



# On the influence of hard leverage in a soft leverage bargaining game: The importance of credible claims



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## ABSTRACT

What makes a bargaining proposal credible? We study how hard leverage (binding commitment) influences soft leverage (appealing to a focal point) in a rich-context bargaining game known to exhibit competing claims to focality. In three treatments, our experiment varies one bargainer's ability to commit, holding the soft leverage condition fixed. As in previous studies, we observe that opening offers are consistent with the available soft leverage. The influence of hard leverage is most evident in the concessionary stage. Hard and soft leverage interact to influence outcomes: Hard leverage advantages its holder, yet settlements largely stay between the two focal points. We posit that focal points induce mutual expectations of bargainer social preferences that, when combined with the Nash bargaining solution, imply the comparative statics concerning the settlements observed. A similarly modified version of the Zeuthen–Harsanyi model of the bargaining process, agrees with the comparative statics on opening offers and concessions.

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*[E]ach party will make a concession at a given stage of the negotiation if and only if he thinks he has at least as much "reason" as his opponent has to yield ground at that point.*

[John C. Harsanyi (1956)]

*[I]t often looks like the ultimate focus of agreement did not just reflect the balance of bargainer power but provided bargaining advantage to one side or the other. . . . One has to have a reason for standing firmly on a position.*

[Thomas C. Schelling (1960)]

## 1. Introduction

What makes a bargaining proposal credible? Where will a bargainer make a stand and where will he back down? Both Harsanyi and Schelling argued that the answer has to do with reasons. Harsanyi argued that the reasons could be deduced from the mathematical game form and bargainer rationality. From this view, we derive *hard leverage* strategies for establishing credibility, strategies such as binding commitments. Schelling argued that focal points – context specific variables extraneous to the mathematical definition of the game form – can provide bargaining advantage as well. Focal points shaped by “analogy, precedent . . . and who the parties are and what they know about each other” among other

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variables (Schelling, p. 57).<sup>1</sup> Focal points give rise to *soft leverage* strategies for establishing credibility, soft in the sense that they rely on *mutual* perceptions to coordinate bargainer expectations.<sup>2</sup>

In the economics literature, hard and soft leverage live largely separate lives. Soft leverage strategies have been investigated mostly in bargaining games with symmetric strategy spaces (ex., Roth, 1995).<sup>3</sup> Hard leverage strategies play the central role in asymmetric bargaining games, particularly those where commitment power is distributed unequally (ex., Tadelis, 2013, chapter 11). One reason to wonder whether this division of labor characterizes the entire relationship hard and soft leverage share is that many if not most asymmetric bargaining encounters take place in a rich context. A ‘rich context’ is one that admits appeal to analogy, precedent, etc. In a rich context, even if one side in the negotiation has a hard leverage advantage, bargainers can find grist to fashion soft leverage strategies as well.

In fact, a rich context typically admits competing claims to focality. To give an example that will be relevant here, one bargainer might argue for a 50–50 split while another might argue for an asymmetric split based on precedent. Studies suggest that competing focal points can act to coordinate expectations. In assessing a series of bargaining experiments conducted with colleagues, Roth (1985) conjectured that, “[The] bargainers sought to identify initial bargaining positions that had some special reason for being credible, and that these credible bargaining positions then served as *focal points* that influenced the subsequent conduct of negotiations.” Some of the games ended in a settlement at one or the other focal point, while other settlements appeared as compromises between focal points. Gächter and Riedl (2005) studying a rich context bargaining game using a novel experimental design, found that most observed settlements appear as compromises between focal claims. Gächter and Riedl (2006) found that varying the asymmetric focal point leads to a shift in the distribution of settlements.

The major goal of our experiment is to generate data that informs us of what a theory that accounts for both soft and hard leverage need explain. We fashion our guiding hypotheses from the robust patterns of behavior previously observed in symmetric and asymmetric bargaining game experiments. The baseline treatment is a symmetric bargaining game. Bargainers are given a fixed amount of time to communicate and reach a mutual agreement in a free form setting. We then create an asymmetric bargaining game by giving the high performer the option, which he can exercise at his discretion during the bargaining, to make a final offer that cannot be revoked (hence the high performer has full commitment power). A third treatment then draws the bargaining game closer to one that is fully asymmetric: The high performer is restricted to a final offer that the low performer must either accept or reject, with no further communication, eliminating the ability of the lower performer to ask for concessions. We examine how treatment manipulations affect both settlements and the process of the negotiations. To more fully gauge the coordinating influence of the focal points and commitment option, we ask bargainers prior to bargaining, what they think a neutral arbitrator would judge to be a fair settlement.

From the data, the observed influence of hard leverage on soft leverage runs as follows: The critical influence of soft leverage is on fairness judgments and on the opening offers made by bargainers. The influence of hard leverage is found in concession behavior. A bargainer facing a bargainer with the final offer option is the one more likely to bend in the concession process. Hard leverage holders do best in the final offer treatment (with modal offers and rejection rates below those in a typical ultimatum game).

None of our original hypotheses provides a totally satisfactory explanation for what we observe. Instead, we propose a simple model in which focal points induce mutual expectations of the social preferences of the bargainers. These social preferences are a generalization of those used to explain bargaining outcomes in low context bargaining games. Modifying the Nash bargaining solution (Nash, 1950) to reflect these preferences implies the comparative statics we observe regarding settlements. Modifying the Zeuthen–Harsanyi bargaining model (closely associated with the Nash solution in the literature) in a similar manner implies the comparative statics we observe with regard to opening offers and concessions.

To the best of our knowledge, our work is the first to study both hard and soft leverage in rich context bargaining. Our work complements other recent studies of the influences on bargaining settlements. Birkeland (2013), in a bargaining game with production and arbitration, shows that settlements can be approximated by the modal focal outcomes bargainers attribute to the arbitrator pool. Anbarci and Feltovich (2013, 2014) study behavior in bargaining games that differ by disagreement outcomes; and find that settlements are substantially less sensitive to the level of disagreement payoffs than standard theory suggests. Our results share a similar flavor in that we find that hard leverage is less effective than one would expect. Rode and Le Menestrel (2011), using dictator and repeated Nash demand games, find that distribution of power influences both fairness judgments and distributive decisions.

The organization of the paper is as follows: Section 2 describes the experimental design and hypotheses. Section 3 reports the results. Section 4 presents the modified Zeuthen–Harsanyi model and discusses how it fits with our results. Section 5 presents concluding remarks.

<sup>1</sup> In the negotiation literature (ex., Fisher et al., 2011), common focal points include market value, ethical standards, scientific judgment, professional codes, efficiency, cost, legal precedent, tradition, reciprocity and fair procedures.

<sup>2</sup> See Innocenti (2008) for a historical account of Harsanyi’s and Schelling’s contrasting views on bargaining.

<sup>3</sup> Focal points are also central to the study of tacit bargaining; ex., Isoni et al. (2013) and Embrey et al. (2014). Here we focus on direct (or explicit) bargaining; ex., Isoni et al. (2014).

## 2. Experimental design and hypotheses

The experiment is designed to gauge the influence of hard leverage on soft leverage through the phases of the negotiation process.

### 2.1. Experimental design

Following Gächter and Riedl (2005), we create a bargaining environment with two competing claims to focality: the 75–25 split based on precedent; and the 50–50 split.<sup>4,5</sup> At the beginning of the experiment, each subject is informed that she is one of two department heads working for a (hypothetical) company. In the past, a salary budget of 4480 points was divided between department heads. High and low performing department heads received, respectively, 3360 and 1120 points: a 75–25 split. Now, due to the economic downturn, the salary budget will be smaller, taking one of three values depending on the joint performance of the two department heads in a real effort task.<sup>6</sup> Another difference from previous years is that top management will not dictate a salary distribution. Instead, the two department heads will negotiate the distribution. The negotiation procedure is varied over three treatments:

- **Treatment 1 ( $T_1$ ) Soft Leverage**
  - Unstructured bargaining.
  - Maximum 10 minutes.
  - In case of a disagreement, both subjects receive zero points.
  - Communication through written verbal messages is allowed.
- **Treatment 2 ( $T_2$ ) Combined Leverage**
  - Treatment 1 plus:
  - The high-performing department head is granted the option to make an ultimatum proposal at any point in time within 10 minutes.<sup>7</sup>
  - Once and if the high-performing department head exercises the ultimatum proposal option, there is no turning back to the unstructured bargaining.
  - In case the low-performing department head rejects the ultimatum proposal, both subjects receive zero points.
  - Communication through written verbal messages is allowed in the unstructured bargaining phase but not in the ultimatum phase.
- **Treatment 3 ( $T_3$ ) Hard Leverage**
  - Ultimatum bargaining.
  - The high-performing department head is granted the “proposer” role.
  - In case the low-performing department head accepts the other’s proposal, they each receive their corresponding shares.
  - In case of a rejection, both subjects receive zero points.
  - Communication is not allowed.<sup>8</sup>

Table 1 summarizes the main elements of the experiment in the sequence they were presented to the subjects. Below, we explain each part in detail.

*Performance and outcome determination.* After reading instructions aloud, department heads’ performances are determined by a general knowledge quiz (Hoffman et al., 1994; Gächter and Riedl, 2005; Karagözoğlu and Riedl, 2015). The quiz consists of 36 multiple choice questions taken from fields of knowledge such as politics, music, arts, religion, astronomy, geography. Each question has five possible answers, and exactly one is correct (unanswered questions are scored incorrect). Each par-

<sup>4</sup> See Güth and Tietz (1986), Hoffman and Spitzer (1985), Hoffman et al. (1994), Gantner et al. (2001), Cherry et al. (2002), and Gächter and Riedl (2005) for related methods of creating asymmetric focal points in bargaining and distribution games.

<sup>5</sup> The focal points in our study are payoff relevant. See the conclusion section for discussion of the applicability of our findings when focal points are payoff irrelevant.

<sup>6</sup> We chose salary budgets that are lower than what was available in the past to create a conflicting claims environment. Historical claims (i.e., 3360 and 1120) are not feasible under any of the possible budget levels.

<sup>7</sup> To be as neutral as possible, this option is labeled as “final proposal option”, not as “ultimatum proposal option” in the experimental instructions. Moreover, we use the ultimatum game to vary the hard leverage across treatments since using the dictator game would practically turn the whole game in  $T_2$  to a dictator game and using the alternating offers bargaining game would unnecessarily add more complexity without bringing much advantage (e.g., alternating offers bargaining games exhibit results consistent with ultimatum game with regard to social preferences (see Bolton, 1991; Roth, 1995; De Bruyn and Bolton, 2008)).

<sup>8</sup> We stick to the standard ultimatum game setup in  $T_3$  to have a completely asymmetric, hard-leverage bargaining game, and so no communication. This comes with a cost: moving from  $T_2$  to  $T_3$  two things change, elimination of communication and shift in bargaining protocol.

**Table 1**  
Sequence of events.

1.	Reading of instructions
2.	Performance determination
3.	Outcome determination
4.	Elicitation of beliefs on performances
5.	Relative performance information
6.	Fairness judgments
7.	Bargaining
8.	Post-experimental questionnaire

participant receives the same set of questions in the same order and has 20 seconds to answer each question. All of this is common knowledge.<sup>9</sup>

The size of the salary budget is determined by the joint performance of department heads in a pair and explained to the subjects in the following way:

- If the total number of correct answers in a pair is from 0 to 24, then the salary budget will be 1510 points.
- If the total number of correct answers in a pair is from 25 to 48, then the salary budget will be 2420 points.
- If the total number of correct answers in a pair is from 49 to 72, then the salary budget will be 3510 points.

In the experiment, 100 points are worth US\$0.75. The medium salary budget of 2420 points then corresponds to roughly \$32.

*Elicitation of beliefs on performances.* We ask each subject to report her beliefs about her own number of correct answers as well as her beliefs about the number of correct answers of the other department head. These belief elicitation are incentivized: for each estimation with 0/1/2 error(s), a subject earns 100/50/25 points; estimates with larger errors earn no points.

*Relative performance information.* Once the real effort task is complete, each subject is told who in her pair was the 'high performer' or 'low performer', depending on the number of correct answers given on the general knowledge quiz. In case of a tie, high and low performer titles are determined at random. To keep things simple, we did not provide exact task scores to the subjects. Earlier studies show that the information provided is enough to significantly influence subjects' bargaining behavior (ex., Gächter and Riedl, 2005, 2006; Karagözoğlu and Riedl, 2015; Karagözoğlu and Kocher, 2015).

*Fairness judgments.* We asked bargainers to report what they thought an impartial arbitrator would judge to be a 'fair' distribution of salary budget using a question, adapted from Babcock et al. (1995): "According to your opinion, what would be a 'fair' distribution of the salary budget from the vantage point of a non-involved **neutral** arbitrator?" What we seek to gauge is how fairness judgments change with the negotiating environment and to what extent the actions and settlements taken reflect these perceptions. Subjects' fairness judgments are reported privately to avoid any strategic value the reporting might have. Gächter and Riedl (2005) compare asking for fairness judgments before and after role specific information (e.g., high vs. low performer information) and find no difference. Franco-Watkins et al. (2013) also find that asking about fairness judgments did not influence bargaining behavior. There is overwhelming evidence that bargaining subjects think about what is fair even absent asking (ex., Güth et al., 1982; Kahneman et al., 1986; Fehr and Schmidt, 2006, essays in Bolton and Croson, 2012).

*Bargaining.* In  $T_1$  and  $T_2$ , bargaining is (almost) unstructured. Unstructured bargaining avoids exogenous first-mover effects and gives subjects as much bargaining freedom as possible (e.g., in the timing, sequence, number of proposals, and communication etc.). Subjects exchange proposals that consist of an amount for themselves and an amount for the other department head. A subject can send one verbal message per proposal (eliminates confusion about which proposal is being discussed).<sup>10</sup> If subjects reach an agreement within the allotted 10 minutes, payoffs are awarded accordingly. If they do not, each earns zero points. In  $T_2$  the high performer has the option, exercisable at any time in the 10 minutes, to convert the bargaining to an ultimatum game (conversion is irrevocable). Once exercised, the high performer makes a final proposal that the low performer must either accept or reject. If he accepts, both get their corresponding shares; if he rejects both get zero. In  $T_3$ , subjects play the ultimatum game (high performer is the proposer). To isolate the influence of concession behavior, no verbal communication is allowed in  $T_2$  or  $T_3$  ultimatum games.

<sup>9</sup> See Karagözoğlu (2012) for a survey of bargaining and distribution games with joint production. See Birkeland (2013), Gantner and Kerschbamer (2016), Gantner et al. (2013), Luhan et al. (2013), Anbarcı and Feltovich (2014), and Fischbacher et al. (2014) for some recent examples.

<sup>10</sup> See Appendix A for a detailed analysis of chat messages.

*Post-experimental questionnaire.* After the experiment, subjects are asked to report their (i) level of satisfaction with the bargaining outcome, (ii) opinion about the legitimacy of the quiz as a measure of general knowledge, (iii) perceived fairness of the bargaining procedure, and (iv) explanations for their bargaining behavior. They are also presented the Machiavelli personality test (MACH IV scale of [Christie, 1970](#)) to measure personality dimensions such as toughness, self-orientation, competitiveness, etc. that could be important in bargaining, and a risk attitude questionnaire ([Dohmen et al., 2011](#)). Finally, subjects answer questions about their personal background. We report on all of these individual characteristics in [Appendix A](#).

The experiment was computerized and programmed in z-Tree ([Fischbacher, 2007](#)). We conducted the experiment in LEMA (Laboratory for Economics, Management, and Auctions) at The Pennsylvania State University. In total 172 subjects participated in seven randomized experimental sessions. We had 29 pairs for  $T_1$ , 29 pairs for  $T_2$  and 28 pairs for  $T_3$ . Most of our subjects were undergraduates in economics, management, accounting, marketing, supply chain management, and finance. A typical session lasted 60–75 minutes (depending on the treatment). The average earnings per subject were approximately \$22.70 (including a show-up fee of \$5).

## 2.2. Hypotheses

Let  $Agree_{High}(T_j)$  be the average agreed share the high performing bargainer receives in Treatment  $j$ . We study three simple benchmark hypotheses on how hard and soft leverage may influence settlements. Each is motivated by the existing literature on either soft or hard leverage.

*Soft leverage hypothesis (null).* Bargaining advantage is determined by the soft leverage in the bargaining environment. In a design similar to  $T_1$ , [Gächter and Riedl \(2006\)](#) demonstrate that the induced focal point has clear effects on settlements in symmetric bargaining. Under the null hypothesis this pattern extends to all three treatments:

$$0.50 < Agree_{High}(T_1) = Agree_{High}(T_2) = Agree_{High}(T_3) < 0.75.$$

What we know of hard leverage from studies of asymmetric bargaining games does not speak directly to what will happen in symmetric games. For this reason, the hard leverage hypotheses we consider are confined to predictions for  $T_2$  and  $T_3$ . The hypotheses don't make any distinction between  $T_2$  and  $T_3$  since hard leverage is equally available to the high performer in both.

*Hard leverage hypothesis 1.* The hard leverage advantage is equivalent to that of the first mover in the standard ultimatum game. In the standard ultimatum game, the average settlement has first movers receiving an average somewhat more than 50%, up to 60% of the pie ([Roth, 1995](#)).

$$0.50 \leq Agree_{High}(T_2) = Agree_{High}(T_3) \leq 0.60.$$

The 0.60 cutoff is an approximation but we think a defensible one; for example, in a widely cited study, [Roth et al. \(1991\)](#), for proposers in a \$10 ultimatum game, the modal (and most generous) offer was typically 50–50 with an average offer of 61–39 split in their favor with a 27% rejection rate (lower offers to responder being more likely rejected). So settlements were in the range of the hypothesis (also see [Slonim and Roth, 1998](#)).<sup>11</sup>

*Hard leverage hypothesis 2.* Hard leverage enables the high performer to obtain 75% or more of the pie. The high performer in our experiment earned his role. [List and Cherry \(2000\)](#), studying an ultimatum game where the pie is fully produced by the proposer, report a higher number of asymmetric offers than is typical in a standard ultimatum game. The average demand was roughly 68%, with 27% of all offers demanding more than 75%. Rejection rates, however, were substantial, with demands of more than 50% rejected at an average rate of 31% to 44% depending on the treatment (rejection rates increased as offers decreased).<sup>12</sup> These figures suggest average settlements substantially less asymmetric than 75–25; in fact, the modal settlement in the experiment was 50–50. The hard leverage hypothesis 2 conjecture is that the context of the present experiment – inducing a focal point at 75–25 – lends 75–25 a legitimacy not found in the earlier ultimatum game experiments.

$$Agree_{High}(T_2) = Agree_{High}(T_3) \geq 0.75.$$

We use these hypotheses as guideposts for our investigation.

<sup>11</sup> Statistics cited are averaged over 4 treatments. There were some statistically significant differences in play across the treatments but the differences were rather small in economic terms; see [De Bruyn and Bolton \(2008\)](#). Roth et al. also conducted \$30 ultimatum game and found similar results to the \$10 games.

<sup>12</sup> See [Garcia-Gallego et al. \(2008\)](#) for similar results in an experiment where responders in the ultimatum game work on a real effort task.

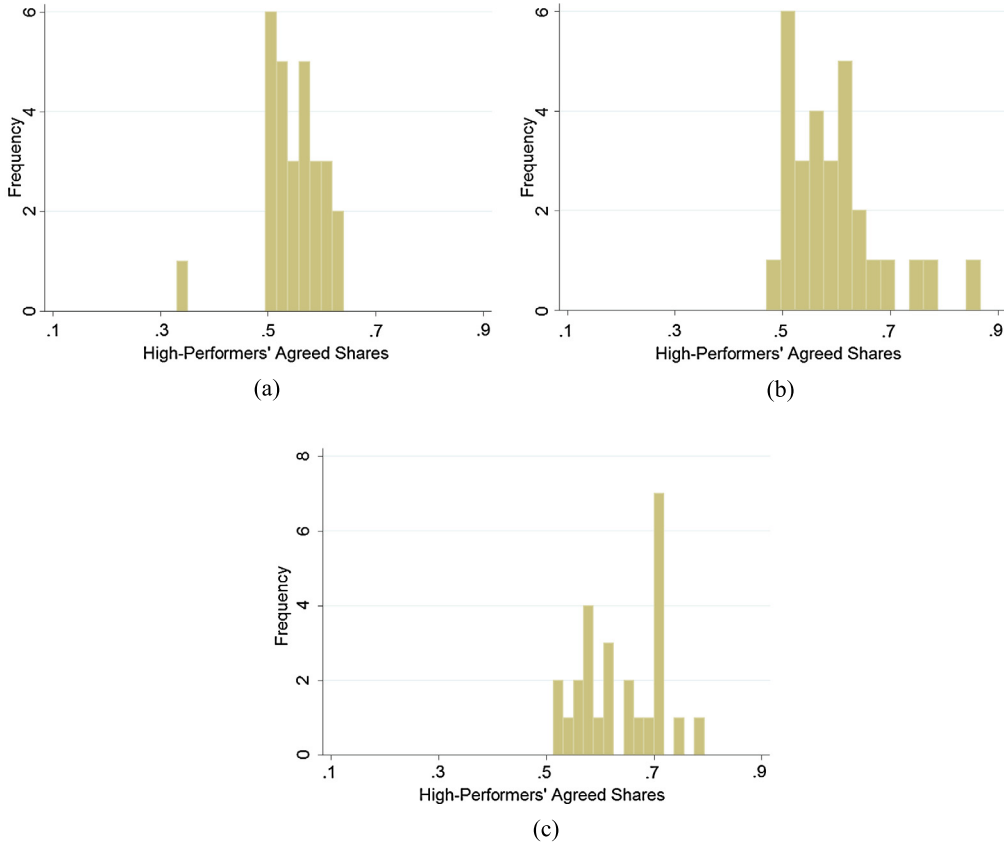


Fig. 1. (a) Agreements in T<sub>1</sub>. (b) Agreements in T<sub>2</sub>. (c) Agreements in T<sub>3</sub>.

### 3. Results

In this section we review results on settlements, fairness judgments, opening offers, and concession behavior. The investigation will lead us to a set of observed regularities which we check against the hypotheses we began with. Throughout, we express settlements in terms of shares to the high-performers and use nonparametric tests.<sup>13</sup> In the tables, we report averages and standard deviations (in parentheses).

The overall average number of correct quiz answers was 20.9 out of a possible 36. High-performers (low-performers) averaged 23.8 (18.0) correct. In estimating their own (bargaining partner's) number of correct answers, subjects' average estimation mistake was 1.77 (1.12). Moreover, subjects' beliefs were in line with their actual relative performances: the average high-performer predicted that he had more correct answers than his partner and the average low-performer predicted that he had less correct answers than his partner. Answers to debriefing questions show that subjects perceived the quiz as a legitimate measure of general knowledge.<sup>14</sup> Answers also show that granting the right to exercise an ultimatum option to the high performing department head in T<sub>2</sub> was judged legitimate.<sup>15</sup> The three budget levels 1560, 2420, and 3510 occurred 2, 70, and 14 times, respectively. There are no significant differences in variables of interest across different budget levels. Hence, we pool all salary budgets together in our analyses.

#### 3.1. Settlements and comparison with the three hypotheses

To start with, disagreement rates in our experiment were low. One bargaining game ended in disagreement in T<sub>1</sub> (3.4%), none in T<sub>2</sub> (0%), and two in T<sub>3</sub> (7.0%). We return to the disagreement rates below.

<sup>13</sup> We check for treatment effects on averages and distributions using Mann–Whitney and Kolmogorov–Smirnov tests respectively. We report only the Mann–Whitney test results when both tests give significant results.

<sup>14</sup> On a 7-point Likert scale where “7 = agree very much”, average (median) degree of agreement with the statement “In my view the knowledge questions have been difficult” is 4.5 (5). Average (median) degree of agreement with the statement “The one with the better general knowledge is able to answer more questions correctly” is 5.58 (6).

<sup>15</sup> 25 out of 29 high-performers and 19 out of 29 low-performers in T<sub>2</sub> found it perfectly fair and legitimate.

**Table 2**  
Average agreed shares for high-performers.

T <sub>1</sub>	T <sub>2</sub> <sup>a</sup>	T <sub>3</sub>
0.55 (0.06)	0.60 (0.09)	0.64 (0.08)

<sup>a</sup> The average agreed share of high performers in the three pairs where the final offer option is exercised is 0.69. In the remaining pairs, it is 0.58. Finally, high performers' expected payoffs across T<sub>2</sub> and T<sub>3</sub> (i.e., factoring in rejections/disagreements) are identical.

With regard to settlements: Figs. 1(a), (b), and (c) show the distribution of high-performers' agreed shares for each treatment. The distributions differ substantially and systematically: With one exception, T<sub>1</sub> settlements range from 50–50 to about 60–40, with peaks that roughly correspond to the two ends of the range. For T<sub>2</sub>, there is still a peak at 50–50 but now the range has widened to include 75–25 with less clustering at 60–40. Only three high-performers exercised the final offer option in T<sub>2</sub> (corresponding proposals were 0.63, 0.70, and 0.74). T<sub>3</sub> shows a further shift to the right; now there is a new peak at 70–30, the 60–40 peak remains but the 50–50 peak is gone.

Average settlements, reported in Table 2, show the rise in average agreed share across treatments, conditional on agreement (results are qualitatively the same if we include disagreements).<sup>16</sup> The Kruskal–Wallis test strongly rejects the hypothesis that agreed shares are identical across treatments ( $p = 0.0004$ ). Pairwise test results are also along the same lines:  $Agree_{High}(T_1)$  is significantly less than  $Agree_{High}(T_2)$  (one-sided,  $p = 0.0438$ ) and  $Agree_{High}(T_2)$  is significantly less than  $Agree_{High}(T_3)$  (one-sided,  $p = 0.0136$ ).

The shift in average settlements across treatments clearly rejects the soft leverage hypothesis. That said, the hypothesis does get the range of settlements correct. In particular, no single focal point makes a satisfactory account of the data:  $Agree_{High}(T_1) = 0.55$  is significantly different from 0.5 (Wilcoxon signed-rank test, two-sided,  $p = 0.0002$ ) and  $Agree_{High}(T_3) = 0.64$  is significantly different from 0.75 (Wilcoxon signed-rank test, two-sided,  $p < 0.0001$ ). Below, we will see that certain features of the negotiation process are also fixed across treatments as the soft leverage hypothesis would lead us to expect.

Hard leverage hypothesis 1 (based on standard ultimatum game behavior) anticipates the clustering in settlements observed near 50–50 in T<sub>2</sub> and (may be less so) in T<sub>3</sub>. But average settlements are higher than anticipated with a significant number of settlements above 60–40 so that the distributions of settlements is not skewed towards 50–50 as is common in standard ultimatum games (Güth and Kocher, 2014). It is clear, particularly from the T<sub>3</sub> distribution, that 75–25 settlements have a viability the hypothesis does not anticipate.

The hard leverage 2 hypothesis does anticipate the acceptability of a 75–25 offer. But actual average offers (and settlements) are lower than 75%. Moreover, the 50–50 focal point still appears relevant to explaining settlements, particularly for T<sub>2</sub>. Other patterns differ substantially from the ultimatum game evidence that the hypothesis is based on (see section 2.2). The rejection rates of 0% and 7% observed in T<sub>2</sub> and T<sub>3</sub>, respectively, are far lower than the 31% to 44% rates reported by List and Cherry (2000) ultimatum game experiment with joint production and earned roles. Also, there is only one demand in T<sub>3</sub> (3.5%) above 75% versus 27% in List and Cherry (their experiment did not induce an asymmetric focal point).

Observe that neither of the hard leverage hypotheses predicts the difference in average agreements across T<sub>2</sub> and T<sub>3</sub>. One hypothesis is that the difference has to do with the potential to induce concession behavior (communication). This can explain why hard leverage is more effective in the final offer treatment than in the interaction treatment. But it cannot explain the influence of hard leverage when moving from T<sub>1</sub> and T<sub>2</sub>, since communication is held constant. Likewise, the fact that the final offer mechanism is optional can explain the differences between T<sub>2</sub> and T<sub>3</sub> but does not explain much about the other settlement regularities we observe.

To summarize, none of the hypotheses provide a clean explanation for the shifts we observe in settlements across treatments. To better understand the pattern of settlements, we next investigate behavior during the process of negotiation.

### 3.2. Fairness judgments

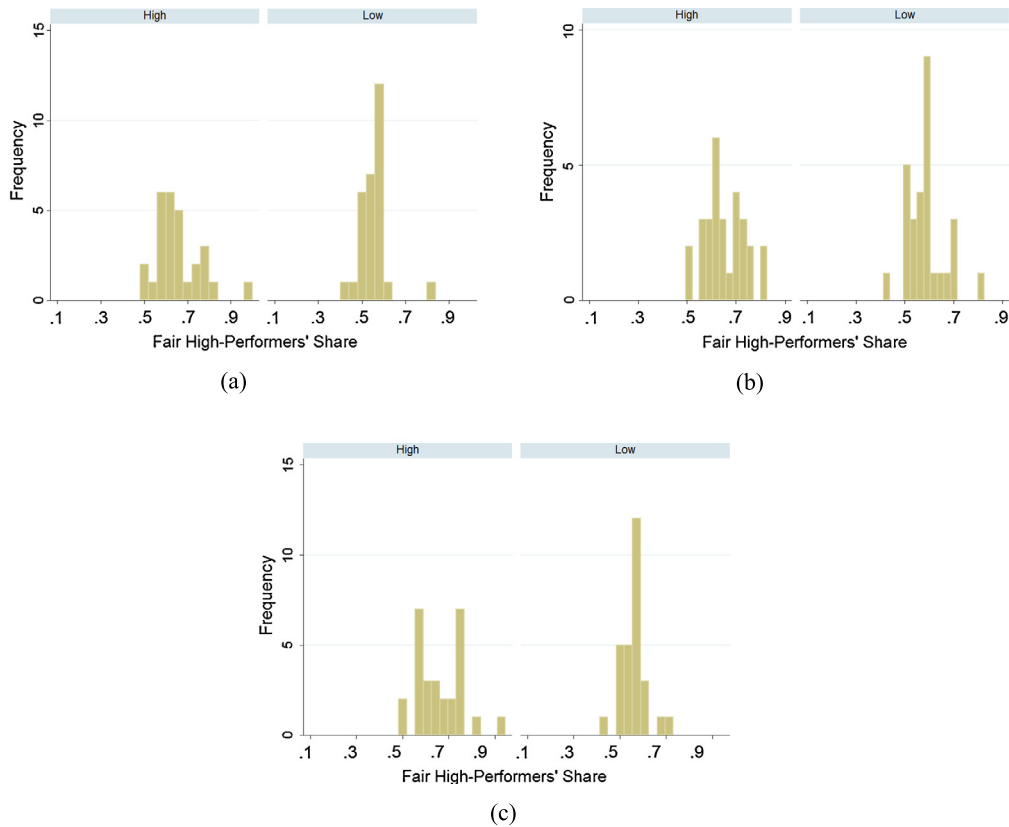
After producing the bargaining pie but prior to negotiating we asked bargainers to report what they thought an impartial arbitrator would judge to be a 'fair' distribution of the salary budget. The resulting data sheds light on how and to what extent the competing focal points shape bargainers' expectations of a bargaining settlement. Table 3 shows average fairness judgments of high and low-performers in all three treatments.

One of the robust findings on fairness judgments in bargaining is that they exhibit a self-serving (egocentric) bias (Messick and Sentis, 1979; Bazerman, 1985; Babcock et al., 1995; Babcock and Loewenstein, 1997; Gächter and Riedl, 2005, and Karagözoğlu and Riedl, 2015). Our data exhibits self-serving biases as well. Writing the average fairness judgment of

<sup>16</sup> Median agreed shares for high-performers are similar: 0.55 in T<sub>1</sub>, 0.58 in T<sub>2</sub>, and 0.62 in T<sub>3</sub>.

**Table 3**  
Average fairness judgments of high and low performers.

	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>
High-performers	0.65 (0.13)	0.66 (0.09)	0.67 (0.10)
Low-performers	0.56 (0.07)	0.59 (0.08)	0.57 (0.06)



**Fig. 2.** (a) Fairness judgments in T<sub>1</sub>. (b) Fairness judgments in T<sub>2</sub>. (c) Fairness judgments in T<sub>3</sub>.

bargainer *i* in Treatment *j* as  $Fair_i(T_j)$ ,  $Fair_{high}(T_j) > Fair_{low}(T_j)$  (two-sided,  $p < 0.0025$  for all  $j = 1, 2, 3$  Mann–Whitney test).

From Fig. 2, observe that the focal points largely bound the self-serving bias in settlement expectations. Only 5 out of 86 low performers' fairness judgments are lower than 50% and only 2 are above 75%. Only 11 out of 86 high performers' fairness judgments are higher than 75% and none are below 50%. Also observe that the majority of both low and high performers report judgments that imply high performers should get more than low performers<sup>17</sup>; in fact, Wilcoxon signed-rank tests show that  $Fair_{high}(T_j) > 1/2$  and  $Fair_{low}(T_j) > 1/2$  for all,  $j = 1, 2, 3$  (two-sided, for high-performers all  $p < 0.0001$ ; and for low-performers all  $p < 0.0003$ ).<sup>18</sup>

How does hard leverage influence fairness judgments? Lerner and Miller (1978) argue that people have a tendency to believe that the world they are living in is a just one (known as the belief in a just world hypothesis). An implication for our experiment is that the more hard leverage a bargainer has the higher share of the surplus he justly deserves. The data we have, however, does not favor this hypothesis. As Table 3 reports, both high and low performers' fairness judgments are constant across treatments. Kruskal–Wallis tests fail to reject both  $Fair_{high}(T_1) = Fair_{high}(T_2) = Fair_{high}(T_3)$  ( $p = 0.8002$ ) and  $Fair_{low}(T_1) = Fair_{low}(T_2) = Fair_{low}(T_3)$  ( $p = 0.1103$ ). Binary comparisons yield an identical result:  $Fair_{high}(T_1)$  and  $Fair_{high}(T_2)$

<sup>17</sup> Observe that agreements in all treatments are between high and low performers' fairness judgments. In T<sub>1</sub> and T<sub>2</sub>, agreements are closer to low-performers' fairness judgments ( $0.55 \leq 0.55 < 0.66$  and  $0.59 < 0.60 < 0.66$ , respectively), whereas in T<sub>3</sub> they are closer to high-performers' fairness judgments ( $0.57 < 0.64 < 0.67$ ).

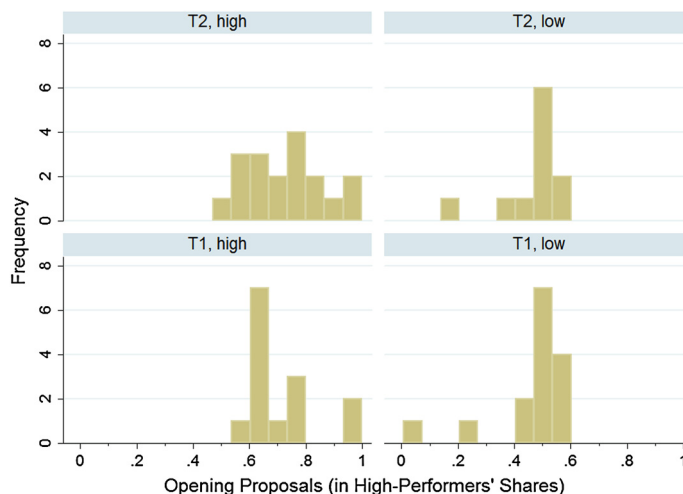
<sup>18</sup> Gächter and Riedl (2005, 2006) and Karagözoğlu and Riedl (2015) report similar findings.



**Table 4**  
Average opening offers of high and low performers<sup>a</sup>.

	T <sub>1</sub>	T <sub>2</sub>
High-performers' opening offer	0.72 (0.13)	0.73 (0.13)
Low-performers' opening offer	0.46 (0.15)	0.46 (0.11)

<sup>a</sup> In T<sub>3</sub>, there is no unstructured bargaining and the proposer is fixed. Hence, we do not include the proposals made in T<sub>3</sub> here. Note that the average ultimatum offer in T<sub>3</sub> is 0.65.



**Fig. 3.** Distributions of high and low performers' opening offers.

are not different (two-sided,  $p = 0.6912$ ).  $Fair_{high}(T_2)$  and  $Fair_{high}(T_3)$  are not different either (two-sided,  $p = 0.7368$ ).  $Fair_{low}(T_1)$  and  $Fair_{low}(T_2)$  are statistically not different according to Kolmogorov–Smirnov test (corrected  $p = 0.279$ ) but different according to Mann–Whitney test (two-sided,  $p = 0.0435$ ). Finally,  $Fair_{low}(T_2)$  and  $Fair_{low}(T_3)$  are statistically not different (two-sided,  $p = 0.2431$ ).

To sum up, the presence of hard leverage has little effect on fairness judgments. The competing focal points coordinate settlement expectations in the sense that bargainers largely agree that a settlement deemed fair by a neutral arbitrator would be one that falls within the compromise interval between the two focal points. Within this interval, however, we observe self-serving biases across high and low performers.

### 3.3. Opening offers

The opening offer in a bargaining pair is the very first offer made. The main reason we focus on opening offers is that they are known to be highly predictive of the remainder of the bargaining process and eventual settlements (Chertkoff and Conley, 1967; Yukt, 1974; Wilson et al., 1996; Park et al., 2010; Galinsky et al., 2009; Karagözoğlu and Riedl, 2015).

In T<sub>1</sub>, high and low performers make the opening offer in roughly equal numbers (14 and 15, respectively). In T<sub>2</sub>, 18 (11) of the subjects who make the opening offer were high (low) performers (two-sample test of proportions, two-sided,  $p = 0.066$ ). Table 4 reports the averages of opening offers in pairs in T<sub>1</sub> and T<sub>2</sub>, Fig. 3 shows the distributions.

Observe that average opening offers for the two bargaining roles are near identical across treatments. Denote the average opening offer of bargainer  $i$  in Treatment  $j$  by  $First_i(T_j)$ .  $First_{high}(T_1)$  and  $First_{high}(T_2)$  are statistically not different (two-sided,  $p = 0.8195$ ), nor are  $First_{low}(T_1)$  and  $First_{low}(T_2)$  statistically different (two-sided,  $p = 0.6941$ ). The important implication is that the introduction of hard leverage has little influence on opening offer behavior.<sup>19</sup>

Fig. 4 shows that the largest fraction of high performers' first offers center around 75–25 division, whereas the largest fraction of low performers' first offers center around 50–50 division in T<sub>1</sub> and T<sub>2</sub>.<sup>20</sup>

All in all, high performer opening offers were more aggressive in T<sub>1</sub> and T<sub>2</sub> than ultimatum proposals in T<sub>3</sub>. There is no evidence that the presence (T<sub>2</sub>) or absence (T<sub>1</sub>) of a hard leverage option influence subjects' opening offers. Opening offers reflect the fairness bias identified in section 3.2, with the average high performer offering closer to a 75–25 split and the average low performer offering closer to 50–50.

<sup>19</sup> There is no significant correlation between opening proposals and counter-proposals in either T<sub>1</sub> or T<sub>2</sub>.

<sup>20</sup> Note that transposed figures would represent cumulative distributions.

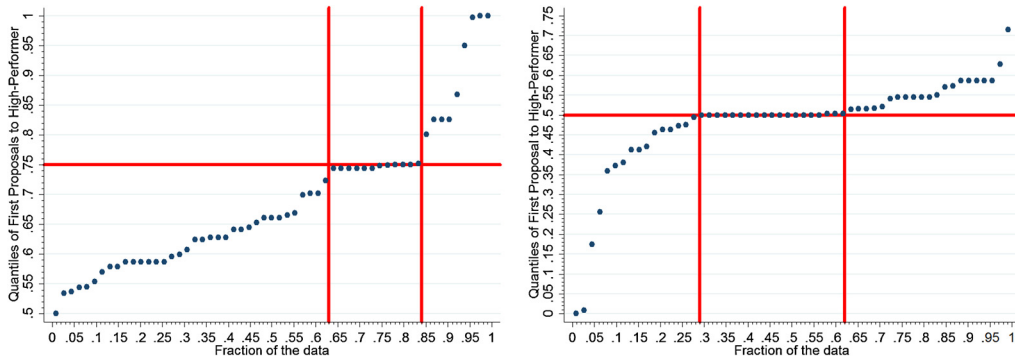


Fig. 4. High performers' first offers and low performers' opening offers in T<sub>1</sub> and T<sub>2</sub>.

**Table 5**  
Settlements, opening offers, counter-offers and yielding (in high performer shares).

	T <sub>1</sub>	T <sub>2</sub>	p-value
High_performer_agreed_share	0.55	0.60	0.043**
High_performer_first_offer	0.68	0.69	0.616
Low_performer_first_offer	0.45	0.51	0.075*
High_performer_opening_offer	0.72	0.73	0.820
Low_performer_opening_offer	0.46	0.46	0.659
High_performer_counter_offer	0.64	0.64	0.770
Low_performer_counter_offer	0.45	0.54	0.008***

### 3.4. Concession behavior

So far, we have detected no difference in bargaining behavior across T<sub>1</sub> and T<sub>2</sub>. Yet we saw that settlements across these treatments do in fact differ. It turns out that the difference has to do with concessions implicit in initial counter-offers. Table 5 displays high and low performers' first offers conditional on agreements, in T<sub>1</sub> and T<sub>2</sub>. First, a clarification: if a bargainer was the first to put a division on the table, her first offer qualifies as an opening offer. If a bargainer did not initiate the negotiation, her first offer is a counter-offer to the opening offer. From Table 5 we see that the more favorable agreements for high performers in T<sub>2</sub> than in T<sub>1</sub> are not due to differences in first offers, but rather reflect difference in low performer counter-offers (0.54 compared to 0.45).

Neither opening offers nor counter-offers of high performers differ across treatments, nor do low performers' opening offers. But low performers' counter-offers do differ: facing the same average opening offer as in T<sub>1</sub>, low performer counteroffers in T<sub>2</sub> concede almost 10% point more to high performers. A higher percentage of opening offers were made by high performer in T<sub>2</sub> than T<sub>1</sub> (section 3.3), compounding the effect of the low performer counter-offer difference on settlements. Further investigation using regression analysis yields similar results to those reported in Table 5; see Tables A.3–A.6 in Appendix A.

### 3.5. A summary of the observed regularities

1. *Settlements* fall with few exceptions between the two focal points, 50–50 and 75–25. The high performer captures a higher share, on average, when endowed with hard leverage in T<sub>2</sub> and T<sub>3</sub>, although the size of the effect is significantly smaller in T<sub>2</sub>.
2. *Judgments of what a neutral arbitrator would deem fair* are in all cases between the two focal points and do not differ statistically across treatments (varying hard leverage does not influence fairness assessments). High and low performer assessments exhibit self-serving biases.
3. *Opening offers* in T<sub>1</sub> and T<sub>2</sub> are significantly more aggressive than fairness assessments: The average opening offer of high (low) performers approximates 75–25 (50–50). In T<sub>3</sub> high performers' opening offers approximate fairness judgments, and are significantly lower than high performer opening offers in the other treatments.
4. *Concession behavior*. Low performer counter-offers (made in response to an opening offer) concede more in T<sub>2</sub> than in T<sub>1</sub>.

## 4. A modified Nash bargaining solution

How might we explain the regularities stated in section 3.5? In section 4.1 we sketch a model positing that competing focal points create mutual expectations of the range of acceptable settlements, the characterization of the underlying social preferences being an extension of those used to explain ultimatum game behavior. The Nash bargaining solution can explain

the comparative statics of observed settlements. In section 4.2 we similarly modify a model of the bargaining process that Harsanyi (1956, 1977) used to motivate the Nash bargaining solution. The modified model can explain why opening offers cluster around the focal points and why hard leverage has its main influence through concessions.

We hasten to note that ours is not the only potential candidate for explaining these regularities. Another approach, for example, is a model with endogenous reference points that shifts with the structure or context of the bargaining game. The theory we sketch borrows from the social preference models of behavior in ultimatum and associated alternating offer bargaining games (ex., De Bruyn and Bolton, 2008). Subgame perfect equilibrium from these models is consistent with observed ultimatum game settlements clustering near 50–50 with the first mover having a modest advantage. But this characterization does not fit our data: For example, the clustering around 50–50 in T<sub>1</sub> and T<sub>2</sub> disappears in T<sub>3</sub>, the treatment most like the ultimatum game (Fig. 1). Shifting the model reference point from 50–50 to 75–25 helps explain the low rejection rates in T<sub>2</sub> to T<sub>3</sub>, but also makes it difficult to explain why there are settlements below the new reference point. The model we sketch takes explicit account of the competing focal points.

4.1. Social preference modification of the Nash bargaining solution

The key innovation we introduce to the Nash bargaining solution is to suppose that the focal points define the limits of potential compromise. We capture this through a social preference characterization. Consider a negotiation between a high (*h*) and low (*l*) performer. Bargainers are risk averse with utility  $u_h(x_h)$  and  $u_l(x_l)$  for a settlement of  $x = (x_h, x_l)$ ,  $x_h + x_l = 100$ . Let  $f^i = (f_h^i, f_l^i)$  be the focal point favored by bargainer *i*. We assume that  $f_h^i > f_h^{i-1}$ ; that is, each bargainer favors the focal point that gives him the larger share of the bargaining pie. We consider two types of bargainer:

*Compromising bargainer.* Let  $X^i = \{x | x_i \geq f_i^i\}$ . Then for all  $x, y \in X^i$  such that  $x_i > y_i, u_i(x_i) > u_i(y_i) > u_i(0)$ . For all  $x \notin X^i, u_i(x_i) < u_i(0)$ .

That is, a compromising bargainer has standard self-interested preferences over the domain in which his share of a settlement is at least as high as the share he would receive from the focal point the *other* bargainer favors. For shares below this point, he prefers the (0, 0) outcome.

*Non-compromising bargainer.* Let  $X_n^i = \{x | x_i \geq f_i^i\}$ . Then for all  $x, y \in X_n^i$  such that all  $x_i > y_i, u_i(x_i) > u_i(y_i) > u_i(0)$ . For all  $x \notin X_n^i, u_i(x_i) < u_i(0)$ .

Hence non-compromising bargainers prefer the (0, 0) outcome to accepting a share less than what they would receive by their favored focal point.

For purposes of illustration, we suppose the high performing bargainer is a compromising bargainer. The low performing bargainer is a compromising bargainer with probability  $1 - \varepsilon$  and a non-compromiser with probability  $\varepsilon$ . We assume the high performer knows (only) the probability of his bargaining partner being a compromiser.<sup>21</sup>

Combining this preference specification with the Nash bargaining solution, we can explain the difference in average settlements we observed across treatments. To do so we need suppose that  $\varepsilon$  is small in that for the high performer bargainer

$$u_h(z'_h) = (1 - \varepsilon)u_h(75) + \varepsilon u_h(0) \quad \text{for } z'_h > 50. \tag{1}$$

The Nash bargaining solution predicts the settlement of the game to be

$$x^* = \operatorname{argmax}_{x=(x_h, x_l)} [u_h(x_h) - u_h(d_h)][u_l(x_l) - u_l(d_l)] \tag{2}$$

where  $d = (d_h, d_l)$  defines the smallest settlement shares that each bargainer finds acceptable to agree on. Consider the bargaining game in T<sub>1</sub>: If the high performer is matched with a compromising low bargainer, the set of acceptable divisions  $x_h - x_l$  are between 50–50 and 75–25, implying  $d = (25, 50)$ . Let  $x^{*1}$  be the T<sub>1</sub> bargaining game settlement predicted by (2). The value of  $x^{*1}$  will be a compromise between the two extremes  $50 < x_h^{*1} < 75$ , the exact compromise depending on the comparative risk aversion of the bargainers (Roth, 1979). If the low bargainer is a non-compromiser, there is only one feasible settlement, 50–50. The expected settlement for T<sub>1</sub> is therefore  $50\varepsilon + (1 - \varepsilon)x_h^{*1}$ .

For treatments T<sub>2</sub> and T<sub>3</sub>,  $d_l$  remains at 25 but  $d_h$  increases with the introduction of the final offer option. To see this, observe that condition (1) implies the optimal high performer final offer is 75–25. So in the T<sub>2</sub> unstructured bargaining phase, the high performer will agree to a settlement no smaller than  $z'_h$  (as defined in (1)); that is,  $d_h = z'_h$ . If the low performer is a non-compromiser, the game ends with no settlement – both unstructured and final offer bargaining end in disagreement. But if the low performer is a compromiser, the increase in  $d_h$  will result is a Nash bargaining settlement  $x_h^{*2} > x_h^{*1}$  (Thomson, 1987) where  $z'_h < x_h^{*2} < 75$ . So the expected settlement for T<sub>2</sub> is greater than that for T<sub>1</sub>. For T<sub>3</sub>, there

<sup>21</sup> Our conclusions would not change if we assume there are some non-compromisers among high performers.

is no unstructured bargaining phase and the high performer final offer will be 75–25 which is accepted with probability  $1 - \varepsilon$ . Since  $75 > x_h^{*2}$ , the expected settlement in  $T_3$  is greater than that in  $T_2$ .

This simple model captures some features of the variation in settlements but fails in regard to others. For  $T_1$  and  $T_2$ , the model predicts settlements should range from 50–50 to 75–25, a close approximation to what is observed (Fig. 1). But neither the range in settlements in  $T_3$  nor the clustering (sometimes) observed near focal points are accounted for. A more refined model, one that allows for more nuanced compromising tolerance than found in the two-type model, might explain at least some of the missing variation. The fairness assessments given by bargainers (Fig. 2) are suggestive of a wide variation in compromise tolerance. Some low performers, for example, might be willing to compromise up to 67–33 but not all the way to 75–25. Another factor that might explain the missing variation is differences in negotiating skill (see section 4.2).

Notes: The compromiser/non-compromiser formulation suggests a measurement of a focal point’s credibility, with higher recognition (lower  $\varepsilon$ ) making for greater credibility. A model that characterizes the value of  $\varepsilon$  more fully might link low focal point credibility to disagreement and delay in bargaining, as well as explain some of the variation in outcomes.

Finally, in the symmetric version of the model all bargainers favor the same focal point, and so both bargainer types, compromising and non-compromising, require at least 50% to accept a settlement. The predicted settlement is then 50–50, consistent with the well-known regularity of free form symmetric bargaining that settlements cluster tightly about 50–50 (Roth, 1995).

4.2. A simple model of the bargaining process

Harsanyi (1956, 1977) extended and generalized Zeuthen’s (1930) model of the bargaining concession process by way of providing a foundation for the Nash bargaining solution. We can use the same model, modified by the social preference characterization provided above, to explain why opening offers cluster at the focal points, and why the influence of hard leverage is through the concession process (regularities 3 and 4, section 3.5).<sup>22</sup>

Applied to the bargaining game in  $T_1$ , the Zeuthen–Harsanyi model runs as follows: Bargaining is broken into periods. In each period, high ( $h$ ) and low ( $l$ ) performing bargainers simultaneously make a proposal for splitting the pie, respectively  $h = (h_h, h_l)$  and  $l = (l_h, l_l)$  where  $i_j$  is the share  $i$  offers to  $j$ . If the proposals are compatible in that  $h_h \leq l_h$  and  $l_l \leq h_l$ , then the game ends with each bargainer getting the share he proposed for himself. Otherwise the game continues to the next period, where each bargainer (simultaneously) has the option to either make a concession (decrease her own payoff and increase the payoff of the other bargainer) or make no concession. The game ends in the first period proposals are compatible, or in the first period in which neither bargainer makes a concession. In the latter case, payoffs are given by the disagreement outcome. To ensure the game is finite, we assume any concession to be at least a fixed minimum amount as specified by Harsanyi (1977, p. 152).

The Zeuthen–Harsanyi model focuses on the question of which bargainer will make a concession at a given period with given proposals on the table. The answer, known as the Zeuthen Principle, asserts that the bargainer least willing to take a risk that the bargaining will end in conflict is the one that concedes. Here we modify the principle to account for the influence of focal points on perceived credibility. We first calculate the *risk limit* for each bargainer. Suppose that  $h$  and  $l$  are the two (incompatible) proposals currently on the table. The high performer’s risk limit, stated as a probability, is  $r_h$ . When  $50 \leq l_h \leq 75$ ,  $r_h$  is defined by

$$u_h(l_h) = (1 - r_h) \cdot u_h(h_h) + r_h \cdot u_h(50). \tag{3}$$

That is, the risk limit is the breakeven probability such that the high performer is indifferent between accepting the present low performer offer and taking the risk of standing on his present offer on the assumption that the worst possible outcome is 50–50, the least favorable, mutually acceptable division. Mathematically, the calculation of the risk limit in (3) differs from Zeuthen–Harsanyi in just one respect, the substitution of 50 for the disagreement payoff.<sup>23</sup> If the low performer is offering the high performer less than 50,  $r_h = 1$ , the highest possible risk limit. Intuitively, the high performer does not find it credible that the low performer will stand on a demand for more than 50%. By similar reasoning, if the low performer offers more than 75,  $r_h = 0$ , the lowest possible risk limit since this is more than the high performer could credibly demand for himself. Putting this together we have

$$r_h = \begin{cases} 1, & \text{if } l_h < 50 \\ \frac{u_h(h_h) - u_h(l_h)}{u_h(h_h) - u_h(50)}, & \text{if } 50 \leq l_h \leq 75. \\ 0, & \text{if } l_h > 75 \end{cases} \tag{4}$$

The risk limit for the low performer is measured in an analogous way.

<sup>22</sup> See Birkeland and Tungodden (2014) for a recent paper that studies the effect of fairness motivations on the bargaining outcome in Nash bargaining.  
<sup>23</sup> The original Zeuthen–Harsanyi has been criticized for being too pessimistic, omitting the possibility of compromise from the calculation. The modified version proposed here is less pessimistic. See Harsanyi (1977) for a discussion of the potential justifications for the original calculation.

$$r_l = \begin{cases} 1, & \text{if } h_l < 25 \\ \frac{u_l(l_l) - u_l(h_l)}{u_l(l_l) - u_l(25)}, & \text{if } 25 \leq h_l \leq 50. \\ 0, & \text{if } h_l > 50 \end{cases}$$

We then apply a version of the Zeuthen Principle, we call it the *credibility principle* because of the modifications we made: Bargainer  $i$  makes a concession if she has the lowest risk limit:  $r_i \leq r_j$ . The intuition is similar to that behind the Zeuthen Principle: Deadlocked with incompatible demands, and with time passing, the probability of conflict rises until one bargainer reaches his risk limit and breaks the deadlock by making a concession.<sup>24</sup> In the case of the credibility principle, the concession is based on mutual expectations of what is acceptable, with the final fallback position for the conceding bargainer being the least favorable focal point.

The credibility principle constitutes a form of risk dominance in that the bargainer running the highest risk concedes ground to the other bargainer (Harsanyi, 1977). In Zeuthen/Harsanyi's treatment, risk limits are defined as given above save that the last term in the denominator is a disagreement payoff instead of the low-end focal point that the bargainer can achieve. As a result, all of the theorems proved for the Zeuthen–Harsanyi game apply here, treating the focal points as the disagreement payments.

Note that there is no reason for either bargainer to demand more than their preferred focal point since doing so will simply lead them to make unreciprocated concessions.

**Proposition 1.** *If bargainers offer their preferred focal point in period 1 and then follow the credibility principle, the bargaining ends in the Nash bargaining solution with disagreement outcome  $d = (d_h, d_l)$ .*

**Proof** (follows section 4, Harsanyi, 1956). Bargainer  $i$  makes a concession anytime  $r_i \leq r_j$  making  $i$  the conceding bargainer. Let's suppose  $i = h$  (the choice is arbitrary). Then substituting the formulas for  $r_i$  and  $r_j$ , and doing some algebra, we have:

$$\pi(H) = [u_h(h_h) - u_h(d_h)][u_l(l_h) - u_l(d_l)] \leq [u_l(l_h) - u_h(d_h)] * [u_l(l_l) - u_l(d_l)] = \pi(L)$$

where  $\pi(X)$  is the Nash product of bargainer  $X$ 's proposal. In words, the conceding bargainer is the one with the lowest Nash product. So long as the Nash product is below its optimum value, one or the other bargainer will need concede to increase it. A settlement is reached once proposals converge on the Nash product.  $\square$

What does the model explain about the experiment? We observed that the model predicts that the opening offers should approximate the offerers' favored focal point (75–25 or 50–50) in both  $T_1$  and  $T_2$ , consistent with regularity 3. In addition, from Proposition 1 it is clear that the extent of concessions made is related to the values  $(d_h, d_l)$ . Specifically, an increase in  $d_h$  of the sort implied in moving from  $T_1$  to  $T_2$  (see section 4.1) is predicted to lead the low performer to make relatively greater concessions than the high performer, consistent with observation (regularity 4, section 3.5). As before, the model does not account for the full variation in behavior that we observe. For example, some opening offers are between the two focal points (Fig. 3). One hypothesis is that this variation is due to a lack of skill on the part of some bargainers – they concede too much too soon. This might also explain some of the aforementioned variation in settlements missed by the modified Nash bargaining model (section 4.1).

Proposition 1 explores the dynamic properties of a game but is not an equilibrium analysis. Harsanyi (1977, p. 158) considers a “compressed Zeuthen game” with just two periods. In period 1, bargainers make opening offers. In period 2, they each either accept the other bargainer's proposal or stand firm on their own proposal. Harsanyi shows that the only equilibrium settlement that is consistent with the Zeuthen Principle is the Nash bargaining solution. Substituting the modified Nash bargaining game considered in section 4.1, the same proof shows that the only subgame perfect equilibrium for the above game that is consistent with the credibility principle is one in which bargainers both propose and accept the Nash solution.

## 5. Conclusions

We investigated the relative credibility of hard leverage (commitment actions) and soft leverage (focal points) for bargainer advantage in a rich context bargaining game where there are two competing focal points. The most important findings have to do with where hard and soft leverage enter the bargaining process. The influence of soft leverage is most evident on bargainers' fairness judgments and opening offers. The influence of hard leverage is most evident in the concessionary stage. Hard and soft leverage interact to influence outcomes: Hard leverage advantages its holder, yet settlements largely stay between the two focal points.

The comparative statics we observe (section 3.5) fit, to a first approximation, with the Nash and associated Zeuthen–Harsanyi bargaining models, modified to account for the role that competing focal points play in coordinating bargainer expectations. The model is a first effort in an area (rich context bargaining) where little is known. No doubt other models

<sup>24</sup> Thus the prediction of who will back down does not assume complete information about risk preferences. See Roth (1979)'s discussion of the intuition behind the Zeuthen Principle.

could be constructed to fit the data. The value of explaining the results with a simple model, we think, is that the model implies untested hypotheses to guide additional research, data from which might then lead to a refinement of the present model or a different model altogether. For example, the model implies that shifting the asymmetric focal point from 75–25 (in either direction) should shift bargaining outcomes in all three treatments in the same direction, with the comparative statics across treatments that we found still holding. Data from such an experiment could give us greater insight into bargainer willingness to compromise, something the simple model we present approximates only coarsely.

An important caveat to our results is that the focal points are payoff relevant. Focal points can be non-payoff relevant as well; see for example, Sugden (1995). Potentially, bargaining involving non-payoff relevant focal points might display a different pattern than we observe here. Note, however, that the characterization of the role of focal points presented here rests not with the payoff relevance of the focal point but rather on whether bargainers recognize one another claim to focality as credible. So we conjecture that our results will generalize to non-payoff relevant focal points so long as they meet the credibility criterion.

What else could change our result? One might hypothesize that having more than two focal points attenuates the influence of any one focal point. But what appears to be important about focal points is that they are starting places for the compromise process. So long as each bargainer can identify a most favored focal point – sufficiently credible to the other side – this should be sufficient to orient the negotiation. More likely to change things is a situation where one or both bargainers claim to focality is not considered sufficiently credible by the other side. For instance, if the exogenously implemented reference point in the experiment was rather extreme (e.g., 99–1), it might not serve as a credible reference point. These circumstances, might for example, lead to more disagreement outcomes than the case examined here or agreements that are less predictable by the reference point outcome.<sup>25</sup> The assumptions on the credibility parameter in our model could be adjusted to accommodate these circumstances.

What might make hard leverage more influential in the sense of trumping the focal structure of the negotiation? Perhaps higher stakes such that one side's commitment threatens the other side with very substantial losses. But this is not obvious: Most experiments increasing the stakes in ultimatum games find at most, modest shifts in behavior; the exceptions involving very high stakes (see Karagözoğlu and Urhan, 2016 for a survey; the review in Cooper and Kagel, forthcoming; Andersen et al., 2011 for an exception).

Another potential caveat to our results is that the bargaining game is played only once. Whether our results would survive if subjects had more experience playing the game is an open question. Also, moving from  $T_2$  to  $T_3$ , both the hard leverage and the availability of communication change. Research shows that communication may help bargainers in arguing for their favored focal points (see Karagözoğlu and Kocher, 2015 for a recent example). Hence, if we had an ultimatum game treatment with pre-play communication, depending on the persuasiveness and risk attitudes (since possibly some messages would employ threats) of bargainers we could have observed different outcomes. Nevertheless, we conjecture that the results from such a treatment would be qualitatively similar (to the ones from  $T_3$ ) since the limited pre-play communication would preserve the effects of increased hard leverage.

In closing, we point to one area of investigation in particular that might lead to large gains in understanding: While we were able to offer a preliminary explanation for the comparative static regularities of the experiment, observed behavior varied more widely than the explanations imply. At least some of this variation might be explained by a more nuanced understanding of bargainer willingness to make concessions towards the focal point that favors the other bargainer. Finding a reliable quantitative measure for the 'credibility' of a focal point might be the key here. The model we sketched in section 4.1 offers a simple measure that might be taken as a starting point but surely other candidates are possible; the ideal would be a model in which reference points emerge endogenously.

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## Appendix A. Supplementary material

Supplementary material related to this article can be found online at <http://dx.doi.org/10.1016/j.geb.2016.08.005>.

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<sup>25</sup> In separate treatments, Gächter and Riedl (2006) implement reference points of 66–34 and 80–20. They find that 80–20 still influences fairness judgments and agreements but the influence is weaker compared to that of 66–34.

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