar{p} = \min_p u_p$ s.t. $u_p \geq 0$.

Given Equation (2) this means \bar{p} is equal to the largest p that keeps $u_p > 0$ non-negative where

$$u_p = \begin{cases} E - p - \alpha_p [n_k E - (E - p)]^+ & \text{if } p \geq t \\ -\beta_p [(E - p) - n_k E]^+ & \\ (1 - \pi) * \{E - p - \alpha_p [n_k E - (E - p)]^+ & \\ -\beta_p [(E - p) - n_k E]^+ \} & \text{if } p < t \end{cases} \quad (\text{A1})$$

We now look separately at the case where the responder faces disadvantageous and advantageous inequalities.

Disadvantageous inequality. If $n_k E - (E - p) \geq 0$ then (A1) reduces to

$$u_p = \begin{cases} E - p - \alpha_p [n_k E - (E - p)] & \text{if } p \geq t \\ (1 - \pi) * \{E - p - \alpha_p [n_k E - (E - p)]\} & \text{if } p < t \end{cases}$$

and the maximum offer for which $u_p \geq 0$ is $\bar{p} = \frac{1 + \alpha_p - \alpha_p n_k}{1 + \alpha_p} E$ for any $\pi \geq 0$. Substituting the

solution into the disadvantageous inequality condition yields $n_k E - (E - p) = n_k E - \frac{\alpha_p n_k}{1 + \alpha_p} E =$

$\frac{n_k}{1 + \alpha_p} E \geq 0$, which is always satisfied. Hence, in this case we have

$$\bar{p} = \left(1 - \frac{\alpha_p n_k}{1 + \alpha_p}\right) E, \text{ if } n_k E - (E - p) > 0. \quad (\text{A2})$$

Advantageous inequality. If instead, $n_k E - (E - p) \leq 0$ then (A1) reduces to

$$u_p = \begin{cases} E - p - \beta_p[(E - p) - n_k E] & \text{if } p \geq t \\ (1 - \pi) * \{E - p - \beta_p[(E - p) - n_k E]\} & \text{if } p < t \end{cases}$$

For p to satisfy $n_k E - (E - p) \leq 0$ it must be $p \leq (1 - n_k)E$ and $u_p \geq 0$. As u_p is decreasing in p for any $0 < \beta_p < 1$, the highest u_p is obtained at the boundary:

$$\bar{p} = (1 - n_k)E, \text{ if } n_k E - (E - p) < 0. \quad (\text{A3})$$

Comparing (A2) and (A3) we can see that $\frac{1+\alpha_p m_k}{1+\alpha_p} E > m_k E$, so that the highest possible offer for proposers is given by

$$\bar{p} = \frac{1+\alpha_p - \alpha_p n_k}{1+\alpha_p} E, \text{ for any } \pi \geq 0. \quad (\text{A4})$$

Determine \underline{t} . Given the utility function for responders in Equation (1), the lowest feasible threshold, \underline{t} , will be equal to the offer for which the responder is indifferent between accepting the offer and rejecting it. Hence, the lowest feasible threshold is equal to the lowest offer for which the utility is non negative and is given by $\underline{t} = \min_p u_r$ s.t. $u_r \geq 0$.

Given Equation (1) this means \underline{t} is equal to the smallest p such that

$$p - \alpha(m_k E - p)^+ - \beta(p - m_k E)^+ \geq \pi * 0 + (1 - \pi) * [p - \alpha(m_k E - p)^+ - \beta(p - m_k E)^+] \rightarrow \pi * [p - \alpha(m_k E - p)^+ - \beta(p - m_k E)^+] \geq \pi * 0$$

Which lead to

$$p - \alpha(m_k E - p)^+ - \beta(p - m_k E)^+ \geq 0. \quad (\text{A5})$$

We now look separately at the case where the responder faces disadvantageous and advantageous inequalities.

Disadvantageous inequality. If $m_k E - p \geq 0$ then (A5) reduces to $p - \alpha(m_k E - p) \geq 0$ and the minimum offer for which $u_r \geq 0$ is $p = \frac{\alpha}{1+\alpha} m_k E$. Substituting the solution into the disadvantageous inequality condition yields $m_k E - p = m_k E - \frac{\alpha}{1+\alpha} m_k E \geq 0$, which is always satisfied as $\frac{\alpha}{1+\alpha} < 1$. Hence, in this case we have

$$t^* = \frac{\alpha}{1+\alpha} m_k E, \text{ if } m_k E - p \geq 0. \quad (\text{A6})$$

Advantageous inequality. If instead, $m_k E - p \leq 0$ then (A5) reduces to $p - \beta(p - m_k E) = (1 - \beta)p + \beta m_k E \geq 0$, which is always true for any $0 < \beta < 1$. Since $m_k E - p \leq 0$ leads to $p \geq m_k E$ and $u_r \geq 0$ is increasing in p , the lowest t is thus given by

$$t^* = m_k E, \text{ if } m_k E - p \leq 0. \quad (\text{A7})$$

Comparing (A6) and (A7) we can see that $\frac{\alpha}{1+\alpha}m_kE < m_kE$. So the lowest possible threshold for responders is given by

$$\underline{t} = \frac{\alpha}{1+\alpha}m_kE. \quad (\text{A8})$$

Q.E.D.

Selection of risk dominant equilibrium. In the interest of finding a unique solution that can be used to derive predictions for the behavior of experimental subjects, we show that most of the equilibria found above can be ruled out using the risk dominance equilibrium selection mechanism.

First, let us rename \underline{t} as t^* , so that $t^*(\alpha) = \underline{t} = \frac{\alpha}{1+\alpha}m_kE$.

Next, let us identify $p^* = t^*$. Substituting into Equation (2), gives

$$u_p = \begin{cases} (1 - \beta_p + \beta_p n_k)E - (1 - \beta_p) \frac{\alpha}{1+\alpha} m_k E & \text{if } p = t^* \geq t \\ (1 - \pi) * (1 - \beta_p + \beta_p n_k)E & \text{if } p = 0 < t \end{cases}. \quad (\text{A9})$$

The proposer will then choose the offer that yields the highest utility and will have $p = t^*$ if $u_p(t^*) > u_p(0)$ and $t^* < \bar{p}$. Solving the inequality yields

$$p^*(\alpha) = \begin{cases} \frac{\alpha}{1+\alpha} m_k E = t^* & \text{if } \pi \geq \frac{(1-\beta_p)\alpha}{1+\alpha} \frac{m_k}{1-\beta_p+\beta_p n_k} \\ 0 & \text{if } \pi < \frac{(1-\beta_p)\alpha}{1+\alpha} \frac{m_k}{1-\beta_p+\beta_p n_k} \end{cases}. \quad (\text{A10})$$

with $\frac{\alpha}{1+\alpha}m_k + \frac{\alpha_p}{1+\alpha_p}n_k < 1$.⁷

Given this definition of p^* and t^* , we can show that (p^*, t^*) risk dominates (\tilde{p}, \tilde{t}) . First, let us show that any pair (p, t) such that $\tilde{p} = \tilde{t} > p = t > t^*$ strictly risk dominates (\tilde{p}, \tilde{t}) . To do so, pick $(p^* + \varepsilon, t^* + \varepsilon)$, a point arbitrarily close to, but strictly larger than (p^*, t^*) . $(p^* + \varepsilon, t^* + \varepsilon)$ strictly risk dominates (\tilde{p}, \tilde{t}) if $[u_r(p^* + \varepsilon, \tilde{t}) - u_r(p^* + \varepsilon, t^* + \varepsilon)][u_p(\tilde{p}, t^* + \varepsilon) - u_p(p^* + \varepsilon, t^* + \varepsilon)] \geq [u_r(\tilde{p}, t^* + \varepsilon) - u_r(\tilde{p}, \tilde{t})][u_p(p^* + \varepsilon, \tilde{t}) - u_p(\tilde{p}, \tilde{t})]$.

Substituting yields $[0 - u_r(p^* + \varepsilon, t^* + \varepsilon)][\Delta u_p^{t^*}] \geq [0][0 - u_p(\tilde{p}, \tilde{t})]$. Note that $u_r(p^* + \varepsilon, t^* + \varepsilon) > 0$ and $\Delta u_p^{t^*}$ is negative because the proposer's utility is decreasing in p and $\tilde{p} > p^* + \varepsilon$ by definition. This means the LHS of the inequality is positive. On the other hand RHS of the equality equals zero. Hence, $(p^* + \varepsilon, t^* + \varepsilon)$ strictly risk dominates (\tilde{p}, \tilde{t}) .

Turning to comparing $(p^* + \varepsilon, t^* + \varepsilon)$ and (p^*, t^*) , we have the following $[u_r(p^* + \varepsilon, t^* + \varepsilon) - u_r(p^*, t^*)][u_p(p^* + \varepsilon, t^*) - u_p(p^*, t^*)] \geq [u_r(p^* + \varepsilon, t^*) - u_r(p^* + \varepsilon, t^* + \varepsilon)][u_p(p^*, t^* +$

⁷ Note that this is always satisfied for $m_k + n_k \leq 1$.

$\varepsilon) - u_p(p^* + \varepsilon, t^* + \varepsilon)$. Substituting yields $[0 - 0][\Delta u_p^{t^*}] \geq [0][0 - u_p(p^* + \varepsilon, t^* + \varepsilon)] \rightarrow 0 \geq 0$, and demonstrates that (p^*, t^*) weakly risk dominates $(p^* + \varepsilon, t^* + \varepsilon)$. Q.E.D.

Appendix B: Model Extensions

Asymmetric information. Suppose the responder has full information and knows the true probability, π , of the ultimatum game, while the proposer knows there is a 50% chance of the probability being high, π^H , and a 50% chance of the probability being low, π^L . We can show that in equilibrium the results will be similar to the baseline model: the optimal threshold is unchanged, while the only change in the optimal proposal is that the cutoffs will depend on the expected probability, rather than the actual probability:

$$t^* = \frac{\alpha}{1 + \alpha} m_k E$$

$$p^*(\alpha) = \begin{cases} t^* & \text{if } E\Pi \geq \frac{(1 - \beta_p)\alpha}{1 + \alpha} \frac{m_k}{1 - \beta_p + \beta_p n_k} \\ 0 & \text{if } E\Pi < \frac{(1 - \beta_p)\alpha}{1 + \alpha} \frac{m_k}{1 - \beta_p + \beta_p n_k} \end{cases}$$

Proof. In this setting, Equation (1) remains unchanged, while Equation (2) becomes:

$$u_p = \begin{cases} E - p - \alpha_p [n_k E - (E - p)]^+ - \beta_p [(E - p) - n_k E]^+ & \text{if } p \geq t \\ \frac{1}{2} \pi^H * 0 + \frac{1}{2} (1 - \pi^H) * \{E - p - \alpha_p [n_k E - (E - p)]^+ - \beta_p [(E - p) - n_k E]^+\} + & \text{if } p < t \\ \frac{1}{2} \pi^L * 0 + \frac{1}{2} (1 - \pi^L) * \{E - p - \alpha_p [n_k E - (E - p)]^+ - \beta_p [(E - p) - n_k E]^+\} & \end{cases} =$$

$$\begin{cases} E - p - \alpha_p [n_k E - (E - p)]^+ - \beta_p [(E - p) - n_k E]^+ & \text{if } p \geq t \\ \frac{1}{2} (\pi^H + \pi^L) * 0 + \left(1 - \frac{1}{2} (\pi^H + \pi^L)\right) * \{E - p - \alpha_p [n_k E - (E - p)]^+ - \beta_p [(E - p) - n_k E]^+\} & \text{if } p < t \end{cases} \quad (\text{B1})$$

Let us define $E\Pi = \frac{1}{2} (\pi^H + \pi^L)$ and substitute in (O1)

$$\begin{cases} E - p - \alpha_p [n_k E - (E - p)]^+ - \beta_p [(E - p) - n_k E]^+ & \text{if } p \geq t \\ E\Pi * 0 + (1 - E\Pi) * \{E - p - \alpha_p [n_k E - (E - p)]^+ - \beta_p [(E - p) - n_k E]^+\} & \text{if } p < t \end{cases} \quad (\text{B2})$$

From here we can see that Equation (O2) is the same as Equation (2) where expected probability, $E\Pi$, taking the place of realized probability, π . Hence, but for the difference in notation, from here the proof of the equilibrium result is the same as that under the full information case provided in Appendix A, and thus is omitted to avoid repetition. Q.E.D.

Online Appendix: Instructions for Experiments

Condition 1 - Baseline

You are about to participate in a decision-making experiment in which you will earn money based on your own decisions and the decisions of others. If you follow the instructions carefully and make good decisions, you could earn a considerable amount of money. Earnings from the game are measured in pesos and will be converted to dollars and paid to you in cash at the end of the study. It is important that you do not look at the decisions of others, and that you do not talk, laugh, or make noises during the experiment. If you have any questions, please raise your hand.

The Game

In today's experiment, there are two different roles: the **Proposer** and the **Responder**. At the beginning of the game, you will be randomly assigned to play one of the roles. The experiment involves **2** decision rounds, in which the role assigned to each player will be kept the same. In every round, one Proposer and one Responder will be paired to determine how to divide a pool of 100 pesos between them. The computer controls the random matching so that pairings will change from round to round. You will not be able to identify who is your opponent.

Probability Condition:

In this game, it is possible for Responders to have an option to reject offers by Proposers. The probability (p) for a Responder to have such an option is either **0.1** or **0.9**. At the beginning of each round, the computer will randomly assign this probability to all Responders. The Responder who obtains $p = 0.1$ will be labeled as **Responder A (p=0.1)**; the Responder who obtains $p = 0.9$ will be labeled as **Responder B (p=0.9)**.

In each round, the Proposer will have an *equal* chance to be matched with either a Responder A or a Responder B. The Proposer will know whether he/she is playing with a Responder A or B before making any offers.

Note that it is very important for Proposers and Responders to first identify their probability conditions before making any decisions.

Proposer Decision:

For a Proposer, the decision task is to determine how much out of **100** pesos to offer to the Responder. The *offer* can be any integer number from 0 to 100. If an offer is accepted, the Responder will get the amount proposed and the Proposer will keep the rest of the pool. For example, if an offer is 20 pesos and the Responder accepts it, the Proposer will get 80 pesos and the Responder will get 20 pesos.

Responder Decision:

For the Responder (both A and B), the decision is to indicate the *minimum* amount (out of the pool) that he/she is willing to accept, which is referred as *threshold* in the game. The threshold can be any integer number from 0 to 100. For example, if a threshold of 30 is indicated, it means that the Responder will reject any offer below 30 pesos (out of the 100 pesos) if she/he is granted the option to reject by the computer. In case a rejection occurs, both players will get 0.

You will make your decision (*offer* as the Proposer, or *threshold* as the Responder A/B) without seeing the other player's decision. After all players input their decisions in a round, the computer will allocate the option to reject to Responders according to their probability conditions i.e., a Responder A will have a 10% chance while a Responder B will have a 90% chance to be able to reject. The final distribution of the 100 pesos in a round between the two players is determined as follows.

Final Outcomes

- If the computer does not give the Responder the option to reject, the pool is divided according to the Proposer's *offer*.

In the above example, the Proposer would get 80 pesos and the Responder would get 20 pesos.

- If the computer does give the Responder the option to reject,
 - If the *offer* by the Proposer \geq the *threshold* by the Responder, the Responder *accepts* the *offer* by the Proposer, and the pool is divided according to the Proposer's *offer*.
 - If the *offer* by the Proposer $<$ the *threshold* by the Responder, the Responder *rejects* the offer, and both players get 0.

In the above example, since the *threshold* (30 pesos) is greater than the *offer* (20 pesos), the Responder would then reject the offer and both players would get 0 for the round.

After all players are done with their decisions for the first round, the game will move on to the next round for you to repeat the task. At the end of the second round, a feedback screen that summarizes the game results for both rounds will be shown to all players. The computer will display, for each round, the offer made by the Proposer and the threshold indicated by the Responder A/B, whether or not the Responder **accepted**, **rejected** the offer or has **no option** to reject, and the final division of the pool between the two parties. After reviewing the results, you will be asked to work on a questionnaire. At the end of the survey, the computer will display your final payoffs in dollars, converted from the total game earnings.

The following tables illustrate, from a Proposer’s point of view, possible outcomes given different matching and allocation of the option to reject by the computer.

Round #	Decisions	Realization of Option to Reject	Final Outcomes
Proposer (You)	Offer: 20	N/A	0
Responder B (Other Player) - $p = 0.9$	Threshold: 30	Rejected	0

Round #	Decisions	Realization of Option to Reject	Final Outcomes
Proposer (You)	Offer: 20	N/A	80
Responder A (Other Player) - $p = 0.1$	Threshold: 30	No Option	20

Condition 4 - Asymmetric Information with Experience

You are about to participate in a decision-making experiment, in which you will earn money based on your own decisions and decisions of others. If you follow the instructions carefully and make good decisions, you could earn a considerable amount of money. Earnings from the game are measured in pesos and will be converted to dollars and paid to you in cash at the end of the study. It is important that you do not look at the decisions of

others, and that you do not talk, laugh, or make noises during the experiment. If you have any questions please raise your hand.

The Game

In today's experiment, there are two possible roles for you to play: the **Proposer** and the **Responder**. The experiment involves 8 trial rounds and 2 paid rounds. In every round, one Proposer and one Responder will be paired to determine how to divide a pool of 100 pesos between them. The computer controls the random matching so that pairings will change from round to round. You will not be able to identify who is your opponent in the game.

In the trial rounds, you will learn about the game by making several decisions in the role of both Proposer and Responder. At the end of each trial round you will be given feedback on your actions as well as the actions of your opponent. Your decisions in the trial rounds will NOT impact your earnings in the experiment. In the paid rounds, the role assigned to each player will be kept the same and results will be shown only at the end of the last paid round. Your earnings from the 2 paid rounds will be accumulated and converted into cash as your final payment from the experiment. A screen will inform you when you are entering the paid rounds.

Proposer Decision:

For a Proposer, the decision task is to determine how much out of **100** pesos to offer to the Responder. The *offer* can be any integer number from 0 to 100. If an offer is accepted, the Responder will get the amount proposed and the Proposer will keep the rest of the pool. For example, if an offer is 20 pesos and the Responder accepts it, the Proposer will get 80 pesos and the Responder will get 20 pesos.

Probability Condition:

In this game, it is possible for Responders to have an option to reject offers by Proposers. The probability (p) for a Responder to have such an option is either **0.1** or **0.9**. At the beginning of each round, the computer will randomly assign this probability to all Responders. The Responder who obtains $p = 0.1$ will be labeled as **Responder A (p=0.1)**; the Responder who obtains $p = 0.9$ will be labeled as **Responder B (p=0.9)**.

In each round, the Proposer will have an *equal* chance to be matched with either a Responder A or a Responder B. The Proposer will NOT know whether he/she is playing with a Responder A or B before making any offers.

Responder Decision:

For the Responder (both A and B), the decision is to indicate the *minimum* amount (out of the pool) that he/she is willing to accept, which is referred as *threshold* in the game. The threshold can be any integer number from 0 to 100. For example, if a threshold of 30 is indicated, it means that the Responder will reject any offer below 30 pesos (out of the 100 pesos) if she/he is granted the option to reject by the computer. In case a rejection occurs, both players will get 0.

You will make your decision (*offer* as the Proposer, or *threshold* as the Responder A/B) without seeing the other player's decision. After all players input their decisions in a round, the computer will allocate the option to reject to Responders according to their probability conditions, i.e., a Responder A will have a 10% chance while a Responder B will have a 90% chance to be able to reject. The final distribution of the 100 pesos in a round between the two players is determined as follows.

Final Outcomes

- If the computer does not give the Responder the option to reject, the pool is divided according to the Proposer's *offer*.

In the above example, the Proposer would get 80 pesos, and the Responder would get 20 pesos.

- If the computer does give the Responder the option to reject,
 - If the *offer* by the Proposer \geq the *threshold* by the Responder, the Responder *accepts* the *offer* by the Proposer, and the pool is divided according to the Proposer's *offer*.
 - If the *offer* by the Proposer $<$ the *threshold* by the Responder, the Responder *rejects* the offer, and both players get 0.

In the above example, since the *threshold* (30 pesos) is greater than the *offer* (20 pesos), the Responder would then reject the offer and both players would get 0 for the round.

Before making any decisions in a round, it is very important for all players to first identify the role assigned to you and the associated probability condition. After all players are done with their decisions in a round, the game will move on to the next round. At the end of each trial round and the end of the last paid round, you will see a feedback screen that summarizes the results. The computer will display the offer made by the Proposer, the threshold indicated by the Responder A/B, whether or not the Responder **accepted**, **rejected** the offer or has **no option** to reject, and the final division of the pool between the two parties. After reviewing the results from the paid periods, you will be asked to work on a questionnaire. Upon completion of the survey, you will find out your final payoffs in dollars.

The following tables illustrate, from a Proposer's point of view, possible outcomes given different matching and allocation of the option to reject by the computer.

Round #	Decisions	Realization of Option to Reject	Final Outcomes
Proposer (You)	Offer: 20	N/A	0
Responder B (Other Player) - $p = 0.9$	Threshold: 30	Rejected	0

Round #	Decisions	Realization of Option to Reject	Final Outcomes
Proposer (You)	Offer: 20	N/A	80
Responder A (Other Player) - $p = 0.1$	Threshold: 30	No Option	20